NAST

The Ninth National Conference on Science and Technology

June 26-28, 2022, Kathmandu

"Science for Society and Innovation for Prosperity"

ABSTRACTS

Nepal Academy of Science and Technology
Khumaltar, Lalitpur,

www.nast.gov.np

9th National Conference on Science and Technology

"Science for Society and Innovation for Prosperity"

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KEYNOTE SPEAKER

RESEARCH AND INNOVATION: BREAKING BARRIERS OF CATARACT SURGERY IN THE COMMUNITY

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Abstract

Until the early 1990s, patients with cataracts in Nepal used to travel to neighboring countries for their surgery. We were very committed to reverse this exodus. The barriers for providing high quality cataract surgery were, the availability of low cost, high quality intraocular lenses, simple appropriate surgical technique and availability of low cost medical consumables. It took us nearly 10 years of hard, persistent work to come out with a simple affordable surgical technique which gave excellent visual outcome. A randomized clinical trial of this technique with an established technique from the industrialized country was done. The results proved that the visual outcome were comparable. Committed research protocols were developed to find ways to reduce the cost of the intraocular lenses without compromising the quality. It was possible to do so. The development of high quality, eye care delivery system at an affordable cost was a great public health shift to bring eye care to the needy ones. This now has been scaled up not only in Nepal but has been used in other parts of the world. The success of eye care in Nepal is based on good quality research and innovation.

Keywords: Intraocular lenses, Low cost medical consumables, Research protocols

PLENARY SPEAKER

ART AND SPIRITULAITY IN SCIENCE

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Abstract

The term art comes from the Latin word arte, which means "to fit or become fit." It can be found in words like artifact, articulate, article, and artisan in English. As a result, art was not considered as separate from life in the past. With civilization's tendency to fragment, we have divided things up and called art a special activity. Art is essentially an aesthetic pleasure with little practical utility. People generally agree that art, not only in its content but also in its creation, has a profound spiritual meaning. Then we can talk about the artistic spirit and wonder if it, like science, could be integrated into existence as a whole. Science is concerned with knowledge, truth, and reasoning, whereas spirituality is concerned with ethics and with individual and collective well-being. There must be a reason why, despite amazing scientific success around the world, the human race continues to suffer from numerous traumatic experiences. Many of these problems can be solved with the help of art and spirituality. Spirituality is the study of the soul's nature as well as information about it. The soul is the ultimate and absolute truth. Culture consists of science, art, and spirituality. All human civilizations share three systems of art, science, and spirituality. Each of these three systems contributes to human progress and joy when they interact cooperatively. Whenever these systems are incoherent, exploiting one another's domain or denying their validity, conflict and misery will result. A common belief among scientists is that nature is symmetrical and beautiful. Microscopy, wildlife photography, and astronomy have generated thousands of artistically pleasing photographs. These images have in turn inspired artists. Spirituality can guide the artist so that the artistic productions are beneficial to both individuals and society rather than harmful. In Science, spirituality and art are essential.

ART, SPIRITUALITY, SCIENCE IN DIPLOMACY

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Diplomacy itself is an art to conduct international relations in a peaceful manner. The major purpose is to develop a strengthened relation between state, nation or organization. Several traits contribute to the diplomatic skills which includes interpersonal skills, communication, leadership, conflict resolution and emotional intelligence. All these skills are part of art, spirituality and science. The way one articulates and perceives any situation or problem depends on creativity. Creativity involves imagination which is an art itself. It requires positive energy to deal with the massive tension, pressure and loads that come along with the responsibilities of the diplomat which can only be achieved through the practice of spirituality. The compassion, empathy, happiness, kindness, calmness, satisfaction, peace and emancipation are the qualities come up with spirituality that every diplomat should have. Similarly, innovation, discovery and their international exchange through science cooperation strengthen relations between nations even in the time of conflict. The countries must collaborate with technical, research based and academic aspects to consolidate international relations. This is how art, spirituality and science contribute not only to practice diplomacy but to be a better diplomat.

PRIORITIZING & DESIGNING MEDICAL RESEARCH IN CONTEXT OF NEPAL

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Abstract

There is no doubt that every sector will flourish only when the service is incorporated with research. There is no sector which will not benefit from research but prioritizing & designing research will depend on the socio-economic and the present knowledge and belief of individual society. A relevant research in one society may be irrelevant in another context. This is why every country needs to individualize their research need by prioritizing research which is most relevant and possible in their context. Then we need to design research methodology taking into consideration our knowledge and resources available to us. This philosophy is equally applicable in medical sector, in this paper we discuss how to prioritize our need in medical research and design the research project accordingly.

SCIENCE, SPIRITUALITY AND ITS IMPORTANCE IN SCIENCE

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Abstract

Science is the systematic study of the properties of energy related to physical nature, its system and the processes it works through, while Spirituality pertains to soul, the spirit with a divinely & Godly nature at its purest of energy level, and perpetually in a state of happiness, peace, love, bliss to the extent of the period it is at its natural state of purity. Human beings being a composite of physical body inclusive of soul which works through mind, intellectual and tendency to act upon, quests for and ponder at physicality as well as spirituality in search for a meaningful direction towards the holistically purposeful living with divine–human values and spiritual wisdom. Spirituality being a driving inner world force, human being feels inner state of contended serenity while its direction brings clarity of mind & intellect which leading the senses to proper and better actions, eventually setting thought, feeling, attitude and actions to right tendency perpetually; man then evolves to greatest of height in terms of purposeful living with values following naturally to the tendency. Spirituality as a humanistic science uplifts his holistic personality. As the powerful & higher energy impacts other energies and entities, soul at its fullest level of a pure state not only directs the total energy & the body, but also the surrounding physical nature (living and non-living). Spirituality, thus, presupposes a conscientious human being whose spirituality guided acts leads to make world peacefully prosperous, beneficial with a happy living to all. Science could set into a holistic fruitfulness, bearing every benefit only when it strictly stands compatible with spirituality.

SCIENCE CITY LALITPUR – THE CONCEPT AND WAY FORWARD

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Abstract

The concept of SCIENCE CITY takes cognizance of the fact that agglomeration of different scientific research, development, exhibition and related activities in a spatial limit within a city region with all requisite infrastructure and facilities including educational, recreational, residential and conference facilities shall support the scientific innovations, and at the same time will greatly enhances the tourism and the local economy. A case studies of science cities located around the globe reveal that evolution of science city follows a general road map that entails establishment of science museum, technological park etc. in the first stage followed by expansion of science and technology park like in science cities in Kolkata, Stockholm etc. The third stage is characterized by densification of educational, scientific, technological and research centers within a spatial extent of a city, and the fifth one is characteristic of a newly planned city namely Chukuwa Science City in Japan, Daedeok Science City Korea, Akademgorodok Science City in Russia and the likes. In this context, a concept of SCIENCE CITY LALITPUR has been initiated by VC NAST Dr. Sunil Babu Shrestha. The concept intends to take advantage of the fact that several institutions with mandates in scientific pursuit are located within the 11 km stretch between Satdobato and Godavari. Accordingly a "Science City Establishment Committee" has been constituted by NAST under the leadership of former VC of NPC, Dr. Dinesh Chandra Devkota and Ms. Luna Bajrachary of NAST has been assigned the responsibility as the Member Secretary of the Committee. The Regional and Urban Planners' Association of Nepal (RUPSON) was called for providing the technical inputs towards the preparation of CONCEPTUAL PLAN for its establishment in due consultations with all the stakeholders, that includes but not limited to: DUDBC/MOUD, NARC (MOA), Lalitpur Metropolitan City, Godavari Municipality, ICIMOD-Knowledge Center Park, National Forensic (NFSL), National Nature Conservation Fund, President Chure Terai Madhesh Conservation Development Committee, Sports Science Academy of Nepal, National Botanical Garden, National Herbarium and Plant Laboratories (NHPL)/KATH, Floriculture Development Center, National Fishery Research Center and the likes. The outcome of the STUDY in terms of the Spatial Framework, Institutional and Investment Modality together with Strategic Action Plan are presented graphically in the adjacent sheet.

DEVELOPMENT OF NOVEL COMPACT RADIOLOGICAL DATING INSTRUMENTATION BASED ON COLLINEAR RESONANCE IONISATION SPECTROSCOPY (CRIS)

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Abstract

Traditional radiological dating techniques such as carbon dating using isotope ratio accelerator mass spectrometry (AMS) are expensive, experimentally complex and access to instrumentation is often associated with excessive lead times. The use of CRIS as an alternative method affords unparalleled interference suppression when compared to other laser based spectroscopy techniques or AMS. The CRIS technique was developed at CERN in the ISOLDE facility for the analysis of exotic radionuclei. When scanning the frequency of the excitation laser across a known transition the hyperfine spectrum maybe acquired. Acquisition of hyperfine spectra enable nuclear spins and precise values of nuclear magnetic dipole and electric quadrupole moments to be determined. By sitting on-resonance without scanning it is possible to further enhance the high selectivity and sensitivity that CRIS affords for the determination of precise isotope ratios for radiological dating. The sample inlet is configured to incorporate a flash gas chromatography nitrogen/carbon elemental analyser for carbon dating; the resulting CO_2 gas is bled into the ion source with initial carbon mass selection & detection of the major isotopes being performed using a multi-collector magnetic sector. The high sensitivity & non-resonant suppression characteristics required for the determination of the ultra-trace ^{14}C isotopic abundance employs the CRIS experimental setup. The instrument at the University of Manchester is initially being configured for isotope ratio analysis of krypton, strontium and carbon but can easily be tuned for other elements and offers a state-of-the-art alternative technique for various forensic, environmental, archaeometry and food security applications.

ROLE OF R & D IN SCIENCE FOR SOCIETY: TRADITIONAL VS MODERN

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Abstract

Rapid Urbanization, economic development and changing lifestyles are changing our Societies. We are naturally very rich and culturally broad with our own Traditional Scientific Knowledge and indigenous technologies. At present, WIPO have also given priority to practice and preserve the Traditional Knowledge scientifically. Food, agricultural products, herbal medicine, and all commodities necessary for livelihood fulfills from natural resources in ancient time making the community self-sustainable and healthy. Locally grown seasonal foods are consumed as functional foods to maintain the healthy life and to protect naturally from diseases due to bioactive secondary metabolites of plants with their antioxidant, immunomodulatory, anti-microbial, anti-cancer, and anti-diabetic properties. The agricultural and household waste is also managed locally by recycling in a sustainable way. In Modern Society, the regular intake of fast foods and imported from third countries are highly preferred all round year that stimulates non communicable diseases in the society and non-degradable waste management problem. Also unseasonal farming by using imported synthetic pesticides, fertilizers and household insecticides may prevalence non-communicable diseases and imbalance the ecosystems in the Modern Society. In this context NAST has hosted "FOOD GREEN CITY" concept for the municipalities for urban sustainability by transferring our R & D outputs from Lab to Land on Natural Products fostering scientific knowledge and generating entrepreneurs in the value chain for healthy life and environment for urban sustainability. Science and Technology is intrinsically embedded in every facet of our lives so it becomes imperative to formulate and implement appropriate National Policies to promote Science, Technology and Innovation to ensure long term economic prosperity and sustainability through proper R & D in Science for the Society.

EMERGING ADVANCES IN FIGHTING CANCER

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Abstract

Cancer is a dreadful disease which is rapidly increasing year by year globally. The prevalent treatment modalities for cancer treatment, namely, surgery, chemotherapy and radiotherapy have provided considerable advances in treatment and care of cancer patients. The recent understanding of molecular biology of cancer cells has opened new targets for radiation and drug actions leading to new and efficient hope for fighting cancer. Radiotherapy continues to play a leading role in cancer treatment and palliative care. More than 40 % of patients are treated by ionizing radiation like gamma ray and X ray. The usual resistance shown by the cancer cells to radiation both intrinsic and acquired during the radiotherapy procedure poses the dominant challenge to cancer treatments. To overcome resistance of cancer cells, a few new approaches have been developed which have shown promise in laboratory studies and some drugs are in various phases of clinical trials. Research results from our laboratory at Bhabha Atomic research Center (BARC) have shown enormous promise to significantly sensitize cancer cells by a variety of plant derived herbal drugs involving ROS. Some of these drugs like Triphala and Ellagic acid have shown great promise *in vitro* and in animal model studies in view of their selective toxicity to cancer cells while causing minimal or no toxicity to normal cells suggesting an ideal drug candidate for the clinic. Apart from new drug discoveries for treating the cancer patients combined with radiation, new approaches for delivery of radiation energy to the target tissues such as accelerator-based radiotherapy have been developed giving new hopes and aspirations for saving the patient life. More recent radiation delivery technology, such as Flash Radiation Technology (FRT) to treat otherwise inaccessible tumor tissues with insignificant damage to normal tissues have been developed which have emerged a significant advance in cancer radiotherapy.

ART AND SPIRITUALITY IN SCIENCE

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Abstract

The objective of this paper is to understand the scientific dimensions of spirituality and introduce yoga and meditation as the tool to experience and apply spirituality. Human beings have always wondered at the mystical side of the universe and fathom its connection with the physical. According to Albert Einstein writes : "The fairest thing we can experience is the mysterious. It is the fundamental emotion which stands at the cradle of true art and true science… the mystery of the eternity of life, and the inkling of the marvelous structure of reality, together with the single-hearted endeavor to comprehend a portion, be it ever so tiny, of the reason that manifests itself in nature". Authentic spiritual experiences are the moments we feel intensely alive and the mystery of the universe is revealed in deep meditation. This is how Rishis, the scientists of consciousness, experience and live reality. The aliveness felt during such a 'peak experience', as psychologist Abraham Maslow called it, involves not only the body but also the mind. Kena Upanishad says: *There the eye goes not, Speech goes not, nor the mind. We know not, we understand not how one would teach it.* Spirituality has been wrongly treated at par with superstition and religious beliefs. However, research in the past seven decades has attempted to de-link spirituality from religion and superstition by establishing the scientific nature of spiritual process and principles. Spirituality is the non-intellectual, direct experience of reality by applying scientific meditation methods that are developed and time-tested for millennials and encompasses all dimensions of human life, including art, science, politics, business and society. Spirituality, if rightly understood and used, can solve not only the mysteries of the universe but also all human miseries, thus contributing to creating a peaceful, happy and prosperous world.

TRIPLE PLANETARY CRISIS AND SCIENCE DIPLOMACY

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Abstract

The world is currently facing a triple planetary crisis namely climate change, biodiversity loss, and pollution. Climate change is already causing disruptions in anthropogenic systems and natural ecosystems. Current biodiversity loss is so unprecedented that about one million animal and plant species are now threatened with extinction within decades. Air pollution is attributed to seven million deaths globally and almost 99% global population breathes air that exceeds the guideline limits of the World Health Organization. To combat climate change, a legal framework of the UN Framework Convention on Climate Change (UNFCCC) exists under which an international treaty called the Paris Agreement was signed. Similarly, the Global Convention on Biodiversity (CBD) was signed to halt the loss of biodiversity but there is no such global framework exists to combat air pollution. All three global issues transcend national boundaries and require multilateral cooperation and strong scientific foundations for making policies and taking actions to reduce their impacts. In that context, this presentation highlights the importance of science diplomacy to foster international cooperation in climate change, biodiversity loss, and air pollution as well as in other global issues where science plays a critical role and diplomates need scientific advice for effective engagement in the multilateral talks and diplomatic dialogues.

NANOARCHITECTONICS BEYOND NANOTECHNOLOGY

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Abstract

Nanoarchitectonics is a new term for a new concept beyond nanotechnology. In nanoarchitectonics, nanoscale materials are assembled in systematic ways to generate new functionalities, which cannot be attained solely by each material. The materials are well designed and synthesized. However, synergetic effects are key factors for device performance rather than the properties of individual materials. That is, each material works as a building block as a member of a nanoscale architecture. We refer to such research concept as "nanoarchitectonics."
To explore this new research field, the International Center for Materials Nanoarchitectonics (WPI-MANA) was founded in 2007 as one of the first five research centers within the framework of the World Premier International Research Center Initiative (WPI), which is sponsored by Japan's Ministry of Education, Culture, Sports, Science and Technology. In this project, we have produced nanoscale components and integrated them into various dimensional systems that exhibit cutting-edge functions. Here, we expect that these efforts will lead to scientific breakthroughs and technological innovations.
In this talk, I present the state-of-the-art achievements of the material architects together with the current activity in MANA we hope that this talk will arouse a feeling of curiosity and provide an excellent springboard for young materials scientists in particular.

ENVIRONMENT AND BIODIVERSITY

THEMATIC SPEAKER

MOLECULAR CHARACTERIZATION OF EMERGING AND RE-EMERGING DISEASES AND ITS DIAGNOSTIC APPLICATION IN THE PROSPECTS OF NEPAL

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Abstract

Nepal is a potential home for many emerging and re-emerging diseases favoring its ranges of climates, peoples' hygiene and economic status. Cutaneous Leishmaniasis (CL), Dengue and Covid-19 diseases of Nepal are the diseases what previous generation remain unaware. There used to be few imported cases of CL but now it is not true. Similarly, Dengue disease ventured to our country in 2006 and then onwards, it has been re-emerging as outbreak in every 3 years. The CL cases though clinically diagnosed remain unknow to its etiological agent. Molecular characterization was carried by amplifying mitochondrial minicircle genome (600 bp and 720 bp) followed by ITS1 (Internal Transcribed Spacer 1) gene (340 and 320 bp) and finally Restricted Fragment Length Polymorphism (RFLP) (210 & 140 bp and 180, 75 & 50 bp). Further, sequencing of the ITS1 gene validated the result as of the *Leishmania major* and *Leishmania donovani* which are the two kinetoplastid protozoans causing CL in Nepal for the first time at Central Department of Biotechnology (CDBT-TU). Similarly, dengue virus serotyping was done for the first time within the country using CDC molecular kit which was always not practical and available. Later, characterization using own designed e-gene primers [DENV-1(500bp), DENV-2(337bp), DENV-3 (189bp) and DENV-4(138bp)] were performed and then Genotyping (DENV-1: Genotype V and DENV-2: Genotype IVA). Whole genome sequencing of Nepal's DENV-2 serotype has also been performed confirming the circulating genotype. In reference to the covid-19, our team is the one from academic institution to carry out the diagnosis of SARS Cov-2 virus and sequence (n=115, GSAID) whole genome for SARS Cov-2 virus variant (Alpha, Delta, Delta+ and Omicron) identification in Nepal. Among the twenty strains of delta variant, AY.39 exhibited unstable and potential to create mutagenic strain. Finally, we have been successful in characterization of Leishmaniasis, Dengue and Covid-19 pathogens in Nepal for the first time. The molecular tools we optimized at CDBT-TU lab have been now promptly being under practice for diagnosis of the respective diseases in Nepal.

MERCURY POLLUTION IN THE NEPAL HIMALAYAS, THEIR SOURCES AND HEALTH RISKS: A REVIEW

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Abstract

Mercury is one of the pervasive pollutants capable of long-range transportation. It reaches to the areas where there are no sources, for example, north pole, south pole, the Himalayas, and the Tibetan Plateau. In the south Himalayas, it was reported that water bodies in high altitudes have higher concentration of Hg compared to the lakes in the urban areas, unlike other heavy metals which are higher in the urban lakes. This is an indication that the long-range transportation of Hg might have polluted the water resources of the higher Himalayas. It has also been documented that the deposition of Hg in lake sediments synchronizes with the worldwide production of Hg which was highest during the 1980s and declining in recent periods. However, there exists possibilities of Hg pollution by local activities, such as tourism, because the recent sediments in remote lake (Lake Gokyo) in the Himalayas showed sudden increase in its concentration when tourist activities were comparatively higher. The isotopic studies of Hg indicated that Monsoon and Westerlies also bring major parts of Hg in the Nepalese Himalayas. The Hg produced and released in the Gangetic Plan is one of the major sources of Hg pollution in the higher Himalayas. One of the major contributors of the Hg pollution is seasonal agricultural residual burning. Reducing the activities responsible for the release of Hg bound to the soils and vegetation would help reduce the Hg pollution in the atmosphere and aquatic bodies. This will further reduce the health risk of Hg poisoning through consumption of fish because it is one of the pollutants of human health concern, particularly by consumption of polluted fish. Nevertheless, fish from some Nepalese rivers and lakes showed less amount of Hg and were safe for consumption during the last decade.

Keywords: Long-range transport, Mercury, Nepal Himalayas

EMISSION FACTORS AND EMISSION INVENTORY OF DIESEL VEHICLES IN NEPAL

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Abstract

The transport sector is one of the fastest growing and most recognized sources of deteriorating air quality in Nepal. With transportation emissions expanding at a higher rate than any other major economic sector, immediate action is required to achieve the sustainable, low-carbon future envisioned in the Paris Climate Agreement and the 2030 Agenda for Sustainable Development. Recently, a comprehensive emission inventory of the transport sector through fuel-based emission factors (EFs) was developed for the first time in Nepal. This study estimated CO_2 emissions to be 2214-2781 Gg including CO (0.51-3.55), BC 0.51-3.55 Gg, and $PM_{2.5}$ 3.42-23.47 Gg in the year 2017/18 in Nepal. Vehicle categories, age-distributed vehicle population, survival proportion of vehicles, vehicle kilometre travelled, fuel consumption/mileage, engine efficiency, and emission factors were some of the key elements that impacted variance in emissions. It is critical to look into cost-effective solutions that might cut emissions considerably. The initial measures in reducing air pollution are to repair and maintain roads, improve fuel quality (with low sulphur), and purchase high-quality (> IV euro grade) and electric vehicles. The paper recommends enhancing sustainable low-carbon transport through amendment of transport policy 2058 B.S. of Nepal.

Keywords: Greenhouse gases, Climate change, Low carbon transport, Policy

INVITED SPEAKER

EXPANSION OF VECTOR-BORNE DISEASES IN HILLY REGION OF NEPAL

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Abstract

Vector-borne diseases (VBDs) are human illnesses caused by parasites, bacteria, and viruses. VBDs are transmitted to humans by the bite of the blood-feeding insects called vectors (mosquito and sandfly). Visceral leishmaniasis (VL), malaria, lymphatic filariasis, and dengue are the important VBDs present in Nepal. The main objective of this paper is to highlight the current situation of VBDs (*Leishmania* and dengue) in Nepal. Secondary data from Epidemiology and Diseases Control Division was also collected and reviewed. A literature review was undertaken to collect updated information in recent years on VBDs (mainly Leishmaniasis and dengue) in Nepal. VL has been reported in Nepal since 1980, but cutaneous leishmaniasis (CL) was reported very recently. VL was endemic in 12 districts terai region and later (2016) it spread to 18 districts of Nepal. Sporadic VL cases were reported from different parts of Nepal including the hilly and mountain region. CL was reported recently and now it has expanded to terai and hilly regions. Dengue fever is an emerging viral disease in Nepal. It was first reported in 2004 in the Chitwan district. Initially, dengue virus was reported only from the Terai region but in 2019, it expanded to 67 districts including hilly and mountainous regions. The VBDs and its vector are expanding in the hilly and mountainous regions may be due to climate change, increased transportation, water scarcity and unplanned urbanization. The increasing trend of VBDs has created high risk for people living in those areas. So, there is an urgent requirement for an effective surveillance program for vectors and VBDs, awareness programs, and strategies for the prevention and control of vectors to achieve target for elimination of VL, malaria and lymphatic filariasis in Nepal.

Keywords: *Leishmania*, dengue, Hilly regions, Nepal

ENVIRONMENTAL SURVEILLANCE OF SARS COV-2 IN NEPAL: OPPORTUNITIES AND CHALLENGES

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Abstract

Corona virus disease (COVID-19) pandemic is a significant public health crisis. SARS-CoV-2, the etiologic agent of COVID-19, is shed in feces and congruently mixes with sewage. Environmental surveillance (ES) of SARS-CoV-2 in wastewater can be used as an epidemiological tool to monitor the community spread of COVID-19 in the areas where the clinical testing coverage is deficient. Herein one-year-long ES reveals the longitudinal quantitative pattern of SARS CoV-2 RNA signals in wastewater samples in Kathmandu valley. The correlation of wastewater RT-PCR data of some sampling sites with the COVID-19 active and new cases advocates the utility of wastewater-based epidemiology as an early warning system for public health decisions in low-income settings. Furthermore, genomic surveillance of wastewater sampling sites are increasingly exploited to map the prevalence and spread of SARS-CoV-2 variants. Amplicon sequencing of spike protein receptor binding sites in wastewater samples revealed the evolution of dominant variants in the environment. The dynamic dominance of Delta and Omicron variants in wastewater correlated with clinical cases. The results of genomic surveillance offer the feasibility and usefulness of wastewater testing to predict genomic variants of SARS-CoV-2 circulating in the communities. This study is evident that it can be exploited as supplementary to clinical surveillance for effective public health interventions to minimize the spread of the diseases. With tremendous opportunities for ES, continued efforts to optimize genomic wastewater-based epidemiological tools are indispensable not only for SARS-CoV-2 but also for other infectious agents. However, implementation of ES in low resource settings like Nepal encounters multiple challenges including low coverage of sewerage, undefined catchment population and impact of seasonal variation in wastewater metadata. Therefore, the infectious diseases' ES requires continuous development and standardization with multi-sectorial collaborative approaches.

Key words: COVID-19, SARS CoV-2, Wastewater-based epidemiology, Variants of Concern, Public health

HEALTH IMPACT OF POLLUTANTS WHILE COOKING WITH COW DUNG IN TERAI REGION OF NEPAL

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Abstract

Traditional biomass accounts for over 90% of total energy supplies in rural areas of least developed countries. The usage of dung cake as a household cooking fuel is quite prevalent. However, when biomass is burned, it produces a variety of emissions such as CO2, CH4, CO, SOx, and particulate matter that harm the environment. In biomass, there is an excess of nitrogen, which is transformed into N2O and other NOx emissions during combustion. A kilogram of dung cake contains 0.92 kilograms of total solids, has a heat of combustion of 230 kcal, and requires 4.6 kilograms of fresh cow dung. The same amount of cow dung can be utilized to make 0.184m3 of biogas with 520 kcal heat. When dung cake is burned directly, it produces 98-134 percent more CO than when biogas is burned. These pollutants not only create indoor air pollution, but they also have detrimental environmental impacts like global warming, eutrophication, acidification, and toxicity to human health. Cow dung cakes are perhaps the cheapest source of cooking fuel, the burning dung cakes are hazardous to dwellers' health. In this context, the goal of this research is to determine the health effects of cow dung burning on residents by applying health impact modeling. Hazardous gases are generated in the smoke during the burning process that is ingested by residents. The inhalation of harmful fumes emitted from the burning of dung cake poses a health risk to people, particularly women and children under the age of five. Furthermore, with the burning of dung in a room with limited ventilation, women inhale hazardous air throughout their pregnancy, causing the fetus to miscarry.

Keywords: Hazardous gases, Indoor air pollution, Dwellers' health, Health modeling

ORAL PRESENTATION

LICHENS DIVERSITY IN KHAPTAD NATIONAL PARK, WESTERN NEPAL

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Abstract

Present study focused on lichen species diversity along the altitudinal gradient and effects of host species on distribution in Khaptad National Park, Western Nepal. Lichens were sampled along different forests found in the study area with elevational range between 2200 m to 3200 m asl. A total of 49 sample plots of 5 x 5m^2 size each were sampled 10 m away from ridges of walking trails with 200 m gap on one side. Same sampling procedure was applied on other side of the trail. Altogether 98 plots sampled for this study. A total of 47 lichen species belonging to 29 genera and 14 families were recorded. Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA) were performed to analyze the species composition and environmental relations through the R- software. DCA first axis eigen value was 0.72 with an axis length of 8.01 *SD* units indicating a complete species turnover along the major altitudinal gradient. Total lichen species richness showed significant increasing pattern with the altitude. Furthermore, the number of lichen species occurred more on the *Quercus* tree towards the lower altitude may be its rough bark and water retention capacity. At the higher altitude, high air moisture would have aided the higher number of lichen species in the *Abies*, *Picea* species. So, altitude and host have significant effect on the distribution pattern of lichen species.

Keywords: Lichen species diversity, altitudinal gradient.

INFLUENCE OF HUMAN DISTURBANCE ON BURROW ACTIVITY OF THE CHINESE PANGOLIN (MANIS PENTADACTYLA) IN NEPAL

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Abstract

People and wildlife are coming into greater contact worldwide due to the increasing human footprint. While some species tolerate certain levels of human activities, others are vulnerable to human disturbance, potentially altering their spatial or temporal patterns in response. We evaluated the influence of human disturbances on the burrowing activity of the Chinese pangolin (Manis pentadactyla), a critically endangered species heavily persecuted for subsistence and illegal trade. We deployed remotely triggered camera traps at pangolin burrows located at four sites with contrasting levels of human density and infrastructure in Nepal. We also estimated burrow activity patterns of pangolins using a kernel density estimator based on the time stamp of camera trap observations. Our findings did not suggest that anthropogenic disturbance affected pangolin burrow activity, but we acknowledge that these findings were based on a limited number of observations. Peak pangolin burrow activity was observed after midnight in three study sites, including those with the highest and lowest levels of human activity. The fourth area, which had intermediate levels of human activity, had an earlier peak in burrow activity, possibly caused by prey deficiency due to intense agriculture. We suggest that pangolins may tolerate human activity because of their strictly nocturnal temporal niche but that this tolerance has made them vulnerable to poaching since it allows them to co-exist spatially with humans. Nocturnal species may be particularly prone to non-conflict-related persecution since they may be easily accessible targets for illegal hunting.

Keywords: Critically Endangered Species, Illegal Trade, Poaching, Spatial and Temporal Patterns, persecution, Mammal, Conservation

IMPACT OF ROAD ON DIVERSITY AND ABUNDANCE OF INVASIVE ALIEN PLANT SPECIES IN MIDDLE MOUNTAIN REGION, CENTRAL NEPAL

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Abstract

Roads serve as a major dispersal corridor for terrestrial invasive alien plant species (IAPS). Despite the variety of road types, little research has been done on how they impact IAPS distribution and diversity. We mapped the IAPS spatial distribution and explored diversity and abundance along two types of roads (main and feeder roads) by comparing 66 pairs of plots (33 pairs in each type of road) in the middle mountain region of central Nepal to investigate the role of roads in IAPS spread. Systematic sampling was conducted along roads at an interval of 2.5±0.25 km. At each site, a paired rectangular plot (25 m × 4 m) was sampled: one adjacent to and along the road and another 20 m away and parallel to the previous one. We found that the main road had a higher number of IAPS (14 species) and cover (33.05%) than the feeder road (10 species; 25.41%), which can be explained by differences in traffic density, disturbances, and habitat conditions. In both road types, IAPS cover and richness were significantly higher in roadside verges than in adjacent interior habitats, which clearly indicates that roads act as corridors for the spread of IAPS. Canonical correspondence analysis (CCA) revealed that elevation, tree canopy, and grazing/mowing/trampling were key factors in the IAPS occurrence. Our study demonstrates that main roads are an important pathway for IAPS dispersal in the study area. Regular monitoring of roadside vegetation can help for the early detection of potentially invasive alien species in the region.

Key words: Biological invasion, IAPS, road types, dispersal corridor, disturbance

GERMINATION ECOLOGY OF SEEDS PRODUCED BY SUMMER AND WINTER COHORTS OF *PARTHENIUM HYSTEROPHORUS*

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Abstract

Germination of seeds is highly responsive to the immediate environment of the seeds as well as environment experienced by the mother plant during growth and seed development. We studied the germination ecology of seeds produced by summer and winter cohorts of *Parthenium hysterophorus* growing in Kathmandu valley. Germination was observed under alternating day/night temperatures of (low: 25/15°C and high: 30/20°C), light (12-h photoperiod of 3000lux and dark) and at different water potentials (-0.1, -0.25, -0.5, -0.75 and -1MPa) for 20 days. Seed mass, Germination percentage (GP), Timson's index (TI) and Mean germination time (MGT) were calculated. Winter seeds had higher seed mass than summer seeds. Although seeds of both cohorts germinated under complete darkness as well as 12-h photoperiod, the germination percentage was 10-18% higher under a 12-h photoperiod than under complete darkness. At low temperature, winter seeds showed high GP, TI, and MGT compared to summer seeds. But, at high temperature, summer seeds showed high GP, TI and MGT compared to winter seeds. This result indicates the influence of maternal growth environment on the germination behavior of seeds. Germination of seeds of both the cohorts decreased with increasing water potential. About 2.67% of winter seeds germinated at -0.75 MPa but summer seeds were unable to germinate beyond -0.5 MPa. This experiment provides evidence of strong impact of the maternal environment on seed germination. Moreover, this study also suggests a wide range of environmental tolerance (chilling and dry winter to hot and humid summer) during seed germination of *Parthenium hysterophorus* which might have allowed the plant to grow both during the winter and summer seasons.

Keywords: Maternal environmental effects, Seed germination, Seed traits, Stress tolerance.

AN INNOVATIVE FLOATING TREATMENT WETLAND SYSTEM (FTWS) USING THE MICROCOSM STUDY TO REMEDIATE POLLUTED WATER OF NAGDAHA

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Abstract

Eutrophication of the water bodies are the most significant problems of surface water quality across the globe which is the consequence of the nutrient pollutants in water. Floating treatment wetland system (FTWS) is a sustainable, low cost, green and simple technology that remediates the polluted water through the removal of pollutants from water by the use of plants supported by floating rafts. The research was carried out to study the effectiveness of the FTWS in remediating the polluted water of the water body in Kathmandu. An experimental setup was prepared with the different sets of microcosm treatment units. Nagdaha lake at Dhapakhel, Lalitpur was selected as the study area. The water sample from Nagdaha was transported to the microcosm units of experimental setup completed with the selected remediating plants *Tradescantia pallida* and *Canna Indica* inserted in the floating material prepared from polyethylene foam. Microcosm contained 5 treatment units. Each unit consisted of three buckets of 40 L capacity inter-connected with a 100 L drum with pipes for circulation of water. Triplicate water samples were collected from each bucket once in 15 days for two months and different parameters including dissolved oxygen, biological oxygen demand, ammonia, nitrate, ortho-phosphate, iron, electrical conductivity and pH were tested in the lab. The percentage removal was calculated from experimentation results. The percentage removal of ammonia ranges from 40 to 80 percent, nitrate 80 to 95 percent, ortho-phosphate 85 to 95 percent, iron 50 to 60 percent and 80 to 96 percent increase in DO. Computing percentage removal provided an insight on effectiveness of FTWS in successful remediation of water pollutants.

Key words: FTWS, wastewater treatment, water quality, eutrophication, polluted water body, microcosm experimental setup, bioremediation, floating raft

STUDY OF AIR POLLUTION AND ITS IMPACT PARAMETERS OVER THE PERIOD 1ST TO 6TH OF APRIL 2021

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Abstract

This paper enlightens about the air pollution carrying particulate matters, its impact parameters like air temperature, relative humidity, and wind speed. The adulteration of air particularly with different sizes of particulate matter is influenced by numerous parameters, this research fascinates to bring concern about the parameters like relative humidity, air temperature, and wind speed, and how they sway the concentration of different sized particulate matter. Additionally, this research foregrounds the concentration of air particulate matter and its effects on human health. This work portrays the data taken from four different stations of Nepal: Ratnapark (latitude: 27.7 °, longitude: 85.3185°), Janakpur (latitude: 26.739805°, longitude: 85.92854°), Dhankuta (latitude: 26.98066°, longitude: 87.34392°) and Nepalgunj (latitude: 28.05275°, longitude: 81.6222°). The data of duration from 1st to 6th of April 2021 were investigated because this duration includes tremendous level of air pollution at Kathmandu valley in Nepal. Further, a line graph and a heat map are developed with the help of python programming to investigate the relationship among the parameters. The co-relation heat map said that the relationship between the impact parameters and the particulate matter varied with the geographic conditions. Moreover, the graph showed that the Kathmandu Valley (the capital city of Nepal) is a zone prone to high human health risks due to air pollution in comparison to other places.

Keywords: Air Pollution, Particulate Matter, Relative Humidity, Air Temperature, Wind Speed

PARASITE PREVALENCE AND LOADS IN *APIS LABORIOSA* ACROSS DIFFERENT ELEVATIONS IN ANNAPURANA CONSERVATION AREA, NEPAL

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Abstract

Apis laboriosa (Himalayan cliff bees) are critical pollinators that have been rapidly declining in Nepal, likely because of parasitism and land-use changes, among other factors. To understand the factors for such declines of these important pollinators, I studied parasite prevalence (infection rate) and loads (infection severity) of *A.laboriosa* across elevations and seasons. A total of 79 *A. laboriosa* were collected along the trail to the Annapurna Base camp (Landruk Bhir and Chhomrong Bhir), including the Sardi River in March, April, May, and August using visual netting. *Nosema spp.*, *Crithidia spp.*, and *Acarapis* woodii were studied following standard protocols for PCR detection. Conopid fly infestations were studied upon dissection of the bee gut, and *Varroa* mites were detected using the icing sugar method (a standard protocol) to dislodge the parasite. There was a presence of Crithidia spp. (3 out of 35), Trypanosomes spp. (1 out of 35) m from Dalang Bhir (1265 masl) in [April 2021], and *Varroa* mite (1 out of 79 samples from Chhomrong Bhir (1898 masl) in [August 2019]), where other three parasites were absent in the samples collected. I could not compare the effects of elevations and seasons on parasitism. Based on NDVI, land-use change was observed from 1990 to 2020, where an increase in builtup area, shrubland, and barren land with a declining water body of the Annapurna Base Camp region was observed. A questionnaire survey and focus group discussions with the local people showed that among the major pollen and nectar sources of wild bees, orchids, *Prunus spp., and Dactylorhiza hatagirea* were found to have declined in the past 10 years because of the conversion of pristine areas to agricultural land and overexploitation for making staging and gumbas, which might be the factors leading to the decline in the population of these bees.

Keywords: Pollinators, Land-use Change, Decline, Polymerase Chain Reaction, Dissection

ROOT AND MICROBIAL RESPIRATION IN SUB-TROPICAL FOREST BY USING TRENCHING METHOD, CENTRAL NEPAL

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Abstract

Soil respiration (SR) is a process of carbon dioxide (CO_2) emission from soil that includes autotrophic and heterotrophic respiration, which are the CO_2 generation by plant roots, soil microbes, and soil animals. The aim of this study was to determine carbon emissions from the soil of undisturbed sub-tropical mixed forest in Shivapuri Nagarjun National park of Nepal and factors like soil temperature, soil water content, and litter that influencing the emission rate of the forest floor. The dominant tree species in the studied forest site were *Pinus roxburghii*, *Quercus glauca*, *Castanopsis tribuloides*. We adopted the trench and non-trench methods for analyzing autotrophic respiration (RR) and heterotrophic respiration (HR). The trench is categorized into two types i.e., trench with no litter and trench with litter. The concentration of CO_2 was measured with the help of an infrared gas analyzer (IRGA). The estimated average annual CO_2 from soil respiration (SR), heterotrophic respiration HR (with litter), heterotrophic respiration HR (without litter), and root respiration (RR) were 878.03, 471.72, 372.40 and 225.10 g C m^{-2} y^{-1}, respectively. The Q_{10} value (temperature sensitivity in each 10°C increase in soil temperature at 5cm soil depth) of SR, HR (with litter), HR (without litter) and RR were 2.75, 2.86, 3.19, and 1.37, respectively. The relation of SR, HR (with litter), HR (without litter), and RR with soil temperature showed a positive exponential relation. The result of this study showed that the soil temperature was the major factor for the soil respiration variations and the soil water content had no clear relation to the soil respiration. It was determined that global warming may affect the increase in atmospheric temperature, which may lead to an increase in soil temperature and release of CO_2 in the atmosphere.

Keywords: Temperature, Soil respiration, Carbon emission, Forest, CO_2

IMPACTS OF UPPER TRISHULI "3A" HYDROPOWER DAM ON BENTHIC MACROINVERTEBRATES AND WATER QUALITY, RASUWA, NEPAL

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Abstract

This study examined the effects of the Trishuli 3A hydropower project on macroinvertebrates and water quality upstream and downstream of the dam in Rasuwa, Nepal, for two seasons, 2020 (Winter) and 2021 (Summer) (Spring). One reference site (T1- far above the dam), three disturbed sites (T2- just above the dam; T3- just below the dam; T4- dewatered section), and a recovery site (T5- far below the dam). The values of physico-chemical parameters were marginally different upstream and downstream, and were higher in the spring season than in the winter season. In addition to 60 water samples, the Multi-Habitat Sampling (MHS) approach was used to sample macroinvertebrates (Six replicates in each site. Principal Component Analysis (PCA), Redundancy Analysis (RDA), and Two-way Analysis of Variance (ANOVA) were used in the statistical analysis. The water quality of the river was assessed using GRSBIOS/ASPT, and all of the locations were classified as class I, indicating good water quality. The species richness at reference sites, such as upstream reference and downstream recovery sites, was higher. RDA study found that dissolved oxygen (DO), pH, temperature, and conductivity have a close relationship with benthic macroinvertebrates, while PCA analysis revealed that PCA1 connected with alkalinity and nitrate (NO_3) in the winter season, whereas PCA2 correlated with free CO_2. PCA1 is connected with TDS and NH_3 in the spring, whereas PCA2 is correlated with turbidity and calcium hardness. Despite the fact that the water quality appears to be similar both upstream and downstream.

Keywords: Benthic macroinvertebrates, Hydropower dam, Water quality, Upstream, Downstream

IMPACT OF INVASIVE PLANT SPECIES ON THE OCCURRENCE OF THREATENED MAMMAL SPECIES IN SHUKLAPHATA NATIONAL PARK, NEPAL

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Abstract

The introduction and colonization of invasive alien plant species (IAPS) is one of the major serious threats to the conservation of native floral and faunal species. Such threats are noticed in different protected areas including lowlands of Nepal with negative impacts on the species and ecosystem services. The impacts of IAPS on threatened mammal species especially on their occurrences is little known. This study identified the effects of IAPS on the occurrence and habitat utilization of threatened mammal species at Shuklaphata National Park (ShNP) Nepal. During the study, ShNP was categorized into IAPS presence and absence area. The occurrence of threatened mammal species was recorded from 210 plots of 10 m X 10 m along the line transect. A total of 14 threatened mammal species were recorded in the study plots. Among them 12 species were in IAPS presence habitat and all 14 species in IAPS absence habitat. The higher occurrence of threatened mammal species was recorded at lower IAPS abundance and near to forest habitat. In addition, the high occurrence of mammal species was found with increasing the distance of water sources and distance to road. The threatened mammalian species utilizes the IAPS absence habitat rather than the IAPS habitat. For providing suitable habitat for threatened mammal species, we recommend removal or control of the invasive plant species from ShNP.

Keywords: Invasive alien plant species, protected areas, mammals, habitat utilization

ASSESSMENT OF WATER QUALITY OF RAJA-RANI LAKE LOCATED IN TROPICAL REGION OF EASTERN NEPAL.

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Abstract

Aquatic ecosystems represent the reservoirs for aquatic life. Aquatic life is profoundly influenced by the physical and chemical properties of water. Therefore, monitoring of water quality status in terms of physico-chemical properties becomes essential in deciphering the existing ecological health of aquatic bodies. The objective of this study was to determine water quality of Raja-Rani Lake, Morang, eastern, Nepal using physico-chemical variables. Thirty water samples were collected from six transects of 100m each at regular interval of 100m, parallel from the shore during pre-monsoon, 2022. Physico-chemical parameters like temperature, pH, total dissolved solids (TDS), turbidity, and electrical conductivity (EC) were measured on the site using a portable probe while total acidity, total alkalinity, dissolved oxygen (DO), nitrate nitrogen (NO_3^-N) and ammonium nitrogen ($NH4^+N$) were measured in the laboratory following standard methods. The mean values of analyzed water parameters ranged between 6.66±0.02 and 7.48±0.14 for pH, 38.8±0.58 and 47.2±0.58 mg^-l for TDS, 5.08±2.54-22.13±3.84 NTU for turbidity, 69.6±2.29-96.8±0.37 μScm^- for EC, 0±0.89-2.8±1.01 mg^-l for total acidity, 3.8±1.09-50.8±7.8 mg^-l for total alkalinity and 5.36±0.84 and 7.6±0.98 mg^-l for DO. The concentrations of NO_3^-N and $NH4^+N$ were < 0.05 and <0.07 mg^-l. On the basis of concentrations of above parameters the water quality of Raja-Rani lake can be considered within good ecological status for aquatic lives. This study could be helpful for the sustainability of aquatic lives in the lake.

Keywords: Environment, Freshwater, Lake, Raja-Rani, Water quality, Nepal

REPRODUCTIVE BEHAVIOR OF RED PANDA (*Ailurus fulgens*) IN THE CENTRAL ZOO, LALITPUR, NEPAL

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Abstract

The population of the diet-specific wildlife such as the Red panda is decreasing with less than 10,000 individuals in the wild because of habitat destruction, fragmentation, poaching, and hunting for its fur. Captive breeding has become an increasingly crucial strategy for protecting such endangered species, but efforts to generate self-sustaining populations have met with poor success despite large resources being allocated. Animals are also known to be stressed in captivity and it is necessary to examine reproductive behavior in relation to the complexity of habitat requirements, dietary preferences, privacy, and, in particular, pregnant moms and their sensitivity to disruptions. This study observed the reproductive behavior of the red panda along with other behavioral activities in the central zoo, Lalitpur, Nepal using the non-invasive method (videography). Scan sampling and focal sampling were used to collect the behavioral data from December 2020 to June 2021. A total of 16,416 behavioral activities were recorded in 20,286 minutes. Scent-marking, allo-grooming, chasing, running, aggressiveness, sniffing, response, and feeding on feces were the observed reproductive behaviors. The study revealed that reproductive behavior covered only 1-2% of the total activity budget. Precipitation influenced the behavior and activities increased at low value. Humidity and atmospheric pressure had no significant effect. Copulation was attempted many times, and reproduction will be successful if the animal husbandry is properly managed. The captive population doesn't only benefit the zoo but also acts as the insurance against extinction in the wild.

Keywords: Behavior, captive breeding, red panda, zoo

CROPPING PRACTICES IMPACT BIRD ASSEMBLAGES IN NEPAL'S AGRICULTURAL LANDSCAPES

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Abstract

Several studies have examined the impact of landscape heterogeneity on agricultural bird assemblages, but few have examined how farming techniques and seasonal variations influence bird assemblages. We studied the impacts of cropping practices (mixed crop, monocultural crop, and fallow land), crop types (rice, wheat, maize, sugarcane, and other crops), seasonal variation (summer, monsoon, and winter), landscape heterogeneity, and the number of houses and trees on the richness and abundance of farmland birds in lowland Nepal. From April 2018 to December 2019, we established 116 transects (farmland = 100, forest = 8, and river = 8) in lowland Nepal. Few transects were established in forests and rivers to assess only the differences in bird composition between those habitats and farmlands. We recorded

201 different bird species in farmland, 133 in the forest, and 131 in river habitats. In farmlands, we found nine globally threatened species and 26 nationally threatened birds. Seasonal variation and cropping practice, but not landscape heterogeneity, had a significant impact on the richness of farmland birds, whereas species abundances fluctuate only by season. We found that the winter season and mixed crop fields had higher species richness, whereas the monsoon and monoculture crop fields had higher abundance. Richness and abundance of farmland birds increased with increasing tree numbers but decreased with increasing house numbers in agricultural lands. Within crop species, sugarcane fields showed the largest bird diversity, whereas rice fields had the greatest abundance. In context of rising agricultural intensification worldwide, our study suggests that the governments in this region should encourage farmers to cultivate mixed crops and simultaneously restrict the urbanization of farmlands to protect bird diversity.

Keywords: landscape heterogeneity, bird diversity, threatened birds, agricultural intensification, urbanization

GERMINATION ECOLOGY OF TWO CONGENERIC INVASIVE *AGERATUM* SPECIES

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Abstract

Comparisons of two phylogenetic closely related but different invasive taxa can yield a key concept into invasion success. Germination ecology of highly invasive *Ageratum houstonianum* and relatively less invasive *Ageratum conyzoides* were compared under controlled conditions. We compared seed germination performance of these congeners under different light environment (light/dark), temperature regimes (low: 25°C under light/15°C under dark condition, and high: 30/20°C) and water stress (□0.1, □0.25, □0.5, □0.75 and □1 MPa). The seeds were allowed to germinate inside growth chamber for 20 days with daily records of germinated seeds. We calculated Germination percentage, Timson's index, Mean germination time (MGT) and Coefficient of germination velocity along with seed mass and seed size. The results indicated that the seed mass and seed size of *A. houstonianum* were greater than of *A. conyzoides*. Seeds of *A. conyzoides* were positively photoblastic as no germination took place in complete dark. In case of *A. houstonianum*, 7% seeds germinated at 25/15°C while there was no germination at 30/20°C under dark condition. All parameters except MGT in *A. houstonianum* were higher than *A. conyzoides*. Seeds of both species germinated up to □0.5 MPa water potential, although the Germination percentage of *A. houstonianum* was higher making it more stress tolerant than its congener. The results indicate that *A. houstonianum* exhibits greater tolerance in germination to a wide range of light and water stress conditions which implies its higher success as an invader than *A. conyzoides*. In conclusion, the results suggest that seed germination traits can be useful parameters for the prediction of invasiveness of a species.

Keywords: Congeners, invasive weeds, germination trait, environmental tolerance

THE COMPOSITION OF MIXED-SPECIES FLOCKS OF BIRDS IN AND AROUND CHITWAN NATIONAL PARK, NEPAL

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Abstract

Mixed-species flocks (MSFs) have been well studied in the South Asia, but there has been no or very little works on MSFs of Nepal, despite a diverse and well-studied avifauna. We aimed to assess MSFs and leadership of MSFs inside and around Chitwan National Park. The study was based on direct observation of MSFs in Sal (*Shorea robusta*) and Vellar (*Trevia nudiflora*) dominated forests for four months (October 2019 to January 2020) in between 07h30-12h00 and 14h30-017h30. All the species seen as moving with the MSF at any one moment in time were included in its composition. We noted the order that species crossed gaps (trails, open water, or forest gaps), making only one observation per MSF. We recorded 222 MSFs that included 100 species, and 6097 individuals. The MSFs were similar to worldwide patterns in being dominated by leaf-gleaning, non-terrestrial insectivores. However, canopy species dominated the MSFs than usual, and did not have a clear gregarious, understory leading species. Drongos and minivets led MSFs in the park, and a cluster analysis of composition showed one group of large body size MSFs particularly characterized by the presence of the Greater Racket-tailed Drongo (*Dicrurus paradiseus*). This study confirms drongos as the nuclear species for some types of MSFs, despite the complex blend of benefits and costs that these species give to those that associate with them. Like in Neotropics, MSFs led by "sentinel" species may also form in Asia.

Keywords: Bird community ecology; Dicruridae; Keystone species; Mixed-species; Species interactions

CO-RELATION BETWEEN MERCURY RESISTANT AND ANTIBIOTIC RESISTANT BACTERIAL POPULATION IN BAGMATI RIVER

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Abstract

Aquatic environments are identified as an ideal settings for the acquisition and dissemination of antibiotic resistance. Along with antibiotics, bacterial traits are also resistant to heavy metals like mercury, lead, and cadmium which may pose cross-resistance with antibiotics. However, the dissemination of antibiotic resistance in the Bagmati River and its association with metals is poorly understood. A cross-sectional study was carried out from October 2019 to December 2020 to describe the relationship between antibiotic-resistant bacteria and metal-resistant bacteria. Triplicate grab river water samples collected from thirteen different points from Sundarijal to Chovar were analyzed for antibiotic and metal resistant bacteria. Heterotrophic plate count was performed using spread plate technique in a metal and antibiotic incorporated Mueller Hinton Agar, separately. Antimicrobial susceptibility testing of isolates using the disc diffusion method and colistin and mercury resistance using the minimum inhibitory concentration (MIC) method was conducted at Nepal Academy of Science and Technology. Conventional PCR was used for the amplification of *mcr-1*, *bla*NDM-1 and *merA* genes. We report a statistically significant positive co-relation between frequencies of mercury resistant bacteria and antibiotic resistant bacteria in particular colistin. ($r = 0.75$, $p < 0.003$) and meropenem ($r=0.63$, $p< 0.01$) resistant isolates. The mean ratio of colistin and meropenem resistant bacterial population to total bacterial population was 0.40 ± 0.068 and 0.41 ± 0.067, respectively. Antibiotic susceptibility test revealed that 73% of the isolates were multidrug-resistant. We detected *merA*, *mcr-1*, and *bla*NDM-1 in 46.2%, 40% and 37.5%, respectively among phenotypically resistant isolates. The detection of clinically relevant antibiotic resistance genes (ARGs) in an urban river in Nepal indicates a need for regular monitoring to restrict the spread of such new worrisome pollutants in the environment to control the spread of resistant organisms and infection.

Keywords: colistin resistance, mercury resistance, meropenem resistance, *bla*NDM-1, *mcr-1*, *merA*

DNA BARCODING OF TWO *PRIMULA* SPECIES FROM CENTRAL NEPAL

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Abstract

The genus *Primula* is one of the largest genera in Nepal, representing 65 taxa (61 species and 4 varieties), out of which five taxa are endemic to Nepal. DNA barcoding is an appropriate strategy for rapid and accurate identification of the *Primula* species. The process would also contribute to enhanced understanding of the *Primula* phylogeny. The objective of the present study is to optimize the DNA barcoding protocol with special emphasis on the identification of molecular markers useful to delineate the *Primula* species. Here, we used two species of *Primula* viz. *Primula nana* Wall. And *P. petiolaris* Wall. Collected from Ghorepani (Kaski, 3000m. asl) and Daman (Makawanpur, 2150m. asl) respectively. We amplified and sequenced three chloroplast loci rbcL (Ribulose-1, 5- bisphosphate carboxylase), matK (Maturase K) and psbA-trnH (intergenic spacer) from both the specimens. Further, we retrieved 34 accessions of plastome sequences from NCBI, representing 17 *Primula* species. Except *P. sikkimensis*, no plastome sequences are available for the Nepalese native species of *Primula* in the NCBI. Similarly, one accession of plastome of *Maesa montana* was also retrieved to be used as out group. Respective aligned sequences of rbcL, matK and psbA-trnH were extracted from each accession. Evolutionary analysis was performed following Maximum Likelihood approach using MEGA X. The result showed that the evolutionary tree generated with combined sequences of all three loci was robust with distinct clades compared to that generated with the sequence of single locus demonstrating that three markers (rbcL, matK and psbA-trnH) are appropriate for molecular identification of the *Primula* species. *P. nana* formed distinct clade in the phylogenetic tree, providing molecular evidence as a distinct taxa. The *P. petiolaris* clumped at the clade of *P. forbesii* suggesting their close affinity as well as necessitating further study of the two species.

Key words: plastome, accessions, molecular markers, evolutionary tree

CHARACTERIZATION OF THERMOSTABLE CELLULASE FROM *Bacillus licheniformis* ISOLATED FROM THE HIMALAYAN SOIL

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Abstract

Cellulases are enzymes that hydrolyze cellulose and its derivatives into fermentable sugar. It has a wide range of applications, but the expensive cost of production is a barrier to its widespread use in industry. The study was conducted to search for a potent thermophilic cellulase producer from the Himalayan soil and to purify and characterize the enzyme according to various parameters. The research was carried out at the Nepal Academy of Science and Technology, Khumaltar, for a period of l3 months from January 2020 to February 2021. The isolation of cellulolytic bacteria was carried out using 1% carboxymethyl cellulose agar. The potent cellulolytic strain PANG L was identified through morphological, biochemical, physiological, and molecular characterization. After the optimization of cellulase production, the enzyme was partially purified through 80% ammonium sulfate precipitation followed by dialysis. The effects of pH and temperature on the activity of the cellulase were also studied. The potent strain was identified as *Bacillus licheniformis* and was processed for the production of cellulase enzyme. The optimum condition for cellulase production was achieved at 45°C after 48h of incubation at 6.5 pH in media containing carboxymethyl cellulose and yeast extract as carbon and nitrogen sources at 100rpm. The optimal activity of partially purified cellulase was observed at a temperature of 60°C and pH 5. The cellulase enzyme was stable within the pH range of 3-5 and retained 67% of activity even at 55°C. The cellulase activity was found to be enhanced in the presence of metal ions Cd^{2+}, $Pb^{2+}$and Ba^{2+}. The enzyme showed the highest activity when CMC was used as a substrate followed by cellobiose. The K_m and V_{max} values of the enzyme were 1.8mg/ml and 10.92µg/ml/min respectively. Thus, the cellulase enzyme obtained had suitable catalytic properties for use in industrial applications.

Keywords: Cellulase, *B. licheniformis* , Optimization, Thermophilic

A SPECIES DISTRIBUTION MODEL FOR GLOBALLY ENDANGERED DHOLES (*CUON ALPINUS*)

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Abstract

Knowledge regarding its real and potential distribution is a foundation for conserving any given species. This study identified potentially suitable habitat areas for the endangered dhole (Cuon alpinus) throughout its range. Historically, dholes occurred all over South and East Asia but have disappeared from more than 75 percent of their historic range and are still declining primarily due to prey depletion, habitat loss, persecution, disease and possibly interspecific competition. The global range of the dhole currently includes 12 countries in Asia. For this study, we used 1604 verified dhole observation records from 1996 to 2018 and 19 spatial predictors to identify suitable dhole habitats. The predictors were associated with climate, ecological, geophysical, and human impact. We constructed a species distribution model using the maximum entropy algorithm implemented in the software MaxEnt. The model had a spatial resolution of 8x8 km, approximately corresponding to the smallest recorded dhole home range size. The model predicted 13.5% of the study region as suitable dhole habitat, and most of the suitable dhole habitat was found in India (28%), Myanmar (18%) and Indonesia (12%). However, areas identified as suitable dhole habitats were widely distributed throughout Asia and subsequently heavily fragmented. In five countries (Bhutan, Laos, Myanmar, Malaysia and Cambodia), over half of the land area was identified as suitable for dholes. Isothermality, tree cover and densities of medium-sized livestock were the most influential environmental characteristics identifying suitable dhole habitat. Our study may provide an important platform for spatially informed conservation action for this highly endangered large carnivore.

Keywords: Conservation of Endangered Species, Habitat, Potential distribution, MaxEnt, Species Distribution Model, Carnivore

BOTANICAL ART AND ILLUSTRATIONS APPLIED IN SOME ENDANGERED, PROTECTED AND RARE WILD FLOWERS OF GHYACHOK VDC, GORKHA DISTRICT, NEPAL

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Abstract

This paper presents some scientific botanical art and illustrations those were facilitated describing 11 of the wild flowers species of Ghyachok in Gorkha District of Nepal. This was a result after the study of the area those occupied tropical, subtropical, temperate and sub-alpine vegetation type .The study was conducted during May and early September, 2017. Among the list of 119 wild flowers species (dicotyledons 98, monocotyledons 20 and one gymonsperm) belonging to 54 families and 100 genera which were recorded and among these, 4 species found to be endangered and 12 species rare and protected. Here, only 11 species of flowering plants (5-Rare,1- Endangered, 3- CITES- App II , Abundant 2) such as *Aeschynanthus parviflorus , Aerides multiflora , Bahunia vahlii , Codonopsis viridis , Disporum cantoniense , Delphinium himalayae , Hoya lanceolata , Marsdenia lucida , Pleione hookeriana , Rhododendron dalhousiae, Rhynchostylis retusa* were described with their morphological structures to habit sketches from living specimens in wild habitat spot as well as in the studio with several studies under microscope. The illustrations were sketched in field book and drawn in scale with several process using different devices such as dividers, microscopic scale and pen and ink drawing tools. The scientific line drawings are denoted in scale bar so that the real size of the specimen is determined by measuring the printed images. Similarly portraits of plants were documented with live specimens on the spot as well as in the studio by applying water color by different brushes in the art paper. Hence these scientific illustrations and portrait of plants form simply not only describes but also aids to identify its genus to species level. Thus, communicates visually more than hundreds words which is considered as one of the important taxonomic tools in flora writings globally .

Keywords: Flowering plants, scientific sketches, taxonomy, visual communication

SPATIAL REPRESENTATION OF BAGMATI RIVER SYSTEM USING BENTHIC MACROINVERTEBRATES AND ITS LINKAGE WITH DISCHARGE AND CONDUCTIVITY IN THE KATHMANDU VALLEY

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Abstract

The existence of Nepal's holy river, Bagmati, which flows through the Kathmandu valley's core metropolitan, has been threatened by an anthropogenic thread. It is necessary to identify such stressors to restore them. This research focuses on determining river water quality to analyze the Bagmati River System's biological health. Benthic macroinvertebrates (BMIs) were used as biological indicators in this investigation along with physical parameter discharge and conductivity. The water discharge was calculated using the salt dilution method, whereas benthic macroinvertebrates were sampled using a multi habitat sampling approach during post-monsoon period (Oct-Dec, 2021). The Ganga River System Biotic Index (GRSBIOS) was used to assess river water quality. From the sampling of 21 sites, a total of 5839 individual BMIs from 51 families were reported. The headwaters of the Bagmati River within Shivapuri Nagarjun National Park are clean, according to this study, and are classified as Class I, whereas rivers from the protected area's boundaries to downstream are classified as Class IV-V, indicating that they are extremely polluted. With an increase in discharge during the post-monsoon season, fluctuations in the composition of benthic macroinvertebrates are particularly substantial. A high abundance of BMIs was found in a high-flow area with low Conductivity. The headwaters have a higher taxonomic diversity with sensitive species compared to downstream. The study also found a negative correlation of -0.26 between stream discharge and conductivity. Conductivity has a substantial negative relationship with taxonomic richness, sensitive and facultative species.

Keywords: Benthic Macroinvertebrates, GRSBIOS, Headwaters, Taxonomic Diversity

AIR POLLUTION FROM HAZE AND SMOKE AT KATHMANDU VALLEY

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Abstract

WHO estimates that air pollution kills about 3 million people worldwide each year, of which 800,000 die prematurely. According to the World Health Organization (WHO), air pollution is responsible for the increase in patients due to respiratory and cardiovascular disease, hospitalization and mortality. The sample collected from the NAST building at 6 th April to 27 th April 2021. The number of microbial load on the nutrient agar plate for bacteria and potatoes dextrose agar for fungus highest on 16 th April 1.9×10 5 and 2.9×10 4 Cfu/m 2 /h. The rapid increase in population and vehicle population due to the continued increase in primary energy consumption in the Kathmandu metropolitan area is the continuation of (Total suspended particulate, Particle Matter less than 10 microns, Sulphur Dioxide, Carbon Monoxide, Nitrogen Dioxide) microbial load, and other air pollution dust, smoke and fumes. It leads to an increase in the number of people. Congestion of houses, traffic jams, and various commercial activities generate large amounts of pollutants that affect human health. Many international studies have shown that air pollution poses a serious health risk. These suggest that Kathmandu air quality is also likely to have a serious impact on public health. The purpose of this study is to collect and analyze available information on the health effects of air pollution in Kathmandu to help policy makers and the general public understands the relationship between pollution and health. Air pollution from smoke and haze also causes COVID-19 because it contains so many spores of bacteria and fungus that cause serious illness.

Keywords: Isolation, Identification, Antimicrobial activity

ASSESSING THE PUBLIC HEALTH RISK BY COMPARING WATER QUALITY OF TAP WATER AND WELL WATER IN BHAKTAPUR, NEPAL.

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Abstract

This study was undertaken to determine the contamination in tap water and well water in Bhaktapur, Nepal. This study aimed to focus on the presence of waterborne bacterial agents that has long been a major concern in Nepal to advance the evidence base available to the Nepalese Epidemiology and Disease Control Division to overcome waterborne diseases. This study included analysis of physico-chemical and microbiological parameters of 60 (30 each) tap water and well water samples monitored at the consumer points from different sites of Bhaktapur, Nepal, by culture-based methods through macroscopic and microscopic observations for total coliforms and spread plate method for other probable bacteria present in water. The analysis revealed that in 29 of 30 (96.67%) tap water samples and in 27 of 30 (90%) well water samples crossed the threshold value for either one or two or three or to all four parameters viz., turbidity, iron, ammonia and fluoride according to National Drinking Water Quality Standards, 2005. The results showed that in 23 of 30 (76.6%) tap water samples and in 30 (100%) well water samples were contaminated by at least one coliform bacterium. The most common etiological agent was *Escherichia coli* found in 21 of 30 (70%) tap water samples and in 17 of 30 (56.6%) well water samples followed by *Enterobacter spp* in 5 of 30 (16.67%) tap water samples and in 15 of 30 (50%) well water samples while surprisingly *Citrobacter spp* was only found in tap water samples and *Klebsiella spp* was found only in well water samples. Although these findings do not represent overall drinking water quality in Bhaktapur, still with such information at hand, policy, strategy, and guidelines could be refined, along with an awareness programs and improving the existing infrastructure to provide safe drinking water.

Keywords: Turbidity, Iron, Ammonia, Fluoride, *Escherichia coli*

MICROPROPAGATION AND ASSESSMENT OF GENETIC STABILITY OF *DENDROBIUM TRANSPARENS* WALL. EX LINDL. USING RAPD MARKERS.

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Abstract

Dendrobium transparens seed derived protocorms were used to develop an efficient *in vitro* propagation procedure. The goal of this study was to create a mass propagation protocol for *D. transparens* and assess the genetic stability of *in vitro* regenerants. Full (FMS), half (HMS), and quarter (QMS) strength MS medium supplemented with BAP, NAA, and 10% coconut water were used to culture immature seeds derived from mother plant capsules (CW). The FMS medium produced the most seed germination. On both full and half-strength MS medium, protocorm induction was achieved. In half MS medium enriched with 100 mL/L coconut water, 1 mg/L BAP, and 2 mg/L Kinetin, the maximum number of shoots (11.9 shoots/explant) was obtained (H10C.1B2K). Furthermore, elongated shoots transplanted to full and half strength MS root initiating media with different auxins and at varying concentrations induced roots; however, the full MS medium fortified with 100 mL/L coconut water and 1.5 mg/L NAA induced the most roots (8.30±0.6 no., 4.90±1 cm) (F10C1.5N). Ten RAPD primers were used to determine genetic stability in wild and *in vitro* produced samples. The amplified bands of all *in vitro* plant samples were similar to the bands of the mother plant. The results indicated the genetic stability of *D. transparens* micropropagated plants. The *in vitro* regeneration procedure used in this study provides a foundation for germplasm conservation and plant production for long-term use.

Keywords: Molecular markers, Tissue culture, Genetic fidelity, *Ex situ* conservation

AMPLIFICATION AND SEQUENCE ANALYSIS OF DNA BARCODE (*rbcL*, *matK* and ITS) IN MEDICINALLY IMPORTANT PLANT SPECIES

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Abstract

Medicinal plants, being a potential source of curative drugs are being used worldwide to treat diseases. However, their over exploitation and illegal trading are being major concern. So, the reliable authentication of plant identification is in demand globally. DNA barcode, a short gene sequence of standardised region of genome is used to identify the species and the process is called DNA Barcoding. The significance of DNA barcoding is resolve taxa from higher (e.g. family) to lower (e.g. species) taxonomic levels, which are difficult to identify by morphology. In context of Nepal, some medicinal plants such as *Asparagus racemosus*, *Zanthoxylum armatum*, *Nardostachys jatamansi*, *Rubia cordifolia*, *Azadirachta indica*, *Bergenia ciliate*, *Tinospora sinensis*, *Rauvolfia serpentine*, *Paris polyphylla*, *Juglans regia*, *Acorus calamus* and *Piper longum* are vulnerable, traded illegally and adulterated in herbal market. The main aim of this study is to evaluate the effectiveness of different barcode marker (*rbcL*, *matK* and ITS) to identify the medicinal plant sample. For this, the DNA was extracted from leaf of plant samples by cetyl trimethyl ammonium bromide (CTAB) method which was subjected to thermal cycler for PCR amplification of target region. Further amplified products were sent to Macrogen, Korea for purification and forward sequencing by Sanger's dideoxy sequencing method. The obtained sequences for each of the regions were compared to the data sequences by BLAST in NCBI. The phylogenetic relationship of the samples with the reference plant sequences was analysed by Neighbour-Joining method based on Kimura 2-parameter model in MEGA7. Result showed that *rbcL* and *matK* were able to discriminate the tested species with identification rate above 90% to 100% relatively higher than ITS

Keywords: Barcode, Amplification, Sequencing, *rbcL*, *matk* and ITS

ABUNDANCE AND DIVERSITY OF WATERBIRDS AROUND THE BEGNAS LAKE OF POKHARA VALLEY, NEPAL

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Abstract

We studied the seasonal abundance and diversity of waterbirds around the Begnas lake of Pokhara Valley. The status of waterbirds in Begnas wetland is not documented so, we monitored the waterbirds using point count method and compared the seasonal abundance and diversity. A total of 585 individuals of 25 waterbird species from 10 families were recorded during the study period. Among the recorded species two species were globally threatened and remaining were least concerned categories. The greater abundance of waterbirds was recorded during winter ($t = -5.98$, $p < 0.001$). Abundance of all feeding guilds was found higher during winter. Cattle egret was recorded with the greatest abundance (N = 85) and Relative abundance (RA = 14.52), it was followed by great cormorant (N = 57, RA = 9.74) and common pochard was the least abundant (N = 2, RA = 0.34). There was no seasonal variation in Shannon Wiener index (H') and species evenness however, the species richness was higher during winter ($W = 16.5$, $p < 0.01$). Distance to the forest, road and settlement did not affect the abundance and diversity of waterbirds however, the abundance of insectivore birds was increased with the decrease of distance to croplands ($t = -3.13$, $p < 0.05$). The Begnas wetland was found with lower abundance and diversity of waterbirds in comparison to the Phewa and other wetlands of Terai region of Nepal. The lake water pollution, infrastructural development, anthropogenic activities, recreational activities and infestation of invasive plants like water hyacinth were the main threats to the waterbirds around the Begnas lake. Awareness program about the conservation of waterbirds and regular monitoring of waterbirds in Begnas was recommended.

Keywords: Anthropogenic, Invasive, Seasonal, Threats, Wetland birds

MICROPLASTIC CONCENTRATION AND CHARACTERIZATION IN THE SURFACE WATER OF PHEWA LAKE, NEPAL

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Abstract

Microplastic pollution is an emerging pollutant of growing concern worldwide due to its adverse negative impacts on biota. However, research on microplastic in a freshwater environments in Nepal is limited. Therefore, this study was conducted with the objective to investigate the presence and concentration of microplastic in the surface water of Phewa Lake. A total of 16 sampling locations were selected to collect surface water samples covering an area of 5.726 km^2. The presence of microplastic in the water sample was analyzed as per National Oceanic and Atmospheric Administration (NOAA) protocol. Isolation of microplastic was achieved with a digestion process using hydrogen peroxide (H_2O_2) which was then filtered through a glass microfiber filter and visually examined using a stereomicroscope. The concentration of microplastic for surface water range from 2.7 to 1.0 particles/L with an average abundance of 1.51 particles/L. The highest concentration of microplastic was found near the dam site where Phikre Khola (stream) mixes into Phewa Lake and the lowest at the temple region and lake center region where human interference is negligible. The observed microplastic was divided into four types, i.e. fibers, films, foams and fragments of which fibers (96.69%) were the most dominant type of microplastic. Transparent color accounted about 31.41% of the total samples. 98.78% of the detected microplastic were found to be <1 mm in size. Polymer identification was not carried out as micro-Fourier transform infrared spectroscopy (μ-FTIR) or Raman spectroscopy was not available in Nepal to analyze the polymer composition of small size microplastics. These findings add a step towards filling the research gap by providing baseline data on microplastic status in the freshwater environment of Nepal.

Keywords: Microplastics, Water, Abundance, Phewa Lake

EFFECTS OF ANTHROPOGENIC DISTURBANCE ON PLANT SPECIES COMPOSITION IN TEMPERATE FOREST OF CHANDRAGIRI HILL, KATHMANDU, CENTRAL NEPAL

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Abstract

The study examined the plant species richness and their diversity along anthropogenic disturbance gradient on Chandragiri Hill. Three (undisturbed, intermediately disturbed, highly disturbed) disturbance classes were categorized based on anthropogenic activities. Vegetation data were collected from 75 sample plots (25 for each disturbance class) from the elevation ranging from 1460 to 2310 m asl by random sampling method in the year 2020-2021. Diameter at breast height was used to broadly categorize plant species into trees, shrubs and herbs measuring at 1.37m height above the ground for trees and shrubs and 10 cm above the ground for herbs. This study found that a total of 38 tree, 32 shrubs and 54 herbaceous species in the study area. The highest species richness of shrubs and herbs were found in intermediately disturbed area while highest species diversity of trees was found in undisturbed area. Tree biomass (6.78 to 21.8t ha^{-1}), tree stand density (120 to 827 individuals ha^{-1}) and tree basal area (9.05 to 68.38 m^2 ha^{-1}) were more in undisturbed and least in heavily disturbed area. The highest values of the Shannon Weiner index, Margalef index and evenness index the lowest value of the Simpson index were noticed at intermediately disturbed area for shrubs and herbs species. Trees species were more dominating in undisturbed area while herbaceous and shrub plants prefer to grow in intermediately disturbed region due to higher competition. *Schima wallichii, Pinus roxburghii, Syzygium cumini* and *Alnus nepalensis* represented tree species found in disturbed area and *Rhododendron arboreum, Quercus semecarpefolia, Berberis aristata* and *Butea monosperma* on undisturbed regions. The variation of species richness, biodiversity index, biomass and basal area in the study area directed the need of development of strategies for proper conservation of trees species by circumventing human interferences along all elevational ranges.

Keywords: Anthropogenic disturbance, Species richness, Disturbance gradient, Chandragiri Hill

IDENTIFYING THE ENVIRONMENTAL AND ANTHROPOGENIC CAUSES, DISTRIBUTION, AND INTENSITY OF HUMAN RHESUS MACAQUE CONFLICT IN NEPAL

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Abstract

Reducing conflict between humans and wildlife is considered a top conservation priority. However, increasingly human-induced disturbances across natural landscapes have escalated encounters between humans and wildlife. In Nepal, forests have been destroyed, fragmented, and developed for human settlements, agricultural production, and urban centers for decades. As a result, human-wildlife conflict, in the form of crop-raiding, livestock predation, and injuries to humans and wildlife, is common throughout the country. In particular, crop-raiding by macaques is an increasingly common form of human-wildlife conflict. Rhesus macaques (*Macaca*

mulatta) have been identified as a top ten crop-raiding wildlife species in Nepal. In order to better understand the nationwide distribution and intensity of human-rhesus macaque conflict (HRMC), we conducted an extensive literature review of reported incidences of HRMC during the period 2000 to 2021 in Nepal. We created an online survey to obtain nationwide data on the location and severity of HRMC, and modeled the set of ecological factors that affect habitat suitability for rhesus macaques. we found that almost 44% of Nepal's land area contains suitable habitat for rhesus macaques, with less than 8% of all suitable habitat located in protected national parks. As humans continue to alter and fragment natural landscapes, HRMC in Nepal has intensified. At present, nearly 15% of the country's land area in which human settlements are permitted, is characterized by moderate or high rates of HRMC. we argue that prioritizing programs of forest restoration, strategic management plans designed to connect isolated forest fragments with high rhesus macaque population densities, creating government programs that compensate farmers for income lost due to crop-raiding, and educational outreach that informs local villagers of the importance of conservation and protecting biodiversity, offer the most effective solutions to reduce HRMC in Nepal.

Keywords: Forest fragmentation, Human disturbance, Human-wildlife conflict, Rhesus macaque

EVALUATION OF WATER QUALITY AND DETECTION OF *bla*$_{kpc}$ AND *bla*$_{kpc-2}$ GENES AMONG ENTEROBACTERIACEAE OF BAGMATI RIVER

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Abstract

Bacteria producing *Klebsiella pneumoniae* carbapenemases (KPCs) are rapidly emerging as a cause of multidrug-resistant infections worldwide. The occurrence of KPCs in polluted river indicate the possible spread of the pathogen. A cross-sectional study was carried out from Oct. 2019 to Dec. 2020 to measure the quality parameters of the river water and to detect *bla*$_{KPC}$ and *bla*$_{KPC-2}$ genes in carbapenemase producing strains. Triplicate grab water samples were collected from 13 different locations from Sundarijal to Chobhar and analyzed. The Electrical Conductivity ranged from 30-1045 µS/cm while turbidity ranged from 3.5-557 NTU. Chloride content ranged between 6.6-99.4 mg/L and nitrate ranged from 0.006-1.8 mg/L. The ionic concentrations were higher in winter season and lower in monsoon season. Total phosphorous and ortho-phosphate were ranged from 0.034-2.17 mg/L and 0.006-0.75mg/L, respectively. We isolated resistant bacteria using meropenem antibiotic incorporated Mueller Hinton Agar. Antimicrobial susceptibility of isolates were tested using Kirby Bauer disc diffusion method and KPC were confirmed by inhibitor-based method using Phenyl Boronic Acid. The median value of meropenem resistant bacterial population to total bacterial population was 0.47. During the study, 35 bacterial isolates were identified, of which 74.28% (n=26) were *Escherichia coli* and 25.72% (n=9) were *Klebsiella pneumoniae*. Antibiotic susceptibility test revealed that 80% of the isolates were multidrug-resistant. Conventional PCR was used for the amplification of *bla*$_{KPC}$ and *bla*$_{KPC-2}$ genes. We detected *bla*$_{KPC}$ and *bla*$_{KPC-2}$ in 47.62% and 23.81%, respectively. We report a statistically significant correlation between meropenem resistant bacterial count and total phosphorous ($r = 0.66$, $p < 0.05$) and chloride ($r = 0.85$, $p < 0.01$) content. Elevated concentrations of major inorganic anions, antibiotic resistant bacteria and resistance gene in the water sample indicates higher magnitude of anthropogenic pollution in Bagmati River.

Keywords: Physico-chemical parameters, Heterotrophic plate count, Antibiotic resistance bacteria, Carbapenemase, *bla*$_{KPC,}$ *bla*$_{KPC-2}$

MICROBIOLOGICAL ANALYSIS OF DRINKING WATER OF KATHMANDU AND DETECTION OF BIOFILM ASSOCIATED GENES IN *ESCHERICHIA COLI*

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Abstract

Biofilms formed in the drinking water distribution system (DWDS) not only ensure the survival of bacteria but also resist antibiotics. Despite tremendous work on biofilm producing bacteria on clinical samples the information on biofilm formation by drinking water isolates is rare. A total of 50 drinking water samples were collected from different areas and analyzed at the Environment and Climate Study Laboratory, Nepal Academy of Science and Technology (NAST) from November 2019 to March 2021. Water samples were examined using physicochemical, microbiological parameters, and antibiotics. Using Congo red agar and the Microtitre plate method, bacterial pathogens were identified for biofilm production. Biofilm associated genes *bcsA* and *csgD* were detected by polymerase chain reaction (PCR) using specific primers. The physicochemical analysis of drinking water samples revealed that conductivity (4%), turbidity (18%), iron (28%), and residual chlorine (8%) exceeded the national drinking water quality standards, 2005. In total, 40% of water samples were contaminated with coliform bacteria. 64.52% of *Escherichia coli* and 35.48% of *Citrobacter* species were identified. *E. coli* from water samples were resistant to Ampicillin (20%), Nitrofurantoin (10%), and Cefotaxime (10%) and 100% sensitive to Ceftriaxone, Gentamicin, Co-trimoxazole, and Ciprofloxacin. 54.54% of *Citrobacter* spp. were found multidrug resistance (MDR). The isolates consisted of 35% biofilm producers using Congo red agar method and 45% biofilm producers by microtitre plate method. 55% of isolates harbored *bcsA* gene while 45% of isolates harbored *csgD* gene. This study concluded that in drinking water, waterborne potential pathogens like *E. coli* harbor *bcsA* and *csgD* gene and hence form the biofilm. Therefore, it is recommended that bacterial biofilm counts should also be added to the indicators of water quality.

Keywords: drinking water; pathogens; biofilm; *bcsA*; *csgD*

FACTORS AFFECTING THE FORAGING HABITATS OF CHINESE PANGOLIN (*Manis pentadactyla*) IN CHANDRAGIRI MUNICIPALITY, KATHMANDU, NEPAL

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Abstract

Chinese Pangolin (*Manis pentadactyla*) is one of the mammalian species found in Nepal that is critically endangered because of its illegal hunting and poaching, deforestation, fires and habitat destruction. It is a strange and shy animal which survives at the highly specialized diets of ants and termites. Limited knowledge is available on the foraging habitat of this species therefore the study identified its foraging habitats and the factors affecting on its occurrence in Chandragiri Municipality of Kathmandu, Nepal. The foraging habitat was assessed by the presence and absence of Chinese pangolin's sign within the plots established in 20 line transects from 21 November to 19 December 2021. In addition, the variables such as food availability, elevation, slope, aspect, canopy coverage, vegetation types, distance of foods including ant nests and termite mounds, distance to nearest water source, settlements, roads were also recorded from the plots. A total of 99 Chinese pangolin's burrows (11 new, 54 old and 34 foraging) were recorded during the study period. The burrows were not uniformly distributed and recorded exclusively in dense forest cover with dominant tree species like *Schima wallichii*, *Myrica esculenta*, *Castonopsis tribuloides*, *Pinus roxburghii*, and *Cleyera* sp. The burrows were observed between 1500-1700 m of elevation within slope 20-40°. Majority of burrows were within the range of 60-80% canopy coverage in the Southeast and South facing. The Chinese pangolin's occurrence at the nearest distance to roads and settlements causing exposure of the pangolins to human threats. The distance to nearest agricultural land, ant nests and the slope had the significant effect on the distribution of the burrows. The baseline data from this study can be used for developing Chinese pangolin's site specific management plan outside the Protected area system of Nepal.

Keywords: Critically endangered, burrows, distribution, habitat utilization

SUITABILITY OF GROUNDWATER OF KATHMANDU VALLEY FOR DRINKING PURPOSES

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Abstract

Groundwater is an important source of drinking water for household uses in Kathmandu valley, but it is contaminated due to domestic and industrial pollutants. Monitoring the groundwater quality is necessary to reduce the health-related issues caused by groundwater pollution. This study was done to assess the groundwater quality of Kathmandu valley. The physical, chemical, and microbiological parameters of the samples were evaluated. Correlation among the parameters was carried out and the Weighted Arithmetic Index method was used to calculate the Water Quality Index (WQI). The study revealed that the groundwater in the valley is unsuitable for drinking purposes without proper treatment. Among the total water samples, 95% contained total coliform bacteria and 35% of the samples contained *E.coli* beyond the National Drinking Water Quality Standards, 2005. Besides chloride, all the physiochemical parameters were found to be higher than the national standard. Out of the total samples 6%, 9%, 64%, 1%, 74%, 4%, 53%, and 1%of pH, conductivity, turbidity, hardness, iron, arsenic, and nitrate respectively were higher than national standards. The Water Quality Index (WQI) based on physicochemical parameters, ranged from 4 to 1040, with an average of 112. Out of the total samples, 25% of water samples were excellent, 16% were good, 10% poor, 10% very poor, and 38% were unsuitable for drinking and fish culture. Among the three districts, samples from Kathmandu district had a WQI of 96, Lalitpur had 113 and Bhaktapur had 151, indicating Bhaktapur district has the most polluted groundwater. Proper treatment is required for any kind of usage of the water.

Keywords: *Water quality, Groundwater, water pollution*

TAXONOMY OF GENUS SWERTIA L. (GENTIANACEAE) IN NEPAL

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Abstract

Taxonomic study has vital role in the flora writing and for identification of the species. This further helps in the enumeration of related genera, update the latest nomenclatural change and adds new herbarium specimen for the herbaria from new locality. Genus *Swertia* commonly known as 'chiretta' or 'felworts' originally described by Linnaeus (1751 and 1753), has a complex taxonomic history. Botanists over last 3 decades have split and lump this genera several times with other closely related genera. According to the latest record, *Swertia* L. consists of about 91 species mostly in Asian and some in African countries. In the present study, a detail taxonomic account of genus *Swertia* found in Nepal was made based on the collected specimens and herbarium specimens at different herbaria (KATH, TI, TUCH) with detail description of species, illustration, distribution, key for identification, dendrogram and photo-plates. Twenty two species have been described in detail and six species with their taxonomic description by consulting secondary literatures. The most important morphological characters to delineate the taxa are habit, height of plant, no. of floral parts and nature and no. of glands. There is wide range of distribution of genus in the country i.e. WCE region ranging from 200-4600m. The dendrogram obtained from the vegetative and reproductive characters show two distinct clusters with further sub-clusters and branches. The study shows that the morphological characters are significant in identifying the species of this genus.

Keyword: Glands, Swertia, Taxonomy

ANTIBIOTIC SUSCEPTIBILTY TEST OF DIFFERENT WATER BORNE PATHOGENS IN SUPPLY WATER AND DETECTION OF ENTEROAGGREGATIVE *Escherichia coli* (EAEC) IN BALKOT, BHAKTAPUR

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Abstract

In the context of Nepal, especially in an urban area like Kathmandu valley, drinking water sources are found to be contaminated with various chemicals and pathogenic microorganisms because of which people suffer from various water borne diseases. This study has been envisioned to assess the antibiotic susceptibility test (AST) of different water borne pathogens and identification of Enteroaggregative *E. coli* (EAEC) strain of *E. coli* carrying *aggR* gene. A total of 50 tap water samples were randomly collected from Balkot area, Bhaktapur. The total coliforms were enumerated by standard membrane filtration technique. Antibiotic susceptibility testing was conducted using the Kirby-Bauer disc diffusion method. Identification of EAEC strain carrying *aggR* gene was done by PCR method. The result showed that 100% of samples were contaminated with total coliforms and 38% of samples were contaminated with *E. coli*. All the isolates of *E. coli* showed growth in M-Endo Agar at 44.5 ˚C indicating the water samples being fecally contaminated. *E. coli* (38%) was the predominant followed by *Citrobacter* spp. (10%) and *Salmonella* spp. (6%). Only 5% of *E. coli* showed multi drug resistance. Similarly, among 38% isolates of *E. coli*, EAEC carrying *aggR* gene was detected in 15.7% of isolates. Thus, this study highlights the poor condition of tap water of Balkot, Bhaktapur which urge for immediate action from the concerned authority to maintain its quality since it directly affects the public health.

Keywords: Tap water, Antibiotic, Total coliform, EAEC, *aggR*.

QUALITY OF HABITAT INFLUENCE ARTHROPODS DIVERSITY AND ECOSYSTEM SERVICES IN VARIOUS ECOSYSTEMS

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Abstract

Ecosystem comprises a unique nature of habitats. The plant diversity, types of vegetation, soil types, topography, landscape nature as well as human intervention in various categories of habitats can influence the arthropod's density and diversity. Arthropods available in the ecosystem play a great role in ecosystem services (ES) and dis-services (EDS). Ecosystem service delivering arthropods or organisms are called ecosystem service providers. For example, pollinators, predators, parasitoids, earthworms, soil microorganisms, shredders and decomposers etc. are ecosystem service providers. Pollinators such as bees and butterflies contribute to pollination services, and predators such as ladybird beetles, syrphid flies, carabids etc. contribute to insect pest suppression. Such habitat information is necessary to evaluate the habitat quality. More diversity and density of such ecosystem service providers in any habitat are more sustainable and nature-friendly. Hence, a study was carried out to evaluate the quality of habitat by monitoring the ecosystem service providers' population. Various monitoring tools such as pitfall traps for carabids and other arthropods, bee bowls for bees, quadrat for earthworms, and visual observations for spiders and other predators were used for the regular monitoring of such service providers from March to April 2021. The study showed that the beneficial arthropods population was significantly higher in undisturbed, more diversified as well as organic habitats compared to disturbed, less diversified as well as intensive farming fields. Those beneficial arthropods were Carabidae, ladybird beetle, hover fly, Staphylinidae, millipedes, spiders and earthworm. These beneficial arthropods potentially contribute to delivering the ecosystem services in various habitats. Such information's are necessary to evaluate the habitat quality and sustainable ecosystem.

Keywords: Habitat, Ecosystem services, Ecosystem dis-services, Arthropods

EVALUATION OF BOTTLED WATER AVAILABLE IN THE MARKET OF KATHMANDU VALLEY

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Abstract

The quality and availability of safe drinking water is a critical issue of Nepal. Due to the health consequences arising from unsafe drinking water and water insecurity, most of the people switched to bottled drinking water. The majority perceive bottled drinking water is safe for consumption however few researches have shown it is not always the case. So, the regular assessment of quality of bottled mineral water is vital. The study collected 30 different brands of bottled water with replicates i.e. 60 samples from different shops in Kathmandu Valley and analyzed the physicochemical and microbial quality. The parameters pH, iron, total coliform count, *Escherichia coli* count, and fecal coliform count exceeded National Drinking Water Quality Standards, 2005 in 30%, 16.67%, 66.67%, 23.33%, and 16.67% samples respectively while all other parameters are within the standard. The water quality index revealed 36.67% bottled water samples falls under grade A (excellent water quality), 6.67% falls under grade B (good water quality) and 56.67% samples fall under grade E which is unsuitable for drinking. In total of 60 samples, 14 bacterial isolates were identified of which 85.71% were *Escherichia coli* and 14.29% were *Klebsiella* sps. The antibiotic susceptibility test revealed that 28.57% of the isolates were multidrug-resistant. Identified bacteria were highly resistant to Gentamicin (71.43%) and less resistant to Meropenem (0%). The study found that 42.86% bacterial isolates were biofilm producers and 57.14% were non-producers in which 66.67% harbored *bcsA* gene and 50% harbored *csgD* gene. These results concluded that all bottled water is not safe for drinking.

Keywords: Biofilm, Microbial, Physicochemical, Water Quality

POSTER PRESENTATION

INVESTIGATION OF CHARACTERISTIC PROPERTIES OF ACTIVATED CARBONS PREPARED FROM *CHROMOLAENA ODORATA* L. FOR THE REMOVAL OF HEAVY METALS FROM WATER

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Abstract

Heavy Metals (HMs) are known to induce toxicity in the environment due to their persistent nature. Their negative consequences on the environment include accumulation in various environmental mediums and tissues of organisms, eventually spawning health issues. Among various methods of removal, a convenient and economic approach includes utilization of an adsorbent material, such as activated carbon. By implementing proper preparation method along with using less-polluting chemical agent and incessant available biomass, carbon of decent quality can be procured. Invasive plants are considered as nuisance to the environment and their presence in ecosystem threatens native flora. Alternatively, they can also be potential source of ligno-cellulosic biomass for the preparation of activated carbons. The study was conducted in order to investigate the potential of activated carbons prepared from *Chromolaena odorata* L. for the removal of heavy metals from water. Carbons were prepared using one-step (AC-1) and two-step (AC-2) activation processes and their characteristic properties; carbon yield and weight loss (%) (Yield and Loss Testing Methods), moisture content (%) (Oven Drying Method), bulk densities (g/ml) (Mechanical Tapping Method), pH, point of zero charge (PZC) (pH Drift Method) & FTIR spectroscopy (Infrared Spectral Analysis), were determined. Except for mean final yield (%), mean moisture content (%) and mean bulk density (g/ml), all the other parameters had higher values for AC-1 than AC-2. Common functional groups that appeared in the tested samples of raw biomass, biochar, AC-1 & AC-2 included H-bonded alcohols and phenols (O-H). The results were evaluated and compared with outcomes of several literatures to estimate the efficiency of carbons and carbon preparation methods, such that these carbons can be applied for removal of heavy metals from polluted water deeming their potential as promising adsorbent.

Keywords: Adsorbent, Adsorption, Accumulation, Invasive Plants, Toxicity

GERMINATION ECOLOGY OF SEEDS PRODUCED BY SUMMER AND WINTER COHORTS OF *PARTHENIUM HYSTEROPHORUS*

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Abstract

Germination of seeds is highly responsive to the immediate environment of the seeds as well as environment experienced by the mother plant during growth and seed development. We studied the germination ecology of seeds produced by summer and winter cohorts of *Parthenium hysterophorus* growing in Kathmandu valley. Germination was observed under alternating day/night temperatures of (low: 25/15°C and high: 30/20°C), light (12-h photoperiod of 3000lux and dark) and at different water potentials (-0.1, -0.25, -0.5, -0.75 and -1MPa) for 20 days. Seed mass, Germination percentage (GP), Timson's index (TI) and Mean germination time (MGT) were calculated. Winter seeds had higher seed mass than summer seeds. Although seeds of both cohorts germinated under complete darkness as well as 12-h photoperiod, the germination percentage was 10-18% higher under a 12-h photoperiod than under complete darkness. At low temperature, winter seeds showed high GP, TI, and MGT compared to summer seeds. But, at high temperature, summer seeds showed high GP, TI and MGT compared to winter seeds. This result indicates the influence of maternal growth environment on the germination behavior of seeds. Germination of seeds of both the cohorts decreased with increasing water potential. About 2.67% of winter seeds germinated at -0.75 MPa but summer seeds were unable to germinate beyond -0.5 MPa. This experiment provides evidence of strong impact of the maternal environment on seed germination. Moreover, this study also suggests a wide range of environmental tolerance (chilling and dry winter to hot and humid summer) during seed germination of *Parthenium hysterophorus* which might have allowed the plant to grow both during the winter and summer seasons.

Keywords: Maternal environmental effects, Seed germination, Seed traits, Stress tolerance

ASSESSMENT OF WATER QUALITY OF SELECTED LOCATIONS OF BAGMATI RIVER APPLYING A WATER QUALITY INDEX MODEL

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Abstract

Human activities have hastened the destruction of river water ecology in recent times. The discharge of industrial and household waste streams without proper treatment into the Bagmati river deteriorates water quality. This study will examine the water quality aspect of aquatic ecosystems and recreation along a significant polluted section of Bagmati river in the Kathmandu Valley, using the Canadian Council of Ministers of the Environment water quality index (CCME WQI). Seven physicochemical parameters with and without (w/o) *fecal coliform* were used to determine the CCME WQI at four different, mostly polluted locations, including the river source, for the sake of comparison. The data analysis indicated that the water quality at the river source is marginal, whereas the water quality in the other selected locations is poor. The study results are likely to provide corresponding stakeholders with appreciated information about the use of black-river water by local people in polluted sections and suggest some onsite technology to improve river water quality.

Keywords: River water pollution. Bagmati river. Water quality parameters. Aquatic ecosystem.

RESTORATION OF FLOOD DAMAGED CROPLAND SOIL IN KOSHI TAPPU REGION OF EASTERN NEPAL

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Abstract

Degradation of ecosystems has been observed across the globe. In Nepal, ecosystems are very fragile and prone to degradation. Among various reasons, flooding and river shifting are frequent to degrade the cultivated land in Tarai. Koshi flood-2008 has damaged about 700 hectares of fertile land by depositing sand and silt. Degraded ecosystem recovers naturally but it is a slow process. The restoration process can be speeded up artificially by planting nitrogen fixing plants. Leaves of legume plants having narrow C:N ratio decomposes at fast rate and add more nutrients to the soil. However, magnitude of addition of soil nutrients may differ as per the litter chemistry. Soil microbial biomass, regulates the decomposition, mineralization and immobilization mechanisms to speed up the restoration process. The main objective of the present study is to accelerate the recovery of soil nutrients by using legume plants. This study is being conducted in the perspective of United Nations Ecosystem Restoration decade 2021 to 2030. Seven to eight months nursery raised seedlings of five leguminous plants namely: *Flemingia macrophylla* (Wild), *Gliricida sepium* (Jacq.) Kunth ex Griseb, *Leucaena leucocephala* (Lam) de Wit, *Pithecellobium dulce* (Roxb.) Benth. and *Tephrosia candida* (DC) will be planted in July-August 2022 in the designed blocks of the flood damaged cropland soil. One control site and one nutrient rich undisturbed cultivated site will be taken to examine the status of recovery. Nitrogen will be determined by micro-Kjeldahl method, phosphorus by colorimetric method, potassium by flame photometer and soil microbial by mass by fumigation-extraction method. After estimating the recovery of soil nutrients (N, P, K) and soil microbial biomass (C, N, P), nutrient addition potential of different plant species will be examined and better one will be recommended.

Key words: Decomposition, N-mineralization, Recovery, Soil microbial biomass, soil nutrients

ANTIBIOTIC RESISTANCE BACTERIA IN HOSPITAL WASTEWATER

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Abstract

Hospital wastewater (HWW) is one of the hot spots for antibiotics resistance bacteria (ARB). This poses a great health risk to humans, animals and plants. This study was carried out to determine the exact antibiotic resistance pattern of bacteria isolated from four different hospitals located in Kathmandu, Nepal. Total viable bacteria and ARB were isolated by using tryptone soya agar supplemented with different antibiotics viz. ampicillin (32µg/ml), ciprofloxacin (4µg/ml), doxycycline (16µg/ml), sulfamethoxazole (512µg/ml) and ceftriaxone (4µg/ml). Antibiotic susceptibility test was performed using the modified Kirby Bauer disc diffusion method. A total of 147 morphologically distinct colonies were picked and identified also with their biochemical characteristics. Among 147 distinct colonies, 26 colonies remained unidentified. Out of 121 colonies, the majority of the colonies were identified as *Pseudomonas* spp. (23.8%), *Bacillus* spp. (17.68%), *Escherichia* coli (9.52%), *Staphylococcus* spp. (8.16%), *Citrobacter* spp. (6.12%), *Proteus* spp. (5.44%), *Klebsiella* spp. (3.4%), *Shigella* spp. (3.4%), and *Salmonella* spp. (2.72%). Among them, 46 colonies were Multidrug-resistant (MDR) which includes 7 *Citrobacter* spp. 5 *Shigella* spp., 10 *E. coli*, 24 *Pseudomonas* spp., etc. This study found that a higher level of isolates was resistant to ampicillin and ceftriaxone. This study also suggests that most of the Gram-negative isolates were resistant to ampicillin and ceftriaxone and the Gram-positive isolates were resistant to ampicillin and cotrimoxazole. It is theoretically possible to transfer the ARB from the hospital effluents to the community. Therefore, it is very necessary that HWW should be properly treated before mixing into the drainage system.

Keywords: Antibiotic resistance bacteria, Wastewater Treatment, Health hazardous, MDR.

MICROPROPAGATION AND ACCLIMATIZATION OF ENDANGERED ORCHID *AERIDES ODORATA* LOUR.

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Abstract

Aerides ordorata is one of the wild epiphytic orchids found in Southeast Asia, having medicinal and ornamental importance with a beautiful aroma. Orchid deterioration and even extinction has come from a lack of clear guidelines on sustainable harvesting and weak implementation of policies, as well as an increase in illegal orchid trafficking. Micropropagation is the use of *in vitro* culture techniques to propagate true-to-type plantlets. *In vitro* propagation is used globally for the conservation of threatened species. Immature seeds of *Aerides odorata* was cultured in different strengths of Murashige and Skoog (MS) media with different concentrations of auxin and cytokinins; both in the presence and absence of coconut water. A high rate of germination was observed in MS media with 10% coconut water. The maximum number of healthy shoots (13.4±0.31) was observed in MS media containing BAP (2 mg/L) and shoot length (3.8cm±0.01) in BAP (1 mg/L) and NAA (0.1 mg/L). The maximum root number (3.2cm±0.13) and root length (4.54±0.03) were observed in MS media supplemented with IBA (3mg/L). The *in vitro* propagated plantlets were further acclimatized in different substrates supplemented either alone or in different combination. A ratio of substrate containing 2:1:1 with coco peat, pine bark, and sphagnum moss was found to be best for acclimatization. About 75% of the plantlets were successfully acclimatized in the greenhouse. Thus, using plant tissue culture, endangered *Aerides odorata* can be propagated and can ultimately help in conservation and fulfill the demand.

Key words: Orchid, Illegal trafficking, *in vitro* propagation, Acclimatization.

ASSESSMENT OF PHYSIOLOGICAL AND MICROBIOLOGICAL PARAMETERS AND PREVALENCE OF ANTIBIOTIC RESISTANCE BACTERIA IN GROUNDWATER OF LALITPUR

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Abstract

Water is precious gift of nature, which is basic requirement of every life-form on this earth.Approximately 50% of the drinking water supply worldwide is obtained from groundwater. Presence of antibiotic resistance bacteria in groundwater source can lead outbreaks of waterborne diseases. This study was aimed to determine the physicochemical and microbial quality of groundwater of Lalitpur and antibiotic susceptibility pattern of bacterial isolates. Total 45 groundwater samples were collected from dug well, tube well, and boring. Samples were analyzed for physicochemical and microbial parameters using procedure as described in standard methods for the examination of water and wastewaterand results obtained were compared with National drinking water quality standards, 2005. Antibiotic susceptibility testing (AST) was conducted by using Kirby-Bauer disc diffusion method. All analyzed physicochemical parameters were within a standard limit except turbidity (48.9%), ammonia (42.3%), iron (64.5%), and arsenic(11.2%). Among total samples, 91.2% contains total coliform bacteria and 46.3% were found to be contaminated with fecal coliforms. The highest percentage of bacteria was *Escherichia coli* (65.7%) followed by *Citrobacter*spp(31.5%), *Klebsiella*spp (2.6%).Antibiotic Susceptibility Testing has been done by using antibiotics;Meropenam, Ciprofloxacin, Tetracycline, Amicacin, Chlorampheicol, Ceftazidime, Co-Trimoxazole, Nalidixic Acid, Amphicillin, and Gentamycin. Groundwater of Lalitpur district is contaminated with chemicals such as ammonia, iron, arsenic as well as bacteria like *E.coli*, *Klebsiella*, and*Citrobacter*. Presence of fecal coliforms in water is the indication of water being fecally contaminated which can cause outbreak of diarrheal diseases. There is urgent need of appropriate intervention, water treatment system and frequent research for the simultaneous removal of hazardous chemicals and bacteria from groundwater resources.

Keywords: Groundwater, physicochemical, microbial, Antibiotics

TAXONOMY OF GENUS CODONOPSIS WALL. *S.L.* (CAMPANULACEAE) IN NEPAL

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Abstract

Codonopsis taxonomy has long been a source of debate. In the history of *Codonopsis*, the species were kept under 10 generic names by different researchers over time. This genus has altogether 46 species and is an endemic to Asia. The purpose of this study is to create a complete taxonomic account of the genus *Codonopsis* Wall *s.l.* in Nepal, as well as to analyze the taxonomic composition of the genus based on morphological characters of the 17 species (12 core *Codonopsis*, one *Himalacodon*, one *Pankycodon*, three *Pseudocodon* species). The treatment is based on herbarium study and field work. Study provides detailed taxonomic description of all the taxa along with keys for the identification, habitat, phenology, illustrations and geographical distribution with in Nepal. Based on morphological study two groups were prepared with habit, erect and twinning. Shape of the corolla is an easy distinguishing factor among erect species; to differentiate twinning species features like leaf surfaces, shape and size of calyx tube, petiole size and surface also play an important role. Cluster analyses of 17 species were done based on 64 characteristics with the help of SPSS using between group methods, dendrogram results in formation of two cluster, three *Pseudocodon* species, *Plankycodon* and *C. reflexa* formed cluster1 while rest of other species form cluster 2 with character corolla lobe *Codonopsis* taxa are found across Nepal, from the east to the west, with high species richness in the eastern and central regions than western region.

Key words: Taxonomy, *Codonopsis*, Morphology, Campanulaceae

MUTUALLY BENEFICIAL AND HARMFUL INSECTS ACROSS ELEVATION GRADIENTS AND SEASONS AT SHIVAPURI NAGARJUN NATIONAL PARK

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Abstract

Insects are the most diverse linage of multicellular organisms and have different roles in the terrestrial and aquatic ecosystem. The study defines the nature of insects (beneficial/harmful) based on the feeding behaviour at Shivapuri-Nagarjun National Park. Over nine months, a total of 1465 insects had collected from three elevations (low -1663masl, mid - 2177masl and high - 2636masl), using three different methods of insect collection, viz. cup trap, pitfall and net swipe. These total insects belong to 11 orders. However, only 1410 individuals had identified from 105 families. These insects were then categorized as beneficial (N = 869) and harmful (N = 544). Total count of insects was significantly high at mid-elevation (n= 724) compared to both high (n= 406) and low (n= 335). As compared to autumn (n= 436), summer had a high number of insect collections (n= 623), but in comparison to the months, more counts had found from June to October (Monsoon). Similarly, when compared among collection methods, significantly low numbers of insects had captured in the net swipe compared to the cups and not much difference in the pitfall. Crawling insects (Orthoptera) had captured more in the pitfall trap. Diptera had the highest abundance in total and was captured more in the yellow cup, followed by Hymenoptera. Based on feeding behaviour, predator (36%) was maximum, followed by herbivore (32%), decomposer, parasitoids, vector and pollinator. In addition, a significant correlation had observed between the number of insects, temperature and humidity. Insects had highly distributed at all sites (Margalef index value = < 2.05), and diversity was poor (Shannon- Wiener Diversity Index ranges from 0.469 to 1.286).

Keywords: Predator, Diptera, Distribution, Temperature, Humidity, Diversity Index

PHYSICOCHEMICAL AND BACTERIOLOGICAL ANALYSIS OF BAGMATI RIVER OF KATHMANDU VALLEY

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Abstract

Bagmati river, which flows through the Kathmandu valley is the principal river of the Bagmati River Basin. The study had been envisioned to assess certain physicochemical parameters i.e. pH, temperature, Total Dissolved Solids (TDS), electrical conductivity, turbidity, bacteriological analysis i.e., isolation and identification of pathogenic organisms and their Antibiotic Susceptibility Test (AST). Seven sites are allocated along the Bagmati River from Sundarijal to Chobhar. Five samples are collected from each site and analyzed by standard procedures. Maximum average of pH, temperature, Electrical conductivity, Total dissolved solid is recorded to be 8.9, 27°C, 1425µs/cm,712.4 mg/l respectively. The organism isolated are *E coli* and *Shigella* spp from Pashupati and Thapathali. Further identification of organisms and their antibiotic susceptibility test is to be done.

Keywords: AST, Coliforms, Physicochemical parameters

STUDY ON PRACTICES OF SOLID WASTE MANAGEMENT AMONG INHABITANTS OF GHORAHI SUB METROPOLITAN CITY, DANG, NEPAL

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Abstract

The Solid waste management practices was reported poor among the respondents of Ghorahi ward number 15 as per the various study carried out in different settings. Only a few studies on Practices of Solid waste management came into attention when compared. This study aimed to assess the Solid waste management practice among inhabitants of Ghorahi sub metropolitan city ward no.15. This cross-sectional quantitative study was conducted in Ghorahi sub-metropolitan city ward no. 15 within the period of one month. Simple random sampling was used for sample selection chosen and 328 respondents were considered for the study. Pre testing of the questionnaire was done among 10% of sample size in Tulsipur sub metropolitan city ward no. 6 in order to correct and modify the questions. SPSS version 16 was used for descriptive and inferential statistical analysis. Among the study participants, 62.5% executes poor solid waste management practices and in contrast, 37.5% perform good practices. The study shows there are such practices for SWM operated by respondents in various percentage in which majority of respondents selects open burning practice for waste management (41.0%) followed by open dumping (27.7%), land filling (26.8%) and other practices (4.6%). The good practices of solid waste management among inhabitants of Ghorahi Sub -Metropolitan City are practiced by less percentage of respondents.

Keyword: Solid waste management, Practice, Knowledge, Attitude, Accessibility

ISOLATION AND IDENTIFICATION OF CELLULOSE DEGRADING BACTERIA FROM COW DUNG

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Abstract

Cellulose is a polymer chain made up of glucose units linked together by β-1, 4 linkages which is generally destroyed by a set of enzymes known as cellulases, which are important enzymes in the conversion of cellulose to fermentable sugars because of their wide range of applications in textile, detergent, leather, food, feed, and paper sectors, biogas production, fiber modification, and pharmaceuticals. As the demand for industrial methods to degrade or modify cellulosic biomass has grown, microorganisms able to produce cellulases have become significantly important. To isolate and characterize the cellulose degrading bacteria from cow dung, optimize the media and growth conditions for maximum enzyme production from isolated bacteria. Cellulose degrading bacteria was isolated in CMC-Congo-red Agar media. Spot inoculation was performed for higher zone of hydrolyzed bacteria in CMC-Congo-red agar plates. Additionally, different biochemical tests were done for identification of bacteria. Bacteria was isolated after 48 hrs of incubation at 28±2 °C. Five isolates were selected by their hydrolysis capacity (HC) value among 14 isolated bacteria from cow dung. *Bacillus spp.*, *Micrococcus spp.*, were isolated. Isolated *Bacillus spp.*, *Micrococcus spp.*, showed cellulose hydrolyzing capacity and further optimizing for cellulase production would be promising for future use.

Keywords: Cellulases, Bacteria, Isolation, Enzymes

ASSESSING THE EFFECTIVENESS OF NATIVE *TRICHODERMA* spp. AGAINST THE PHYTOPATHOGENS AND THEIR GROWTH POTENTIAL ON ALTERNATIVE SUBSTRATES

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Abstract

Agriculture, as we know it, is gradually adopting a more ecological, sustainable, and environmentally friendly approach. One such approach is the development and use of biological control agents. Biological control of plant diseases is a more environmentally friendly alternative to the current chemical approaches. Among the various types of biological control agents used, the fungal genus *Trichoderma* is one of the most utilized BCA for managing plant diseases. In this study five native *Trichoderma* species present in soil were issues from Chitwan, Dhapakhel, Godawari, Phulchowki, and Pokhara. Dual culture against the phytopathogens *Fusarium oxysporum* and *Alternaria alternata* was also done in which strain from Pokhara showed the highest antagonistic activity of 62.71 % and 55.19 % respectively. Similarly, there was a gradient effect of nitrogen on *Trichoderma* growth, with higher concentration inhibiting the growth. The effect of chemical fungicide Carbendazim on *Trichoderma* and fungal pathogens were also observed. Carbendazim inhibited all *Trichoderma* species as well as *Fusarium oxysporum* but had limited effect on *Alternaria alternata* at all used concentrations (0.1 %, 0.15 %, and 0.2%). Similarly, the mass multiplication of *Trichoderma* on various alternative liquid (Potato Dextrose Broth, 3 % Molasses, and 20 % Whey) and solid (wheat, inner flesh of sugarcane bagasse, whole sugarcane bagasse, and rice husk) substrates showed excellent growth, with highest growth observed in 20 % whey and rice husk.

Key words: Dual Culture, Mass multiplication, Phytopathogens, *Trichoderma*.

FIRST REPORT OF DNA BARCODES FOR MUSHROOMS FROM KATHMANDU VALLEY, NEPAL

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Abstract

Mushrooms are macrofungi that are one of the most diverse and important groups of organisms on the planet with a variety of biological, ecological, and economic benefits. Due to the diverse geography of Nepal, the country has been enriched with many important and diverse mycoflora. Over 1000 species of mushrooms have been described till date, however, they have only been identified based on their morphology and distribution which is time-consuming, difficult, and error-prone. To this end, a rapid and reliable identification method is DNA barcoding which has the high-throughput potential for rapid identification as well as less susceptible to misidentification. In this study, four morphologically distinct wild mushrooms were subjected to molecular characterization using Internal Transcribed Spacer (ITS) region. The PCR amplicons obtained were sequenced and identified by performing a BLAST search. The collected specimens were found to be belonging to three different genera: *Amanita* sp. (n=1), *Russula* spp. (n = 2) and *Microporus* sp. (n = 1). Hence, here we report for the DNA barcodes for mushrooms collected from the forests around Kathmandu valley, Nepal.

Keywords: Mushroom, DNA Barcoding, Nepal.

HEALTH AND MEDICAL SCIENCE

THEMATIC SPEAKER

SPINAL SURGERY IN NEPAL - EVOLUTION TO REVOLUTION

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Abstract

Spinal column keeps our torso upright and assists in our body movements. It protects spinal cord. Any disease conditions affecting the spine lead to varying degrees of disabilities ranging from pain to paralysis. Spinal problems circumvent a wide range of disease conditions like injury, infection, deformities, tumors, degenerative and metabolic. Indications for spinal surgery includes; 1. Incapacitating pain 2. Instability of spinal column 3. Spinal deformities 4. Pathology in vertebrae or cord 5. Progressive neurological deficits. Spinal surgeries are challenging as well as demanding. Due to lack of expertise, proper instrumentation systems and back up facilities in the hospital set ups, spinal surgeries were limited only to some of the disease conditions till about 15 years back. Patients had to rest in bed for months during treatment and had to live with spinal deformities. With the development of expertise, availability of varieties implants and proficient critical care team there has been a visible revolutionary evolution in the field of spine surgery in Nepal, just over a short span of years. Gradual transition from non-operative treatment to open spinal instrumentation to minimal invasive spine surgeries are the testimony for this revolution. Today any spine surgery is focused on painless early mobilization without spinal deformity aiming to bring the patient back to his / her regular daily activities as soon as possible thus improving the quality of life. Younger generations are showing their interest in spine surgery. Newer technologies are being introduced. Now our collective efforts should be on bringing this so called expensive treatment to the accessibility of general population of the country.

Keywords: Implants, Spinal instrumentation, NOT, MIS

HEALTH AND MEDICAL SCIENCE

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Abstract

Human health has always been a matter of concern in the history of mankind. Generally, "Health" is considered as a status of an individual enabling him/her perform expected normal works. Certain health conditions or illnesses can limit perform normal activities. World Health Organization's definition states that "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Spiritual health as the fourth dimension of human health is added to this definition. More pragmatically, Health is an ability of a person to adapt and manage physical, social and emotional challenges in his/her life. Health and illness are dynamic processes and there needs to be a balance between agent (disease causing factors), host (humans) and environment where people live and work. In ancient eastern medical practices, the Ayurveda and in Chinese medical philosophy "Health" was considered as a holistic balance between health, environment, soul and the body. Hippocrates the "Father of Modern Allopathic Medicine," had established scientific relationships between environment, cleanliness and the disease. The advancement of medical science provided better understanding of the structure and function of human body and effective measures for treatment and prevention of diseases. We find that discoveries in life sciences and innovations have equipped people with more knowledge than ever before. Much is known today, but much more is yet to be known. As human society and prosperity depends much on science and innovations, health professionals, policy makers, planners and citizens need to understand what Health and Medical Science really is, so that necessary measures can be taken.

Keywords: Health, physical, mental, infirmity, medical, science, innovation

NUCLEAR MEDICINE THERANOSTICS: NEPAL'S PERSPECTIVE

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Abstract

Nuclear medicine uses small amounts of radioactive materials (radiopharmaceuticals) to diagnose and treat various disease including many cancers. Nuclear Medicine Theranostics is new concept in Nuclear Medicine where the same radioisotope can be used for both diagnosis and treatment of a cancer. In nuclear medicine imaging, the radiopharmaceuticals are detected by different imaging modalities (PET/CT, SPECT/CT, PET/MRI etc.) to provide very precise pictures of the area of the body being imaged. Positron Emission Tomography (PET) is one of the most advanced nuclear medicine modalities which has been used to diagnose various type of cancers and other complicated disease of brain and heart. PET scan is especially known for providing functional information of disease. However, hybrid PET/CT scanner provides both functional and anatomical information simultaneously to diagnose various types of cancers accurately in the early stage. Iodine-131, Lutetium-177, Rhenium-188, Radium-226 are few of many theranostic radioisotopes which are widely used nowadays for the diagnosis and treatment of thyroid cancer, prostate cancer, liver cancer, bone cancer etc. The essential requirement for PET/CT imaging is Cyclotron. Cyclotron produces PET radioisotopes such as F-18, C-11, O-15, N-13 etc. These radioisotopes are further labeled to prepare PET tracers e.g., 18F-FDG which is most widely used to diagnose cancers and many other metabolic diseases. PET/CT has become essential imaging modality in theranostics because of its numerous advantages such as Staging, Treatment Response Evaluation, Restaging and Prognosis.

INVITED SPEAKER

REVIEWING THE CHALLENGES IN IMPROVING HEALTHCARE AND BIOMEDICAL RESEARCH GOVERNANCE AND CLOSING THE GAPS IN BUILDING A PRODUCTIVE HEALTHCARE ECOSYSTEM IN NEPAL

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Abstract

Significant gaps exist in healthcare and biomedical research in Nepal, and the COVID pandemic exposed them and made those gaps unmistakable and undeniable. This presentation, using the World Health Organization's (WHO) conceptual framework for health research systems, aims to review where such gaps exist and the possible structural causes for the gaps, and discuss some of the lessons that can be learned from the examples of efforts in other countries in building better health research systems.

Keywords: Research Systems, WHO

EPIGENETIC REGULATION OF TUMOR EVOLUTION, METASTASES AND STEMNESS

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Abstract

Epigenetics regulation has growing evidences linked with multiple cancer types. In recent years, epigenetic dysregulation mainly DNA methylation and histone modifications has been reported in tumorigenesis, malignancy, invasion, and metastases, and stemness in various cancers. In our studies using genome-wide DNA methylation array, we have identified genes that contribute to metastases of primary breast tumors to the brain through dysregulation in DNA methylation in genes These epigenetic dysregulations occurred either in early stages (early events) or in later stages in tumor evolution (late events). We detected these DNA methylation changes using patients' serum as a plan to develop non-invasive prognostic tests for primary breast tumors that metastasizes to the brain. Therefore, the epigenetic changes that occur in early stages due to DNA methylation could be used in detecting the possibility of tumor metastases to the distant organs. In addition, the subtypes of some tumors (such as Glioblastoma/GBM, a subtype of brain tumors) have shown a distinct DNA methylation pattern, that could be used in classifying tumor phenotypes and therapeutic decision making. Further, we have found that DNA methylation and histone modification together contribute to tumorigenesis, proliferation and invasion of tumor initiating cells (cancer stem cells) in non-small cell lung cancer (NSCLC), a type of lung cancer with poor prognosis and limited therapeutic options. These data show that the two important epigenetic mechanisms (mainly DNA methylation and histone modification), contribute to tumor initiation, and its evolution to multiple subtypes, metastases and in cancer stem cells.

Keywords: Epigenetic regulation, cancer, DNA methylation, metastases, stem cells

LABORATORY INFORMATION SYSTEM WITH ELECTRONIC LABORATORY MEDICINE ORDERING– A NEED FOR QUALITY LABORATORY TESTS AND ENHANCING EVIDENCE-BASED PRACTICE

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Abstract

Evidence-based laboratory medicine is a branch of evidence-based medicine which focuses on the evaluation and use of laboratory tests with an overall aim of improving patient outcomes. Laboratory testing is an important clinical act with a valuable role in screening, diagnosis, management and monitoring of diseases or therapies. About 30% of patient contacts in primary care result in ordering one or more laboratory tests. There is a large variation in the appropriateness of these orders. Besides the burden this poses on health care spending, it also negatively influences quality of care. This has also shown to increase turn-around time in the laboratory since pre-analytical and post-analytical phases contribute to nearly 96% of the turnaround time in a clinical laboratory. Order sets, a form of clinical decision support systems where a limited set of evidence-based tests are proposed for a series of indications which are backed up by a laboratory information systems. This system can be effective in reducing the volume of ordered laboratory tests. This also helps in reduction of errors and turn -around time as test order and labelling is computerized and supported by IT and also improving the accuracy of tests. This can be sown to overall improve quality of test and enhance evidence based practice.

Keywords: Evidence based laboratory medicine, Laboratory information system, Turn-around time

SPECIAL TALK, NAST

STRUCTURE-ACTIVITY RELATIONSHIP STUDIES OF CHALCONE AND FLAVONOL LIBRARIES

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Abstract

Flavonoids are polyphenolic secondary metabolites that ubiquitously occur in higher plants to lower algae. They are found in vegetables, fruits, seeds, nuts, grains, spices as well as in beverages. The skeleton of flavonoids can be represented by C6–C3–C6 system consisting two benzene rings. Flavonoids have displayed various biological activities, such as anti-inflammatory, antiviral, antibacterial, antiallergic, anti-ischemic, antiplatelet, immune-modulatory, antitumor, etc. Chalcones (1, 3-diaryl-2-propen-1-ones) and flavonols (3-hydroxy-2-phenylchromen-4-ones) are two sub-groups of flavonoids. We have synthesized a library of chalcones *via* Claisen-Schmidt condensation between arylmethyl ketones and aromatic aldehydes. Like wisely, commercially available quercetin (3, 3', 4', 5, 7-pentahydroxy-2-phenylchromen-4-one) was used to synthesize another library of flavonols through derivatizations. Thus synthesized chalcones and flavonols were characterized using spectroscopic tools. Furthermore, these compounds were utilized in *in vitro* bioassays for the evaluation of antioxidant capacity and antibacterial activity. The substituent's effect in the exhibited bioactivities and required structural modifications for the possible enhancement will be summarized in the presentation.

Keywords: Antibacterial, Antioxidant, Conformational analysis, Flavonoids, SAR, Synthesis.

ORAL PRESENTATION

ASSOCIATION BETWEEN VITAMIN D RECEPTOR FOKL AND BSML GENE POLYMORPHISM AND DIABETES MELLITUS IN NEPALESE POPULATION.

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Abstract

Vitamin-D being involved in secretion of insulin is a known fact. Vitamin-D receptor (VDR); a factor required for genetic regulation involving vitamin D thus can be regarded as a good candidate for Diabetes Mellitus (DM). Several studies have been conducted on association between VDR polymorphism and the risk of DM. However the results are still inconclusive. The study was conducted to find the association of Fok1 and Bsm1 polymorphisms of VDR gene with DM in a Nepalese population using case-control study. The total 200 blood samples were collected; 100 from clinically diagnosed DM patient and 100 from healthy controls (HC) from July 2019 to February 2020. Genomic DNA was extracted from blood followed by PCR-RFLP analysis. After restriction digestion, Single-Nucleotide Polymorphisms (SNPs) of Fok1 (T/C) [rs2228570] and Bsm1 (A/G) [rs1544410] were assayed using agarose gel documentation system. Odds Ratios (ORs) along with their 95% confidence Intervals (CIs) were computed to compare the distribution of genotypes/alleles between DM and HC patients, As patients and controls were analyzed for genotype distribution and allelic frequencies it was found that the frequency of VDR gene SNPs of Bsm1 rs1544410 differ significantly ($p < 0.05$, each) between cases and control where A allele was dominant (91%) in healthy controls with OR of 0.55 unlike VDR Fokl where significant association between subjects and control could not be found. No significant association ($p > 0.05$) was found between VDR gene with gender, age, BMI, family history, alcohol consumption, and serum triglycerides level ($p > 0.05$) etc. However the association between VDR gene SNPs and LDL and HDL ($p < 0.05$) level was found to be significant. The data suggests that VDR gene (especially Bsm1) is associated with the risk of DM. Hence, further studies of Bsm1 gene as a probable genetic risk marker for DM.

Keywords: Vitamin D Receptor, Diabetes Mellitus, PCR-RFLP, Nepal.

BACTERIOSPERMIA IN MEN AMONG COUPLES UNDERGOING FERTILITY INVESTIGATION

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Abstract

The number of infertile couples seeking medical treatment has been increasing year by year, not only in global scenario but also in Nepal. Infertility due to male factor alone or in combination to female was reported in about half of the cases in Nepal. Infection of male urogenital tract or male accessory glands, one of the important causes of male infertility, results in bacteriospermia, the presence of bacteria in semen. Bacteriospermia may affect the fertility potential of sperm. It is important to know about the type of bacteria in semen to understand the etiology and pathogenesis of urogenital tract infections. The aim of this study was to know the rate of infection in semen of infertile men, the type of bacteria present in semen and the relation of bacteriospermia to sperm concentration, motility, morphology, and vitality in semen. A descriptive cross-sectional study was done based on an infertility center of Nepal and university microbiology laboratory. Semen samples collected from the male partners of the couples consulting for fertility problems were processed for routine semen analysis and culture based bacteriological analysis for the isolation and identification of isolated bacteria. The result of semen analysis only one-third of the samples studied were normozoospermic with respect to sperm concentration, motility, morphology and vitality. Microbiological analysis of semen samples showed about one fourth of the tested semen samples had bacteriospermia. Most common bacterial isolates recovered from semen samples was *Staphylococcus* spp. Decrease in the percentage of sperm motility, morphology and vitality were observed in semen with bacteria. Our study provides a baseline data of bacteriospermia in infertile Nepalese population and new insights on role of bacterial infection in male factor infertility in Nepal. Our results indicate the significance of bacteriological analysis of semen in the identification of possible cause of male infertility and its effective treatment.

Keywords: Male infertility, Infection, Bacteriospermia, Semen parameters, *Staphylococcus*

STORAGE AND MEDICINE DISPOSAL PRACTICES BY PATIENTS VISITING A TERTIARY CARE CENTER OF KATHMANDU

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Abstract

Unused medicines can be stored by people at their places of residence and houses for later use. The objective of this study to assess the status of medicine disposal and storage practices Storage and medicine disposal by patients visiting pharmacy of a tertiary care center of Kathmandu Valley of Nepal. Method: A cross-sectional study was done using a semi-structured questionnaire from February to May 2021. The study population was the outpatients visiting the pharmacy of the hospital. Systematic sampling was used for the data collection. The data was collected from 10 working days per month which was selected randomly. Descriptive statistics and t-test/One-way ANOVA were used to compare the respondents' mean knowledge scores. Practice variables were presented as frequencies. Results**:** Majority of participants were from age group of 20-30 years, 303 (69.8%). Majority of participants were females 223 (51.4%). Many of them were literate 421 (97%). Many of them were literate. Majority were having secondary level of education, 216 (49.8%). Nearly one third, 137 (31.6%) participants were doing service. Majority of participants, 331 (76.3%) were storing medicine at their homes. Appropriate ways of discarding expired medicines were known by 293 (67.5%) of participants. Correct response were recorded for the persons responsible for improving the knowledge among households about proper disposal of 'Expired medicines' by 270 (62.2%) of participants. Throwing in a dustbin was the preferred method of expired medicine disposal. Conclusion**:** There is a good level of knowledge and practice of disposing the unused medicines among the patients visiting the hospital. Various educational intervention programs may help improve awareness further. Creating a chart summarizing disposal procedures of common medicines is important.

Keywords: Medicine storage, Medicine disposal, Kathmandu, Nepal, self-medication

ANTIBIOTIC RESISTANCE SURVEILLANCE AND MOLECULAR CHARACTERIZATION OF ESBL AND CARBAPENEMASE GENES PRESENT IN BACTERIA ISOLATED FROM FRUITS AND VEGETABLES SOLD IN KATHMANDU

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Abstract

Antibiotic resistance has become a global threat. Resistant bacteria can spread between individuals, animals, and the environment. Foods could serve as a vehicle for transmitting antibiotic-resistant bacteria, especially the fresh fruits and vegetables which are often eaten raw and can become a source of food-borne illness. A total of 40 fresh fruits and vegetable samples were collected from vendors around ten major hospitals and seven major marketplaces in Kathmandu. Samples were transported in sterile condition to the laboratory where they were washed with MRD (Maximum Recovery Diluent) separately, followed by 3 hrs. Incubation. Bacteria were then isolated by using the spread plate technique in MacConkey and VRBG (violet red bile glucose) agar. Gram staining followed by different biochemical tests were performed for the preliminary identification of bacteria. The antimicrobial susceptibility test was done using twenty different antibiotic discs by the disk diffusion method. Polymerase chain reaction was carried out for the detection of ESBL and Carbapenem genes. Of the 241 isolates from different samples, 102 (42.32%) were identified as ESBL producers and 23(9.54%) were identified as carbapenemase producers. Among these, bla_{TEM} (19), bla_{SHV}(2), bla_{OXA}(2), bla_{IMP}(1), and bla_{NDM}(1) were found. In conclusion, fresh produce and fruits could be one of the potential sources of transmission of antibiotic-resistant bacterial pathogens.

Keywords: Antibiotic Resistance, Carbapenem Resistance, ESBL, Fruits and Vegetables.

FERMENTATION AND ANTIMICROBIAL ASSAYS OF SECONDARY METABOLITES PRODUCING BACTERIAL EXTRACTS

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Abstract

Actinomycetes are extensively disseminated microbes in nature, typically abundant in soil. They are responsible for the production of around two-thirds of all known antibiotics, with *Streptomyces* being the most prolific producer. On that account, today's main issues regarding multi-drug resistance can be somehow predicted to be overcome utilizing bacterial extracts from *Streptomyces* species. However, the screening of actinomycetes has not met its pace. Henceforth, to identify the novel antibiotics from the natural environment, the screening techniques must be emphasized**.** This study was aimed at the isolation and extraction of potential antibiotics from the soil samples collected in Nepal. Actinomycetes were isolated on ISP4 media. By their morphological characterization, the available colonies were subjected to seed culture by flask fermentation and secondary metabolites were obtained. Antimicrobial assays were performed by cross streaking and agar well diffusion methods. Molecular characterization was done through molecular sequencing. A large number of actinomycetes were isolated from the soil. Among them, five isolates have shown good antibacterial activity against different bacterial strains. The highest zone of inhibition (ZOI) was shown by AB1(26mm), PT7(25mm), AA2-3 (15mm), AA3-2(15mm), GT2-1(13mm) against *Staphylococcus aureus* and *Shigella sonnei* indicating its potentiality as an antibiotic. This gives us a vision that actinomycetes found in Nepalese soils could be used to produce antibiotics in the upcoming days.

Keywords: Actinomycetes, ISP4 media, Secondary metabolites, ZOI

LC-HRMS PROFILING AND ANTIDIABETIC, ANTIOXIDANT, AND ANTIBACTERIAL ACTIVITIES OF *ACACIA CATECHU* (L.F.) WILLD

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Abstract

Acacia catechu (L.f.) Willd is a profoundly used traditional medicinal plant in Asia. Previous studies conducted in this plant are more confined to extract level. Even though bioassay-based studies indicated the true therapeutic potential of this plant, compound annotation was not performed extensively. This research aims to assess the bioactivity of different solvent extracts of the plant followed by annotation of its phytoconstituents.Liquid chromatography equipped with high-resolution mass spectrometry (LC-HRMS) is deployed for the identification of secondary metabolites in various crude extracts.On activity level, its ethanolic extract showed the highest inhibition towards α-amylase and α-glucosidase with an IC_{50} 67.8 ± 1 µg/mL and 10.3 ± 0.1 µg/mL respectively, inspected through the substrate-based method. On the other hand, the plant extract showed antioxidant activity of 23.76 ± 1.57 µg/mL, measured through radical scavenging activity. Similarly, ethyl acetate and aqueous extracts of *A. catechu* showed significant inhibition against *Staphylococcus aureus* with a zone of inhibition (ZoI) of 13 and 14 mm, respectively. With the LC-HRMS-based dereplication strategy, we have identified 28 secondary metabolites belonging to flavonoids, and phenolic categories. Identification of these metabolites from *A. catechu* and its biological implication also support the community-based usage of this plant and its medicinal value.

Keywords: Acacia catechu, Enzyme inhibition, LC-HRMS and Bioassays

BACTERIOLOGICAL ANALYSIS OF STONE SPOUT WATER AND PERFORM ANTIBIOTIC SUSCEPTIBILITY TEST OF ISOLATES

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Abstract

Dhunge dhara, traditional stone drinking foundation is still most dependent ground water drinking source in Kathmandu valley. The present study was conducted to evaluate the recent physico-chemical and bacteriological status of stone spout water. Bacteriological parameters were checked by enumerating heterophilic plate count (HPC) on Plate count agar (PCA) at 37 0 C, total coliforms count at 37 0 C and thermotolerant bacteria count (fecal coliform) at 44.5 0 C on M-endo agar by membrane filtration technique and spread plate technique. In physico-chemical analysis, out of total 18 samples tested, 14(77.77%) were found within expected pH according to WHO guidelines. Likewise, for conductivity, total hardness and chloride concentration, 18(100%) samples were found within WHO guideline. While total alkalinity 11(61.11%), dissolve oxygen (DO) 1(5.56%), biochemical oxygen demand (BOD) 13(72.23%) samples were within WHO guideline. Similarly, total coliform count 1(5.56%) and thermotolerant bacteria 14(77.77%) samples were found within the guideline. In enteric pathogenic bacteria Salmonella spp. 5(11.36%), Shigella spp. 5(11.36%) and Vibrio spp. 2(4.454%) were isolated. Beside these, Proteus spp. 3(6.818%) and Pseudomonas spp. 5(11.364%) were also isolated. In antibiogram of coliform, Cotrimoxazole, Ofloxacin and Ciprofloxacin were found as effective antibiotics. Among the bacterial isolates 6(13.63%) were found to be MDR.

Keywords: Stone spouts, Microbiological, Coliform, Thermotolerant, Antibiotics

ANTIOXIDANT, ANTIMICROBIAL AND *IN VITRO* ENZYME INHIBITORY ACTIVITY OF SOME NEPALESE MEDICINAL PLANTS

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Abstract

Diabetes Mellitus is a serious global health problem caused by the deficiency or inefficiency of insulin produced by the pancreas. The increasing side effects of synthetic antidiabetic drugs have drawn attention of researchers in the search for new therapeutic approaches. One of the common approaches to reducing postprandial hyperglycemia is the use of digestive enzyme inhibitors from natural products.This study aimed to investigate phytochemicals, antioxidants, and digestive enzyme inhibitory activity of selected medicinal plant extracts and their fractions. The enzyme inhibitory activity for α-amylase, α-glucosidase, and pancreatic lipase using the crude extracts of *Mimosa pudica*, *Phylanthus emblica,* and *Bergenia ciliata* was evaluated, followed by an estimation of total phenolic and flavonoids contents and antioxidant activity using DPPH method. Moreover, antibacterial activity was evaluated using the agar well diffusion method. The ethyl acetate extracts of all selected plants have shown higher TPC and TFC contents. The aqueous extract of *B. ciliata* (IC_{50}:16.99±2.56 µg/mL), ethyl acetate extract of *P. emblica* (IC_{50}:11.98±0.36 µg/mL), and crude extract of *M. pudica* (IC_{50}: 34.35±5.11 µg/mL) showed effective antioxidant activity. Furthermore, ethyl acetate extract of *B. ciliata* showed significant enzyme inhibitory activity against α-amylase and α-glucosidase with IC_{50} values of 38.5±1.32 µg/mL**,** 3.41±0.04 µg/mL, respectively. The hexane fraction of *Mimosa pudica* exhibited strong inhibitory activity against pancreatic lipase with an IC_{50} value of 0.49±0.03 µg/mL Thus, these medicinal plants are found to be effective inhibitors of digestive enzymes.

Keywords: Diabetes, Antioxidants, Enzyme inhibitors, Digestive enzymes

ASSESSMENT OF ANTIBACTERIAL PROPERTIES OF NEW OXOVANADIUM (IV) COMPOUNDS BY MOLECULAR DOCKING

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Abstract

Molecular docking calculations of newly synthesized Oxovanadium(IV) complexes of Schiff bases against various bacterial strains showed good binding affinities compared to the standard drug Neomycin. Various types of interactions present between the ligand and the participating amino acid residues of the protein of the bacteria were determined. The poses of the molecules at the orthosteric site of the receptor and the key residues involved were identified from the receptor-ligand complex. The interactions of vanadium compounds with the receptor were found to be more prominent than that of their precursors. The preliminary results show that the presence of different functional groups at various positions in the Schiff bases play a major role in initiation of non-covalent interactions that provide stability to the complex. The results have guided the future experimental work of synthesizing compounds with adequate functional group that would have even stronger binding and better medicinal capabilities.

Keywords: Schiff base, receptor-ligand complex, binding affinities, computational methods

MERGER OF AYURVEDA AND BIOTECHNOLOGY FOR STUDY OF ANTI CANCER ACTIVITY OF MEDICINAL PLANTS OF NEPAL

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Abstract

In the last twenty-five years, approximately half of all newly registered chemotherapeutics have been developed from natural products isolated from plants, fungi or microorganism. Nepal because of her geographical biodiversity,is home to flora and fauna of tropical, sub tropical and alpine origin. These herbs has been used since ancient time to treat numerous diseases. The present study was undertaken so as to find the phytochemical presence, antioxidant and antimicrobial activity and anticancer activity of methanol extract of Nepalese medicinal plants. Phytochemical screening of extracts revealed presence of various phytochemicals like alkaloids, flavonoids, terpenoids, coumarin, saponin, reducing sugar, glycosides, tannin, and steroid. The plant extract also showed antioxidant assay namely DPPH (Diphenyl-2-picrylhydrazyl) free radical scavenging activity**.** Antimicrobial screening showed sensitivity against *C. albicans, S. typhii,P. aeruginosa, Klebsiella pneumonia, Staphylococcusaureus,* and *E. coli* by the plants.. We also looked at anti cancer activity in human normal and cancer cell lines and we see cytotoxic effect of the extracts against cancer cells lines as seen by MTT assay and CV staining and also looked at their target proteins through Western Blotting.

Keywords: Antioxidant, ZOI (Zone of Inhibition), Phytochemicals, Cancer, Cell Lines

OCCURRENCE OF B-LACTAM RESISTANT GENES IN *ESCHERICHIA COLI* ISOLATED FROM WASTEWATER AND RIVER WATER OF KATHMANDU VALLEY.

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Abstract

Wastewater provides an ideal environment for the acquisition, proliferation and propagation of antibiotic resistant bacteria (ARB) originating from anthropogenic and veterinary sources, transforming it into a vast reservoir of resistant organisms. However, genomic transmission potential of ARB in wastewater of Kathmandu is rarely studied. A cross-sectional study was carried out from December 2020 to December 2021 to determine the occurrence of β-lactam resistant genes in *E. coli* isolated from wastewater of Kathmandu. Fifteen stratified random grab samples, five each from hospital outlets, sewage discharged river and sewerage were analyzed to isolate and identify bacteria using culture-based approach followed by antibiotic susceptibility testing using disc diffusion assay. Out of total 103 Gram negative bacterial isolates, dominant ones were identified as *Citrobacter* spp, and *E. coli*. and *Klebsiella spp.* 73.68% of total *E. coli* isolates were multidrug resistant (MDR). Hospital wastewater (90%) had the highest MDR isolates, followed by sewage (57.1%) and river water (50%). Phenotypic detection of β-lactamase enzyme production revealed that 22.2%, 50% and 40% of the *E. coli* isolates were ESBL, AmpC and Metallo-β-lactamase producing strains, respectively. None of the isolates were *Klebsiella pneumoniae* Carbapenemase positive. We tested presence of five β-lactam resistance genes to evaluate the genomic potential of antibiotic resistance in wastewater isolates of *E. coli* using polymerase chain reaction method. Among detected genes, $bla_{CTX\text{-}M,}$ was the most frequent gene (68.4%), while $bla_{TEM,}$ $bla_{NDM\text{-}1,}$ $bla_{OXA\text{-}48}$ and $bla_{VIM\text{-}2}$ were detected only in 63.2%, 10.5%, 10.5%, and 5.3% isolates, respectively. In total, 90% of hospital wastewater isolates tested positive for at least one gene, followed by 85.7% sewage isolates and none from river water. Gene co-occurrence was found in 63.2% of isolates. The presence of antibiotic resistant bacteria and genes in urban wastewater and river water indicates the potential threat of horizontal gene transfer and the emergence of superbugs.

Keywords: Wastewater, antibiotic resistant bacteria, *E. coli*, β-lactam resistance genes, Multidrug resistance.

UNTARGETED METABOLOMICS OF STREPTOMYCES SPECIES ISOLATED FROM SOILS OF NEPAL

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Abstract

Actinomycetes are natural architects of numerous secondary metabolites including antibiotics. With increased multidrug-resistant (MDR) pathogens, antibiotics that can combat such pathogens are urgently required to improve the health care system globally. The characterization of actinomycetes available in Nepal is still very much untouched which is the reason why this paper showcases the characterization of actinomycetes from Nepal based on their morphology, 16S rRNA gene sequencing, and metabolic profiling. Additionally, antimicrobial assays and liquid chromatography-high resolution mass spectrometry (LC-HRMS) of ethyl acetate extracts were performed. In this study, we have employed a computational-based dereplication strategy for annotating molecules which is also time-efficient. Molecular annotation was performed through the GNPS server, the SIRIUS platform, and the available databases to predict the secondary metabolites. The sequencing of the 16S rRNA gene revealed that the isolates BN6 and BN14 are closely related to *Streptomyces* species. BN14 showed broad-spectrum antibacterial activity with the zone of inhibition up to 30 mm against *Staphylococcus aureus* (MIC: 0.3051 µg/mL and MBC: 9.7656 µg/mL) and *Shigella sonnei* (MIC: 0.3051 µg/mL and MBC: 4.882 µg/mL). Likewise, BN14 also displayed significant inhibition to *Acinetobacter baumannii*, *Klebsiella pneumoniae*, and *Salmonella typhi*. GNPS approach suggested that the extracts of BN6 and BN14 consisted of diketopiperazines ((cyclo(D-Trp-L-Pro), cyclo(L-Leu-L-4-hydroxy-Pro), cyclo(L-Phe-D-Pro), cyclo(L-Trp-L-Pro), cyclo(L-Val-L-Pro)), and polypeptide antibiotics (actinomycin D and X2). Additional chemical scaffolds such as bacterial alkaloids (bohemamine, venezueline B, and G), anthramycin-type antibiotics (abbeymycin), lipase inhibitor (ebelactone B), cytocidal (oxopropaline D), antifungal and antitumor antibiotics (reductiomycin, streptimidone, deoxynybomycin), alaremycin, fumaramidmycin, anisomycin, and others were also annotated, which were further confirmed by using the SIRIUS platform, and literature survey. Thus, the bioprospecting of natural products from *Streptomyces* species from Nepal could be a potential source for the discovery of clinically significant and new antimicrobial agents in the future.

Keywords: Actinomycetes, Antibiotics, Mass spectrometry, Molecular annotation, GNPS

ENCAPSULATION OF URSOLIC ACID ISOLATED FROM *RHODODENDRON ARBOREUM* FLOWER IN LIPOSOMAL DRUG DELIVERY SYSTEM

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Abstract

Rhododendron arboreum has long been used to treat diarrhea, headaches, inflammation, and microbial infections. The compounds also exhibit antioxidant properties and have the potential to be used as active components in cosmetics. Moreover, using liposomal technology as a carrier system maximizes the therapeutic benefits by delivering the bioactive compounds to specific molecular targets. To prepare liposomal gel containing antioxidant compound, ursolic acid isolated from flower of *R. arboretum*. Isolated ursolic acid from *R. arboreum* was identified by UV, FT-IR, LC-MS, and ^{13}C-NMR. Formulation of liposomes was carried out by thin-film hydration method using Minitab software varying ratios of soya lecithin (10:100) and cholesterol (1:10). The particle size, entrapment efficiency, and zeta-potential were determined and optimized dispersion batches were prepared. The isolated compound with a melting point of 285 ^{o}C, λ_{max} at 205 nm, FT-IR showing the absorptions of C=O str. of –COOH group, geminal dimethyl, C=C stretching and OH group, the molecular ion peak at m/z 457.5 and ^{13}C-NMR absorbance of 30 Carbon atoms revealed compound as ursolic acid. Thirteen formulations were obtained from Minitab software which showed particle sizes ranging from (2941.9-6034) mm, Zeta potential (-44.4 to -63.2) mV, and entrapment efficiency (58.52 to 82) %. Optimized formulation showed the highest entrapment 84.61 % with R^2 value of 0.95 which was found to be significant at $P<0.05$.

Keywords: Ursolic acid, R. arboreum, Entrapment, Liposome

ANAEROBES IN SURGICAL INFECTIONS- EASTERN NEPAL

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Abstract

In surgical infections, anaerobic bacteria are known to be major pathogens. Some are extremely dangerous and have a high fatality rate. The aim of the study was to isolate and identify anaerobic bacteria from surgical infections using a standard technique. A cross-sectional study was conducted at Birat Medical College Teaching Hospital (BMCTH) over the course of a year. In the Robertson's cooked meat medium (RCM), tissue, pus and fluid aspirates were collected aseptically for culture. Each sample was subcultured on anaerobic blood agar with metronidazole disc (5g). GasPak was used to incubate the plates for 48 hours in an anaerobic jar and identified using standard and rapid VITEK 2 automated methods. Anaerobes were isolated from 53 (33.6%) of the 390 samples. *Bacteroides spp*. was the most common anaerobe isolated, followed by *Prevotella spp*. and *Peptostreptococci spp*. anaerobic bacteria a total of 390 specimens were collected from surgical ward. The most common clinical manifestation with anaerobic etiology was necrotizing 66 (16.9%), followed by liver abscess 64 (16.4%). The 53 anaerobes were isolated from 390 (13.5%) and 168 (43%), respectively, aerobes from surgical patients. *Bacteroides species* (38%) were the most prevalent, followed by *Prevotella species* (26%), and aerobes *Staphylococcus aureus* (24%) and *Pseudomonas aeruginosa* (15%). Anaerobic bacteria were found in (8.5%) and (5%), respectively, as monomicrobial and polymicrobial isolates. *Bacteroides fragilis* was the most common Gram-negative anaerobic bacillus (19%), followed by *Prevotella melaninogenica* (13%). The most common anaerobic cocci found were Peptostreptococci anaerobius (13 %). The most prevalent clinical manifestation with anaerobic etiology was liver abscess 11(21.7%), followed by appendicular infections 9 (17 %). Anaerobic bacteria in surgical infections must be detected by surgeons and laboratories to minimize treatment failures.

Keywords: Anaerobes, Surgical infections

EFFECTS OF CLIMATIC FACTORS ON THE CHANGING BURDEN OF WATER-BORNE DISEASES IN GORKHA AND SYANGJA DISTRICTS OF GANDAKI PROVINCE

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Abstract

To assess the relationship of climatic factors with the incidence of diarrhea disease in Syangja and Gorkha districts of Gandaki Province.This study was a retrospective descriptive study design. The study utilized climatic data (Maximum, Minimum, Rainfall, and RH) and diarrheal incidence data from 2010 to 2020. The obtained data were analyzed using the time series package of R software. The ethical approval to conduct this study was taken from the Ethical Review Board of the Nepal Health Research Council (NHRC).The climatic factors (maximum, minimum, and RH) and diarrheal incidence in the Gorkha and Syangja districts were not positively associated. However, a Positive association was found between rainfall and diarrheal diseases in Gorkha and Syangja districts respectively. overall 1mm increase in rainfall increases diarrheal incidence by 0.12% (RR= 1.002, 95% CI=1.0008-1.002) in Gorkha district and 1mm increase in rainfall increases diarrheal incidence by 0.06% (RR= 1.0008, 95% CI =1.0001-1.0012) in Syangja district. The Gorkha district's annual maximum warming trend was decreasing i.e. - 0.1155 °C/year. and the minimum warming trend was increasing by 0.0514°C/year. The annual precipitation trend was declining at -2.5938mm per year. The Syangja district's annual trend of maximum and minimum temperature was increasing by 0.0273°C/year and 0.0482 °C/year respectively. The annual rainfall of the Syangja district is in a declining trend i.e. -0.8109mm/year. Overall with the change in climatic factors the rate of diarrheal incidence is in increasing trend in both districts.

Keywords: Climate factors, Diarrheal diseases, Climate change.

EXTENDED SPECTRUM BETA LACTAMASE *ESCHERICHIA COLI* ISOLATED FROM BAGMATI RIVER, KATHMANDU

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Abstract

Bagmati, a holy river flowing along human settlements in Kathmandu valley is polluted with solid and liquid waste. Polluted water is reservoir to antimicrobial resistant (AMR) organisms. Onetime survey collecting water samples from upstream, mid-stream, downstream and tributaries of Bagmati river was carried out to determine the burden of ESBL *E. Coli* at different intersections of the river, generating evidences for appropriate policy and interventions by local government. A total of 258 water sample in triplicates were collected from 86 different locations in upstream, midstream, downstream of Bagmati river, major tributaries and also spring water sources (well and stone spouts) during Jan 2020-Dec 2021 and analyzed at Central Department of Microbiology, Tribhuvan University for isolation, identification, antimicrobial susceptibility testing, ESBL confirmation and detection of bla CTX-M and bla TEM genes in ESBL isolates. All samples of water analyzed contained coliform bacteria, indicating poor quality of water everywhere. Among 716 isolates, 278 (38.8%) were fecal coliforms. Non fecal coliforms, *E. Coli* 287 (62%), *C. Freudii* 141 (59.7%), *C. Koserii* 10 (58.8%) and fecal coliforms *C. Koserii* (41.2%), *C. Freudii* 95 (40.3%) followed by 176 (38%) *E. Coli* were identified. ESBL *E. Coli* accounted for 24% (172) of total isolate. Imipenem, a drug in reserve category as per WHO-aware classification was the only antibiotics susceptible for fecal coliform isolates. Gene's bla CTX-M and bla TEM were detected in 20% and 65% of the ESBL isolates while 5% of the isolates harbored both bla CTX-M and TEM genes. All samples showed presence of *E. Coli*, while upstream was less polluted than mid and downstream. Early implementation of appropriate water safety plan and sensitive surveillance based focal interventions including functional waste treatment plant, may improve quality of water to abate health risks due to AMR bacteria.

Keywords: Bagmati river, Water pollution, ESBL Ec, Water-safety, Water quality surveillance

EVALUATION OF THE EFFECTS OF NATURAL ISOQUINOLINE ALKALOIDS ON LOW DENSITY LIPOPROTEIN RECEPTOR (LDLR) AND PROPROTEIN CONVERTASE SUBTILISIN/KEXIN TYPE 9 (PCSK9) IN HEPATOCYTES, AS NEW POTENTIAL HYPOCHOLESTEROLEMIC AGENTS

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Abstract

Nine different isoquinoline alkaloids, berberine, govaniadine, stylopine, adlumine, adlumidine, bicuculline, sanguinarine, protopine and californidine have been evaluated for their effects on a cellular model of hepatocyte for their effect on low density lipoprotein receptor (LDLR) and proprotein convertase subtilisin/kexin type 9 (PCSK9) expression compared to simvastatin. Berberine, californidine and govaniadine induced LDLR with an effect similar to 2.5 µM simvastatin. Californidine and berberine at tested doses reduced the expression of PCSK9, with an opposite behaviour to simvastatin on this target. Govaniadine, on the other hand, showed a statin-like effect, although less

potently, by increasing both LDLR and PCSK9 levels. Berberine, californidine and govaniadine were then tested on the same cellular model to assess possible effect of reduction of total cholesterol, compared to simvastatin. All compounds were able to reduce total cholesterol level in the hepatocytes.

Keywords: Corydalis, Berberine, Alkaloids, Anti-cholesterol

AN APPRAISAL OF INDIVIDUAL MONITORING SERVICE (RADIATION) IN NEPAL

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Abstract

The use of ionizing radiation is ubiquitous in the field of medicine, industry, agriculture etc; however the hazardous aspects of those radiations should be addressed during their use. In Nepal, the use of ionizing radiation is mainly focused on medical sectors and all the equipment in use include X-Ray machine, Computerized Tomography (CT), Cobalt-60 therapy, linear accelerator (LINAC), fluoroscopy, mammography, nuclear medicine facilities, high dose rate brachytherapy sources, etc. However, individual monitoring for the implementation of radiation protection is fairly recent. With the radiation related law in place in the country recently in 2020, the radiation protection related issue can be expected to intensify in near future. An initiation on the radiation protection of individuals has been carried out at Nepal Academy of Science and Technology (NAST) with the establishment of Individual Monitoring Service (IMS) laboratory at Physical Science Unit of NAST. This laboratory has been established in Dec. 2015 in collaboration with Ministry of Education, Science and Technology, Government of Nepal and IAEA under the technical cooperation project NEP9001 and NEP9005. The only IMS laboratory currently hosts a 6600 plus Harshaw TLD reader along with 1050 TLD-100 cards. The reader is calibrated annually by exposing calibration cards to known dose at SSDL, Nuclear Malaysia and the IAEA. The individual monitoring service is being provided to almost 800 radiation professionals from more than 100 health institutions of the country with a monitoring period of three months. The dosimetry service has gained serious attention from the stake-holders with numerous requests received for personal dosimetry. The laoboratory however currently is not able to address all the received requests due to limited resources. The laboratory plans to expand dosimetry network all over Nepal in near future.

Keywords: Personal Dosimetry, TLD, Radiation

TRENDS OF NARCOTIC DRUGS CASES IN NATIONAL FORENSIC SCIENCE LABORATORY DHANGADHI, KAILALI

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Abstract

Narcotic drugs are defined in Narcotic Drugs (Control), Act 2033 of Nepal Government. Narcotic drugs analysis is one of the major services of National Forensic Science Laboratory. The study aims to analyze the data from January 2021 to May 2022 for trending of narcotic drugs at newly established branch office at Dhangadhi, Kailali. Narcotic Unit of this laboratory analyzed 639 total cases by using Thin Layer Chromatography (TLC) and Gas Chromatography-Mass Spectrometry (GC-MS) methods. Heroin and Cannabis were the most identified as Narcotic drugs reported as 58.05 and 13.14%, respectively. Nitrazepam was found significantly with 11.11%. Buprenorphine, Codeine, Opium and other drugs were reported less than 10%. This data revealed Heroin is the major and frequently misused narcotic drugs, whereas Cannabis, Nitrazepam, Diazepam and Buprenorphine are also misused and illegally traded by drug abusers and drug trafficking network.

Keywords: Forensic Science, Narcotic Drugs (Control) Act 2033, GC-MS, Drug abuser

USING NOBLE METAL NANOPARTICLES FOR S PROTEIN MODIFICATION IN CORONAVIRUS TREATMENT: AN APPROACH FROM QUANTUM MECHANICAL STUDY

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Abstract

In response to the recent outbreak of COVID-19, scientists have been devoted to discover an efficient treatment such as mRNA vaccines. Although contemporary methods of combating COVID-19 such as vaccinations and social distancing had been effective methods, the evolution of new variants had continuously posed threat to the world. To overcome and tackle those challenges, more in-depth understanding of the SARS-C0V-2 virus is highly needed. Through density functional theory (DFT), I had used quantum mechanical method to efficiently monitor the reactions between virus and noble metal nanoparticles as an effective treatment method for the COVID-19. The key information from theoretical investigation in this field will have additional value for further curing methods. To answer the question of interaction between noble metal nanoparticles and S protein, I have carried out quantum mechanical based theoretical investigations in this project. Here, I will analyze the interaction of noble metals like Au, Ag, Pt, Pd and Cu with the S protein. For the proteins with extremely complicated structures and functional groups, I will focus on several key fragments of S protein. I will reveal the interactions between the S protein fragments and noble metal nanoparticles regarding the binding strength, electronic structures, and stability of the fragments, etc. These information will be valuable for both understanding the protein modifications and suppressions of the SARS-CoV-2 virus. If this project, I had analyzed that noble metal nanoparticles will be effective to suppress the functionality of S protein. This result will open a new route in treatments of COVID-19 and benefit further research in this field.

Keywords: COVID-19, S protein Modification, Noble Metal Nanoparticle, Quantum Mechanics, Density Functional

DETECTION OF MYCOTOXIN FROM ARRO-BASED COMMODITIES LIKE MAIZE PRODUCTS (MAIZE GRITS, POPCORN, FLOUR, ANIMAL FEED) AND PEANUTS FROM THE LOCAL MARKET OF THE LALITPUR AND KATHMANDU DISTRICT

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Abstract

Mycotoxins are group of low molecular weight toxic compounds produced by fungi as secondary metabolites cause toxic to human and animal health. Among them, aflatoxins are the most toxic, mutagenic and carcinogenic. Fungi can grow on a variety of different crops and foodstuffs including cereals, nuts, spices, dried fruits, apple juice and coffee, often under warm and humid conditions. Peanuts and maize are vulnerable to fungal infections during long term storage. The aim of this study was to determine the mycotoxin (total aflatoxin) found in maize and its products such as flour, grits and peanuts which mostly consumed in the Kathmandu and Lalitpur district, Nepal. Total 86 samples, popcorn (n=16) maize grits (n=21), corn flour (n=18), animal feed (n=9), peanut (n=22) were collected from local markets and supermarkets includes. The one step lateral flow immune-chromatographic assay with Agra Vision Reader was used for the detection of total aflatoxin. The study showed that most of the sample did not cross maximum permissible limit (MPL) set by the Codex Alimentarius Commission whereas very few sample showed the aflatoxin higher than MPL. The total aflatoxin in all the popcorn was lower than MPL, followed by animal feed 11%, corn grit 23%, peanut 35% and corn flour 55 %. The isolation of the moulds from the same samples also performed by using Total Fungal Count technique. Identification of isolated fungi was done by microscopic analysis. The majority of identified isolates belongs to the mycotoxin producing genera *Aspergillius, Penicillium, Fusariumand Mucorales.*

Keywords: Aflatoxin, Aflatoxin B1, Food safety, peanut, maize, agro-based food commodities, Aspergillus, Frusarium, Penicilliun

ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF *IN VITRO* CALLUS AND *IN VIVO* RHIZOME OF *PARIS POLYPHYLLA* SM.

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Abstract

Paris polyphylla is a vulnerable medicinal plant, mainly used in cuts, wounds, antidote, anthelmintic, abnormal uterine bleeding, and anticancer. This study aimed to evaluate the antioxidant as well as antibacterial activity of *in vitro* callus and *in vivo* rhizome of *P. polyphylla* against *Acinetobacter baumannii, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Bacillus subtilis* bacteria through agar-well diffusion method. The antioxidant activity of crude methanol extracts and their fractions such as dichloromethane (DCM) and methanol were evaluated by 1,1-diphenyl-2-picrylhydrazyl (DPPH) free-radical scavenging activity. In addition, the total phenol and flavonoid content of these extracts were determined using a spectrophotometer with Folin-Ciocalteau reagent and aluminum chloride complex-forming assay respectively. The lowest IC_{50} value was found in the DCM fraction of rhizome (197.06 µg/mL) followed by the crude extract of callus (339.60 µg/mL). The highest total phenolic and total flavonoid contents in 1 mg of extracts were found in the DCM fraction of rhizome at 26.40±0.61 mg of GAE/g dry weight and 43.72±0.61 mg of QE/g dry weight respectively. The antioxidant activity of crude extract of rhizome was lower than their DCM and methanol fractions. The DCM fractions showed the minimum inhibitory concentration at 5 mg/mL and a minimum bactericidal concentration of 7.54 mg/mL against *E. coli*. The callus was induced in MS media containing 0.5 mg/L 2,4-D + 0.25 mg/L KN and 10% coconut water. The antioxidant and antibacterial activity of the *in vitro* callus were comparable to those of the *in vivo* rhizome. These findings demonstrated that *in vivo* rhizome and *in vitro* callus of *P. polyphylla* could be a valuable source of natural antioxidants and antimicrobials for better therapeutic uses.

Keywords: Bactericidal, Extracts, IC_{50}, Media, Well-diffusion.

IN-SITU EVALUATION OF URANIUM-238, THORIUM-232, AND POTASSIUM-40 AROUND MINING AREA IN SOUTHLALITPUR, NEPAL, AND ASSOCIATED RADIOLOGICAL RISK

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Abstract

The majority of construction materials utilized in urban areas come from mining sites, contributing to health concerns owing to natural radioactivity. Environmental safety and awareness are necessary since natural radioactivity is a big concern that cannot be neglected around the world. The purpose of this research is to determine the distribution of three natural radionuclides in the mining area in Southern Lalitpur in Nepal. A portable gamma-ray spectrometer was used to determine the concentration of natural radionuclides. The mean activity concentrations of ^{238}U, ^{232}Th, and ^{40}K, are found to be 85.82±40.63 Bq/kg, 104.87±30.42 Bq/kg, and 1257.47±304.37 Bq/kg, respectively. The radiological hazard parameters linked to radioactive concentrations were calculated and compared to internationally accepted standards. The computed value of radium equivalent activity (Ra_{eq}) ranges from 104.42 to 612.72 Bq/kg, with a mean of 332.62±63.08 Bq/kg which is less than the global recommended value. In the air, the average absorbed gamma radiation dose rate is 155.81±29.19 nGyhr^{-1}, which is greater than the global average recommended amount. Indoor and outdoor Annual Effective Dose Rates were found to be 0.76±0.14 mSv/yr and 1.91±0.36 mSv/yr, respectively. Annual Gonadal Dose Equivalent has an average value of 1098.41±204.47 □Sv/yr, ranging from 355.06 to 1995.45 □Sv/yr. The representative level index, external hazard index, and internal hazard index have their average values of 2.46+0.46, 0.90±0.17, and 1.13±0.24, respectively. The average indoor and outdoor excess lifetime cancer risks are found to be 2.73±0.51 mSv/yr and 6.83±1.28 mSv/yr, which are higher than the universally accepted standard.

Keywords: Gamma spectroscopy, Hazard indices, Mining area, NORM.

METAGENOME ANALYSIS OF HUMAN GUT MICROBIOME ALONG DIFFERENT ALTITUDES OF NEPAL

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Abstract

Human gut microbiome diversity between individuals was viewed from the perspective of altitude situation, age, ethnicity, and gender of the human host. We characterized stool bacterial composition obtained from three distinct geographical altitudes of Nepal; Bharatpur, Kathmandu and Lukla situated at 415 m, 1400 m and 2860 m above sea level respectively. Metagenomic analysis of 34 stool samples revealed that human gut microbiota was diverse and dynamic in Nepalese population but not significantly associated with the geographical altitudes residing the human hosts as well as their ethnicity. However, the Beta-diversity of the human gut microbiota significantly varied with the geographical altitudes, age and obesity of the human hosts. Altogether, 18 bacterial phyla, 39 classes, 61 orders, 119 families, 189 genera and 433 taxonomic units were identified from 34 stool samples. Two phyla Bacteroidates and Firmicutes occupied more than 80% of bacterial abundance in human gut. Prevotella and Bacterioides were two most dominant bacterial genera in fecal specimens across all three geographical locations. Actinobacteria, in particular, Bifidobacterium were associated with infants' gut microbiome. More or less similar core microbiomes (key bacterial species) were associated with location, ethnicity and weight (obesity). *Prevotella copri* represented key dominant species in the most samples.

Keywords: Metagenome, Microbiome, Ethnicity, Beta-diversity

LARVAL SOURCE ELIMINATION OF MOSQUITO BY NATIVE *Bacillus thuringiensis* (Bt) OF NEPAL

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Abstract

Vector control is an effective technique to prevent Mosquito borne diseases. The most effective method is larval source elimination to prevent the transmission of diseases. *Bacillus thuringiensis* subsp *israelensis* strain AM65-52 is recommended by WHO for larval source management of Mosquito. The research aims to isolate potent native Bt, effective for larval source elimination to control Mosquito borne diseases. Native Bt were obtained from *soil s*amples by acetate selection method. Identified as Bt by observing crystal protein by Coomassie Brilliant Blue in a light Microscope. The larvae were collected from the fields; placed in a tray, fed with sucrose and yeast in sterile distilled water for 2days in the laboratory. For larvicidal assay 25 larvae which have reached to ≈ 9mm to 14mm, placed in a cup containing sterile distilled water of 5cm height and inoculated with 0.03gram of spore and crystal mixture, four replicates of each isolates along with the control containing 25 larvae with distilled water was incubated at room temperature and the mortality percentage was calculated after 24 hours. A total of 88 Bt producing different shapes of crystal protein, spherical 79.54%, Spherical + cap headed 10.22%, Cap headed 2.27%, Rod shaped 5.68%, bipyramid 1.13% were analyzed for larvicidal activity. Mortality percentage was observed in 46.59% isolates and 53.40% were ineffective to control larvae of Mosquito. Among the 46.59% isolates 80.48% isolates (1 Bipyramid, 32 spherical) showed less than 20% mortality, 7.31% isolates showed 20% mortality, 27P4C, 32P3D, 11P3G and 1P4A isolates showed 24%, 28%, 31% and 34% mortality respectively. Only one isolate 12P3B showed 100% mortality against the Mosquito larvae.Native *Bacillus thuringiensis* was effective in killing the larvae of Mosquito and such isolate may serves as future tool to manage, vector resistance and larvae of Mosquito.

Keywords: Mosquito, Larvicidal, Crystal protein, Mortality, *Bacillus thuringiensis*

DISINFECTION USING ROBOTICS VIA MICROBIOLOGICAL APPROCH IN COVID-19 DEDICATD HOSPITAL AND QUARANTINE SETTINGS

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Abstract

Robotics has become a vital area of concern in health care settings for infection control with human contactless cleaning practices. This research is aimed to compare the efficiencies of disinfection procedures with robotic splashing and conventional applications in the hospital settings. The disinfection robot was designed and assembled at Institute of Engineering of Tribhuvan University, and its performance to disinfect surfaces and inanimate objects was tested. Microbiological experiments were conducted at Central Department of Microbiology of Tribhuvan University. The disinfection efficacy was compared based on the count of bacteria and recovery of selected priority pathogens after the disinfection. Sodium hypochlorite (0.5%) was used as disinfectant for both the applications. The swab samples were collected before and after the disinfection by conventional and robotic method from floor, bed, door knob and medical instruments of a COVID-19 dedicated hospital and a quarantine center. Both the conventional and robotic applications of disinfectant was satisfactory both in the hospital and quarantine center, however the reduction in bacterial count achieved was $\log_{10}$ 5.8 and Log_{10} 2.3 by robotic and conventional applications, respectively. Targeted priority pathogens were not recovered following the disinfections procedures by both applications. Our results demonstrated that the spraying robots is more efficient over conventional application of disinfectants in high risk zones. In addition, robotic application ensures contact-less application of disinfectants protecting cleaning workers in such settings particularly during pandemic situations.

Keywords: Pathogens, COVID-19, robotics, disinfection

HEPATITIS C VIRUS AMONG PATIENTS ATTENDING A REFERRAL HOSPITAL IN NEPAL

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Abstract

Hepatitis C virus (HCV) infection is a growing major health problem worldwide. It might cause acute and chronic hepatitis leading to liver cirrhosis and hepatocellular carcinoma. There is a great need of information about HCV, the disease burden and status of co-infection with Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV) in Nepal. The aim of the study was to identify the various demographic factors, transmission routes and proportions of co-infections with HIV, HBV in HCV patients. A hospital based cross sectional study was carried out from December 10, 2019 to June 3, 2022 in Tribhuvan University Teaching Hospital. Enzyme linked immunosorbent assay (ELISA) was used to detect HCV antibody, HBV surface antigen (HBsAg), HIV antibody. Real time polymerase chain reaction (PCR) was used to detect HCV RNA from the patient's serum. Results showed that 0.84% (92/10994) patients were found positive for Anti HCV. Among them, 8.7% (8/92) were found positive for HIV antibody but not for HBsAg. Among 92 HCV patients, male (80.4%) were significantly higher than female ($p<0.05$). 54.3% patients were Janajatis followed by Brahmin/ Chhetri (30.4%), Madhesi (7.6%) and others. Majority (72.8%) of the patients were young group (15-47 years). They were found from various professions. Majority of the patients were literate (79.3%). Majority of the patients were Hindus (76.1%) followed by Buddhist (12%). Only 39.2% patients were found to be regular alcoholic. Needle sharing among intravenous drug users were found common mode of transmission among 43.5% of the patients followed by sexual intercourse (33%). Among 26 patients, 21 patients' serum was detected for HCV RNA. It is concluded that hepatitis C viral infections is more common among young male intravenous drug user and having unsafe sex with multiple sex partner. HIV co-infection is found with HCV infection but not with HBV.

Key words: HCV, Co-infection, Risk factors

CHITOSAN FUNCTIONALIZED SALICYLALDEHYDE THIOSEMICARBAZONES, AND THEIR COPPER(II) COMPLEXES: SYNTHESIS, CHARACTERIZATION, AND ANTICANCER ACTIVITY

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Abstract

Functionalization of chitosan as chitosan thiosemicarbazone involving amino group at C2 position of pyranose ring was confirmed by comprehensive characterization by Fourier Transform- Infrared (FT-IR) and solid state ^{13}C nuclear magnetic resonance (^{13}C NMR) spectroscopic techniques, powder X ray diffraction (PXRD) analysis and CHNS microanalysis. Based on the correlative characterization by spectroscopic and analytical ways, chitosan functionalized salicylaldehyde thiosemicarbazones (CSSTSC & CCSSTSC) from both the low molecular weight chitosan oligosaccharide (CS: < 3000 Da Mw and 87% DDA), and high molecular weight crab shell chitosan (CCS: 350 k Da Mw and 67% DDA) were found to show NOS tridentate ligand behavior to form the copper(II) chitosan functionalized salicylaldehyde thiosemicarbazone complexes (Cu-CSSTSC & Cu-CCSSTSC) with copper(II) chloride. The paramagnetic behavior of complexes was elucidated by the measurement of effective magnetic moment (μeff) and their square pyramidal mononuclear geometry was confirmed by magnetic susceptibility below 1.90 BM and electron paramagnetic resonance (EPR) spectra that were characterizable by axial g tensors. In particular, the IC_{50} (μgmL^{-1}) values against the tumorigenic Madin-Darby Canine Kidney (MDCK) cells were >400 in CS and CCS, 334 in CSSTSC & 258 in Cu-CSSTSC, >400 in CCSSTSC & 391 in Cu-CCSSTSC, and the IC_{50} (μgmL^{-1}) values against the human breast cancer (MCF-7) cells were 370 in CS & >400 in CCS, 343 in CSSTSC & 222 in Cu-CSSTSC, 393 in CCSSTSC & 390 in Cu-CCSSTSC. The anticancer activity enhancement upon the modification of chitosan through functionalization and complex formation was indicative of enhanced permeation of these cationic chitosan biomaterials through the negatively charged tumorigenic and cancer cell surfaces.

Keywords: Anticancer activity, Characterization, Chitosan thiosemicarbazones, Copper(II) chitosan thiosemicarbazones, Functionalization, Salicylaldehyde

STEM CELLS IN THE REGENERATION OF MAJOR VISCERAL ORGANS: REDUCTION IN XENOTRANSPLANTATION-ASSOCIATED MEDICAL AND ETHICAL COMPLICATIONS

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Abstract

The demand for well-functioning organs exceeds the organ supply. This research serves to discuss the current trends of organ demand and organ supply, highlight the breakthroughs in organ transplantation, analyze the prospects and challenges of xenotransplantation, and seek an alternative and reliable method to mitigate the challenges seen in xenotransplantation. Databases like Google Scholar, Pubmed, and SCOPUS were searched to find out and study the available research papers in detail. The prospects and challenges of xenotransplantation were analyzed. Several potential approaches to mitigate the challenges in organ transplantation, a conclusion of using stem cells for the purpose was generated. Xenotransplantation has the potential to reduce the gap between organ demand and supply because pigs, commonly used animals, show cardiac output, glomerular filtration rate, and insulin production mechanisms similar to those of humans. These animals can be genetically manipulated and reproduced in a lab to get more organs that perform similar functions to that of human organs without immune rejection. However, owing to ethical complications like animal mistreatment and medical complications like organ rejection and risk of infection with Porcine Endogenous Retrovirus, the use of pluripotent stem cells is found to be a promising way of generating visceral organs like the heart, liver, kidney, lungs, and pancreas. Although there are some chances of cellular contamination, ensuring a hygienic environment while growing stem cells could easily reduce the contamination. The current knowledge of using stem cells in organ regeneration is still limited. Hence, adequate research is to be done in order to use reprogrammed pluripotent stem cells in organ regeneration and transplantation in such a way that tumor formation, immunologic stem cell rejection, and other stem cell therapy-associated risks can be limited.

Keywords: Xenozoonosis, Immune rejection, Transgenic pigs, CRISPR/Cas genome editing

SYNTHESIS OF THE ZINC OXIDE NANOPARTICLES (ZNO NPS) AND ZINC OXIDE/COPPER OXIDE NANOCOMPOSITES.

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Abstract

A green synthesis route was used for the synthesis of the zinc oxide nanoparticles (ZnO NPs) and zinc oxide/copper oxide nanocomposites (ZnO/CuO) using *Punica granatum* juice extract by microwave method and their catalytic activities against 4-Nitrophenol was investigated. The fabricated nanomaterials were characterized by UV-Vis Spectrophotometer, X-Ray Diffraction, Energy Dispersive X-ray Spectroscopy, Dynamic Light Scattering, Field Emission Scanning Electron Microscopy and High Resolution Transmission Electron Microscopy. The results from UV-Vis spectra, and XRD showed the formation of the ZnO NPs and ZnO/CuO nanocomposites. From EDS analysis, the elemental composition of nanomaterials was found. The band gap energy of ZnO/CuO (10%) found less than ZnO nanoparticles. ZnO NPs, ZnO (ext) NPs, ZnO/CuO (5%) nanocomposites and ZnO/CuO (10%) were found as 87 nm, 268.2 nm, 195.7 nm and 52 nm respectively from DLS. FE-SEM images and HR-TEM images showed that ZnO/CuO nanoparticles was irregular sphere with the diameter 50-200 nm. ZnO/CuO (10%) nanocomposites showed the higher degradation of 4-Nitrophenol than the other nanomaterials.

Keywords: Nanoparticles, Nanocomposites, 4-Nitrophenol, 4-Aminophenol.

ASSESSMENT OF DIFFERENT PARAMETERS OF PROCESSED DRINKING WATER AND PERFORM ANTIBIOTIC SUSCEPTIBILITY TEST OF THE ISOLATES

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Abstract

Processed drinking jar water is literally water gone through different treatments and is packaged in plastics (or PET) bottles. Jar water can be found everywhere, the reason behind such immense popularity lies in the advertisements and marketing techniques. This study aimed to monitor different physico-chemical and microbial parameters, which were compared with the WHO guidelines, and antibiotic susceptibility test was also performed of the obtained isolates. Random/convenient sampling method was employed for the collection of samples. The physico-chemical parameters of water: pH, electrical conductivity, total hardness, total alkalinity and microbial parameters, i.e., total plate count and total coliform count, were assessed. Fifteen samples were randomly collected from three districts: Kathmandu, Lalitpur, and Bhaktapur district. Out of 15 water samples, all the samples for physico-chemical parameters were found to be within the WHO guideline except pH; 2 (13.33%) samples were below the guidelines. Similarly, only 2(13.33%) samples were within the guidelines, and the remaining 13 (86.67%) water samples were above the WHO guideline for the total coliform count. However, there was an absence of thermotolerant bacteria from all the collected samples. Likewise, for the total plate count, 13 (86.67%) water samples followed the guidelines, whereas the remaining 2 (13.33%) samples didn't follow the provided guideline. *E. coli* (41.38%), *Citrobacter* spp. (20.69%), *Enterobacter* spp. (6.90%), *Klebsiella* spp. (10.34%), *Salmonella* spp. (6.90%), *Shigella* spp. (3.45%), and *Vibrio* spp. (3.45%) were enumerated from different selective media. The obtained isolates were subjected to the Antibiotic Susceptibility test using the modified Kirby-Bauer disc diffusion method using five different antibiotics. Among the total isolates, the isolates were resistant to Ampicillin (96.55%) whereas least resistant to Ofloxacin (96.55%). Also, MDR was found to be 24.14%. Hence, this study recommends regular monitoring of processed water quality at the water source, processing industries, and distribution outlets for quality assurance.

Keywords: Coliform, Antibiotics, Guidelines, Isolates, Parameters

2-HYDROXYETHYL METHACRYLATE BASED HYDROGELS FOR DEXAMETHASONE DELIVERY INTO POSTERIOR EYE SEGMENT – SCREENING OF COMONOMERS, SORPTION/DESORPTION BEHAVIOUR AND *IN VITRO* BIOLOGICAL ACTIVITY

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Abstract

Most of ocular disease treatments are still based on topical (eye drops), systemic, intraocular and periocular. The efficacy of such delivery is limited due to certain disadvantages, such as mixing with tear fluid. Frequent instillation is needed to provide therapeutic doses which can cause various side effects and patient compliance. To overcome the drawbacks, several ophthalmic drug delivery systems have been proposed 1, 6. Polyhydroxyethyl methacrylate (pHEMA) is one of the popularly used synthetic, stable, optically transparent hydrophilic polymers used as biomaterials, especially in ophthalmology. Interestingly, copolymerization of pHEMA monomer in free radical poliymerization together with active comonomers has been shown to be more effective in several application 6 and is of great interest for developing into various controlled release drug delivery systems 4,6. Dexamethasone is a glucocorticoid steroid that relieves the symptoms of inflammation caused by chemicals, infection, and/or severe allergies. However, prolonged administration of drug can cause serious side effects. Therefore, controlled release of dexamethasone from a local delivery system could be a clinically useful method. The aim of this work is to prepare and optimize pHEMA-based hydrogels for modulated loading and sustained release of dexamethasone by mean of the incorporation of co-monomers that are ordinarily used for improvement their water up take, and the modification of their molecular characteristics during their synthesis. The forthcoming information may facilitate to achieve an insight into the potential of those systems as a basis of medicine devices with controlled release capability of hydrogels with affinity for other drugs too.

Keywords: Local chemotherapy, Dexamethasone sodium phosphate, Methylacrylate hydrogel.

ASSISTIVE TECHNOLOGY AND ITS STATUS IN NEPAL

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Abstract

One billion people, or 15% of the world's population, experience some form of disability. The average percentage of people with disabilities in Nepal is 2.3%. Due to their disability, they are unable to perform day-to-day normal activities like others, and most of them are unaware of the existence of Assistive Technology (AT) and its benefits. AT products, equipment and systems that enhance learning, working and daily activities of persons with disabilities. Previous research has mostly limited their paper only for explanations, but in this paper, we include the status of assistive technology in Nepal which will give an overall vie to the public about it. We used data that we gather from the recent statistics and users of AT in Nepal as well as providers, and we visited different districts of Nepal, which will give the most accurate status in overall context of AT in Nepal. We found that only 5% of the population with disabilities in Nepal are using AT, others are not using them due to lack of several reasons like: Awareness, Knowledge, Affordability, and many others. So, we concluded that these problems can only be solved when awareness programs and production will be done at the government level. From this work, we aim to raise awareness of AT and survey its status in Nepal continuously to look closely at its growth. Also, we want to reach authorized personalities and want to let them know the importance of AT.

Keywords: Assistive Technology, AT, Nepal

COMPARISON OF EXTRACTION METHODS FOR THE DETERMINATION OF ESSENTIAL OIL COMPOSITION OF *Colebrookea oppositifolia*

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Abstract

In this work, the chemical composition of essential oils obtained from *Colebrookea oppositifolia* was determined. *C. oppositifolia* is commonly called Bhaman or Dhursul in local and also known as Indian Squirrel Tail in English which is a monotypic genus of Lamiaceae. The plant has traditionally been used for dermatitis, diarrhea, fever, headache, peptic ulcer, hemostatic, wounds, anti-fertility agents, fungicide, and epilepsy treatment. *C. oppositifolia* is a highly used medicinal plant and an enriched source of essential oils.The present study was designed to extract the volatile chemical constituents and compared them with different extraction techniques namely the steam distillation and simultaneous distillation extraction by using different solvents such as hexane, dichloromethane, and diethyl ether based on their polarity.The isolated volatile essential oils were analyzed by GC-MS analysis.Total 20 compounds were identified. Caryophyllene (50%) was found in the essential oils of each part which was also the major volatile component of *C.oppositifolia*. The composition of essential oils from leaves has a high content of Caryophyllene oxide (6.03%), Asarone (12.38%), 1,4,7,-Cycloundecatriene, 1,5,9,9-tetramethyl-, Z,Z,Z- (10.51%) and their percentage yields were varies accordingly solvents used. While alpha-Caryophyllene (3.47%), Hexadecane (3.08%), Eugenol (2.19%), and 1,6-Octadien-3-ol, 3,7-dimethyl (2.38%) were found the major component of the flower. The result showed that the composition of different techniques of extraction was mainly similar. Although the significant difference in volatile compounds concentration varies according to the solvent used during the extraction of oils.

Keywords: *Colebrookea Oppositifolia*, Caryophyllene, GC-MS, Volatile compound, Essential oils.

STUDY OF DIFFERENT METHODS OF PREPARING AND OBTAINING DRY BONES FROM FORMALIN FIXED HUMAN CADAVERS

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Abstract

Dried human bones, an important part of medical education, can be obtained from formalin fixed human body by several methods. Burial method is common but requires long duration. Hence, this study was conducted with the aim to obtain the clean and dry bones in simple and less expensive method in shorter duration. An observational study was conducted in Nepalese Army Institute of Health Sciences, after obtaining ethical clearance. Formalin fixed eight cadavers were used to obtain the bones by burial, maceration and chemical methods. In burial method, bones were boiled for three hours and buried in the ground at 2 feet depth for six months, just before monsoon. In maceration method, bone was dipped in a bucket containing cow dung and water, and left in sun for 15 days. In chemical method, bone was treated with washing soda for 19 hours. The bones obtained from maceration as well as chemical methods were bleached by 6% hydrogen peroxide for 5 hours. Remaining soft tissue was scraped, cleaned, and bones were dried for 2 to 3 days. Bones obtained by burial method were of good quality without any cracks but little soft tissue and mud were present, which could be easily cleaned. The disadvantages of this method were time consuming and need of burial ground. Bones obtained by maceration method was initially black colored and bleached by treating with hydrogen peroxide. The texture of bone obtained so after was good, intact and clean. Clean bones were obtained by chemical method but few cracks were present. Bones obtained by this method were lighter because of demineralization by chemical. Among the above mentioned three methods; maceration method was cost effective and less time consuming. Chemical method was faster but concentration of chemical should be proper to prevent cracks and demineralization.

Keywords: Cadaver, Chemical Method, Dry Bones, Maceration

ANTIBACTERIAL ACTIVITY OF AMIDES THAT SYNTHESIZED VIA MAGNESIUM-CATALYZED ACETYLATION OF AMINES

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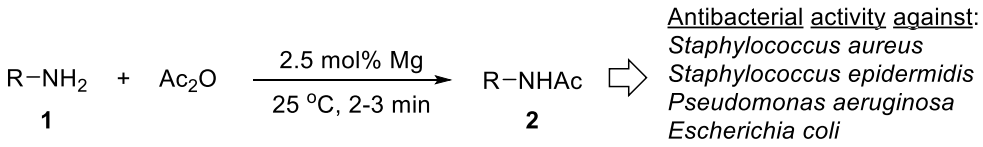
Abstract

Magnesium powder was found to be an extremely efficient catalyst in the acetylation of amines (**1**) with acetic anhydride. This green synthetic protocol has utilized a trace amount of magnesium powder to afford the corresponding amides (**2**) within a couple of minutes, at room temperature, in excellent product yields (up to 96% yield). Thus synthesized*N*-phenylacetamide (**2a**), *N*-(4-bromophenyl)acetamide (**2b**), *N*- (4-methoxyphenyl) acetamide (**2c**), *N*-(m-tolyl) acetamide (**2d**), *N*-(o-tolyl)acetamide (**2e**), *N*-benzylacetamide (**2f**), *N*-(naphthalen-2-yl)acetamide (**2g**), *N*-(2-hydroxyphenyl)acetamide (**2h**),*N*-(4-hydroxyphenyl)acetamide (**2i**) and4-acetamidophenyl acetate (**2j**)were further evaluated for the antibacterial activity. These compounds were subjected to the agar well diffusion assay followed by determination of minimum inhibitory concentration against four different gram-positive (*Staphylococcus aureus* and *Staphylococcus epidermidis*) and gram-negative bacteria (*Pseudomonas aeruginosa* and *Escherichia coli*). Compound **2d**was found antibacterial against *E. coli*, andcompounds **2b** and **2i**have inhibited the growth ofboth *E. coli* and *S. epidermidis*.



Keywords: Acetanilides, Agar well diffusion assay, Bioassay, Catalysis, Minimum inhibitory concentration.

ENHANCEMENT IN ANTICANCER ACTIVITY OF N(4) DIMETHYL 5-HALOISATIN THIOSEMICARBAZONES ON COORDINATION WITH COPPER(II): *IN VITRO* STUDY

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Abstract

A series of N(4) dimethyl isatin thiosemicarbazones (**1-4**) [*Istdma* (**1**), *Fistdma* (**2**), *Clistdma* (**3**), *and Bristdma* (**4**)] and their copper(II) complexes (**5-8**) [*Cu-istdma* (**5**), *Cu-Fistdma* (**6**), *Cu-Clistdma* (**7**), *and Cu-Bristdma* (**8**)] have been synthesized and characterized by elemental analysis, spectroscopic techniques (IR, NMR, ESI-HRMS, UV-Vis, and EPR) and single crystal analysis. The single-crystal X-ray crystallographic study of compound **1** (*Istdma*) revealed its thione tautomeric form in the solid state. EPR data confirmed the distorted square planar geometry and mononuclearity of Cu(II) complexes coordinated through terdentate thiosemicarbazonato chelator and a chloride ion. The *in vitro* cytotoxic study of the compounds against MCF-7 (breast cancer), A431 (skin cancer), and PNT2 (human normal prostate epithelium) cells showed significant cell growth inhibition. Chelation of ligands to Cu(II) ion resulted in increased cell growth inhibition. The Cu(II) complexes exhibited higher cell growth inhibition effect (63-73%) toward PNT2 cell line than their corresponding ligands (36-59%) thereby confirming the slight toxicity nature of the complexes. Compound **6** (*Cu-Fistdma*) showed the best antiproliferative activity against MCF-7 and A431 cells with 71% and 53% cell growth inhibition respectively. The colony formation assay and PI staining studies of the compounds **6** (*Cu-Fistdma*) and **7** (*Cu-Clistdma*) showed cell growth inhibition in dose-dependent manner.

Keywords: Anticancer potency, Colony formation, Copper(II) complexes, Electron paramagnetic resonance, Isatin thiosemicarbazones

SCREENING OF VANCOMYCIN RESISTANT GENES AMONG METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATED FROM A TERTIARY CARE HOSPITAL IN NEPAL

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Abstract

Methicillin Resistant *Staphylococcus aureus* (MRSA) is a common bacterial pathogen associated with infections. Acquisition of various antimicrobial resistant genes by *S. aureus* has led to transform of this bacterium as a superbug. The main objective of this study was to determine the susceptibility status of the *S. aureus* isolates towards vancomycin and detection of *vanA* and *vanB* genes among MRSA isolates. A total of 1245 clinical specimens were collected from hospital patients. *S. aureus* were isolated, identified and antibiotic susceptibility test (AST) were performed by modified Kirby-Bauer disk diffusion method. Inducible clindamycin resistance test was performed by D-test and minimum inhibitory concentration (MIC) of vancomycin was determined by agar dilution method. *mecA*, *vanA* and *vanB* genes were amplified through polymerase chain reaction. From 1245 clinical specimens, 80 *S. aureus* isolates were detected. Among 80 *S. aureus* isolates, 47.5 % (38/80) were phenotypic MRSA and among them, *mec*A gene were detected in 84.21% (32/38). Among 38 phenotypic MRSA isolates, 10.5% (4/38) were found to be vancomycin intermediate *S. aureus* (VISA) by MIC determination. None of the MRSA was identified as vancomycin resistant *S. aureus* (VRSA). None of the isolate was positive for *vanA* gene, however, 2 VISA isolates were found to be positive for *vanB* gene. There might be spreading of vancomycin resistance among *S. aureus* which may create serious public health problem. Therefore, measures to limit vancomycin resistance should be considered in healthcare facilities.

Keywords: MRSA, VISA, Vancomycin resistant genes, *mecA*, Inducible clindamycin resistant *S. aureus*

POINT PREVALENCE SURVEY OF ANTIBIOTICS USE IN SIX PRIVATE HOSPITALS IN KATHMANDU

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Abstract

Point prevalence survey (PPS) on antibiotic use developed by WHO has been used globally. This study was done to obtain information on the prescribing of antibiotics using PPS methodology in six private hospitals in Kathmandu. This cross sectional descriptive study was done from 20th July to 28th July 2021 among inpatients admitted at or before 8:00AM on the day of survey in various wards of hospitals. Patient sampling was done as per the PPS methodology. The institutional capacity was measured by indicators for infrastructure, policy and practice, and monitoring and feedback. Data were presented as frequencies and percentages. Patients above 60 years were 34 (18.7%). There were equal number of males and females, 91 (50%). Maximum patients were from the Surgery ward, 38 (20.8%), followed by Obstetrics and Gynecology ward, 25 (13.5%). Only one antibiotic was used in 81 patients (44.5%) followed by two antibiotics in 71 (39%) patients. Duration of antibiotic prophylactic use was one day in 66 (63.7%) patients. The culture result was positive for 17 (24.7%) samples. The organisms isolated were *E. Coli*, *Pseudomonas*

aeruginosa and *Klebsiella pneumoniae*. Ceftriaxone was the most used antibiotic. Drug and therapeutics, infection control committees, and pharmacovigilance activities were present in 3/6 (50%) study sites. About 38.9% antibiotics were from access and watch groups, and 11.1% from reserve and not recommended groups. Antibiotic formulary and antibiotic guideline was present in 4/6 sites, and facilities to audit surgical antibiotic prophylaxis choice in 2/6 (33.3%) sites, facility to monitor antibiotic use was present in 4/6 (66.6%), and cumulative antibiotic susceptibility reports in 2/6 (33.3%) sites. Studies should be done periodically to study Antimicrobial Resistance (AMR) and monitor the impact of antimicrobial stewardship and infection control programs.

Keywords: Antibiotics, Nepal, Tertiary care centers, WHO PPS methodology

SEVERITY AND THEIR TREATMENT IN SECOND WAVE OF COVID-19 IN A TERTIARY CARE CENTER OF NEPAL

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Abstract

The second wave of the COVID-19 pandemic was confirmed in Nepal with an exponential rise in the number of cases in April 2021. The objective of our study was to find out severity of patients, their treatment and approximate drug cost for the treatment of COVID-19 in second wave in a tertiary care center in Nepal. Retrospective, cross sectional study, where data of all patients who tested positive and were admitted in KIST Medical College and Teaching Hospital between 25th April 2021 – 25th July 2021 was collected for the study. A total of 215 patients were included. Among the cases admitted, 88.4% were symptomatic. Intensive Care Unit/High Dependency Unit admission was done in 52.5%, among which 29.2% received ventilator support. The patients treated in isolation unit were 47.4%. Among the patients admitted, only 10.7% were vaccinated. Severe cases were 37%, moderate cases were 33%, 23% were mild and the severity of 7% patients was not mentioned. Antibiotics were used in 88.4% case; ceftriaxone (61.4%) was the most common antibiotic used. More than one antibiotics were used in 65.6% cases. Antifungals were used in 18.1% cases. Commonly used drugs were corticosteroids (86%), proton-pump inhibitors (84.3%), antihistaminics (78.4%), anticoagulants (76.7%), Vitamin C (71.2%), Vitamin D (70.7%) and zinc (65.1%). The patients who were discharged were 70.2% and 19.5% of total patients died. The average drug cost was Nrs. 3,246 in mild, 27,645 in moderate and 76,420 in severe cases. Majority of patients were treated in ICU/HDU. Most commonly used drugs were antibiotics, corticosteroids and anticoagulants. Mortality was high in second wave.

Keywords: Pandemic, Drugs, Cost, Mortality

PATTERN OF DRUG INFORMATION SOURCES UTILIZED BY MEDICAL PRACTITIONERS AT A TEACHING HOSPITAL IN NEPAL

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Abstract

This study aims to understand commonly used sources of Drug Information (DI) by prescribers at our institute, their usefulness and the need for an independent drug information unit at the institute. A cross-sectional descriptive study, that included all prescribers presently working at this institute and actively involved in patient care, was conducted. The duration of the study was seven months. Consenting participants were requested to return the filled-in self-administered questionnaire within three working days and were reminded to submit the same in the next three working days, if failed to do so. Participants not returning the questionnaire even after six days were labelled as non-responder and excluded from the study. The developed study questionnaire had three sections: general information of the participant, present practice of seeking DI and opinion about the necessity of an independent DI unit at the institute. Data thus collected were analysed using SPSS version 18. Ethical approval for the study was obtained from the institutional review committee. Filled in questionnaires were obtained from 147 prescribers (response rate 75.38%) which included interns (101, 68.7%), medical officers (4, 2.7%), residents (12, 8.2%), lecturers (24, 16.3%), associate professors (4, 2.7%) and professors (2, 1.4%). Almost all of the participants (137, 95.80%) used textbooks and online medical sites (OMS) as a source of DI. Among participants using OMS for DI, 80 (58.39%) classified them as sometimes biased. It was seen that only 33 (24.09%) participants reported that textbooks answered their queries in all instances. Most of the participants 61 (41.25%) agreed that they will absolutely be benefitted from having unbiased DI services at the hospital. Participants most commonly (136, 92.50%) had queries related to dosage/administration followed by adverse drug reactions (121, 82.50%) on a daily basis.

Keywords: Biased Drug Information, Drug Information Unit, Drug Query, Rationale use of Medicines

EPIDEMIOLOGY OF GASTROINTESTINAL ZOONOTIC HELMINTH PARASITES IN DOGS OF SURYABINAYAK MUNICIPALITY, BHAKTAPUR, NEPAL

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Abstract

This study was carried out to determine the prevalence of gastro-intestinal zoonotic helminths in dogs. The samples were collected from March 2021 to September 2021. A total of 400 samples were collected purposively from the ground immediately after voiding or directly from the rectum by using gloved index finger and were examined under microscope by salt floatation techniques. Overall prevalence of infection was found to be 59.50%. The prevalence was found higher in stray dogs (70%) than pet dogs (49%) which was statistically significant ($p<0.05$). Altogether six species of gastrointestinal parasites were found. They were *Ancylostoma* spp., *Toxocara* spp., *Trichuris* spp., *Capillaria* spp., *Dipylidium caninum* and *Tenia/Echinococcus* spp. The result showed highest prevalence of *Ancylostoma* spp. (49.16%) and prevalence of *Capillaria* spp. was found least (0.84%). The parasites of class nematode were found higher (73.95%) than cestoda (26.05%). In sex-wise study, higher prevalence was found in male (63.79%) as compared to female (52.87%) which was statistically insignificant ($p>0.05$). In age-wise study, highest prevalence was found in puppy (86.96%) and least prevalence was found in old (31.58%) pet dogs which was statistically significant ($p<0.05$). The prevalence of intestinal helminthes was found high (78.65%) among samples from non-dewormed pet dog than dewormed pet dogs (25.23%) and deworming was found statistically significant ($p<0.05$). Among 10 different wards of Suryabinayak municipality, highest prevalence was found in ward nine (72.50%) whereas least prevalence was found in ward two (45.00%) but it was found statistically insignificant ($p>0.05$). The stray dogs of ward nine were found highly infected but among pet dogs, high prevalence was recorded from ward four, nine and 10. The relation between ward wise prevalence of intestinal helminths parasites and deworming was found inversely proportional with each other.

Keywords: Pet dog, Prevalence, Stray dog, Zoonosis.

SYNTHESIS, CHARACTERIZATION AND STUDY ON ANTIMICROBIAL ACTIVITY OF *TAMRA BHASMA*

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Abstract

Ayurveda is traditional medical science that uses natural products for curing ailments, improving lifestyle and increasing lifespan. *Tamra bhasma* (TB) is one the product prepared by incineration of copper (Cu) and incorporation of other therapeutic agents according to *Rasashastra*. The major steps involved in the preparation of TB are *sodhana*-purification, *marana*-incineration and *amrutikarana*-eliminating toxicity. *Sodhana* was done in several therapeutic medium, incineration was done with *kajjali* in electric muffle furnace (EMF) and *amrutikarana* in yam.The *bhasma* so obtained was analysed by physical and physiochemical parameters. The percentage weight of TB obtained was 81% of the relative weight of the metal taken. It was found to be dull, fine minute powder, sparingly soluble in water but soluble in dimethyl sulphoxide (DMSO). Organic groups like ketone and ester were found to be incorporated in *kajjali* whereas ether, ester and amide were observed through Fourier Transform Infra Red (FTIR) spectroscopy data. Analysis of X-ray diffraction (XRD) data showed that TB primarily consists of copper sulphide (CuS-hexagonal, Cu_7S_6-orthorhombic, $Cu_{13}S_{16}$-monoclinic) and traces of other compounds. The average crystalline size of major compound CuS was found to be 17.38 nm. The crystallinity was calculated to be 38.30%. Energy dispersive X-ray (EDX) data analysis showed 71% Copper, 21% sulphur (S) and various other elements present in TB. Antimicrobial activity study of TB showed effective against bacteria *Bacillus subtilus*, *Enterococcus faecalis*, *Escherichia coli*, *Staphylococcus aureus*, Mithicillin-resistant *Staphylococcus aureus*, *Staphylococcus epidermis* and fungi *Saccharomyces cerevisiae*.

Keywords: Kanji, Kajjali, Sodhana, Puta, Amrutikarana, Bhasma

ANTI-EPILEPTIC DRUGS MONITORING IN PAEDIATRIC POPULATION

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Abstract

Seizure control with anti-epileptic drugs can significantly improve several quality of life (QOL) domains, especially when drugs and dosages are optimized to avoid disabling side effects. Drug therapy monitoring, including serum drug level measurement, has been found to be useful in optimizing anti-epileptic drug therapy in clinical practice. This study was carried out with an aim of determining usefulness of serum anti-epileptic drug level measurement for improving QOL of pediatrics patients. Children between the ages of 1–16 years, diagnosed of epilepsy and receiving anti-epileptic drug for longer than 1 month, were enrolled. Parents or caretakers of children were interviewed using epilepsy-specific QOLCE (QOL in Childhood Epilepsy) questionnaire. Their blood samples were analyzed for serum level of the drug that they were administering. On the basis of this level and the relevant clinical data, the concerned pediatrician made the dose alteration whenever deemed necessary. Total of 24 patients were enrolled in this study. Majority of them were on sodium valproate (79.17%). Remaining were taking phenobarbitone and carbamazepine. Serum drug level was found to be within the therapeutic range in only 48% patients. Overall QOL was also found to be highly compromised. Energy/fatigue, social interaction and quality of life item subscale were more affected. QOL assessment should be an important part of epilepsy management protocol. Regular serum drug level monitoring and dose adjustment according to the measured drug level will facilitate achievement of desirable therapeutic outcome.

Key words: Epilepsy, Anti-epileptic medicines, Quality of life, Drug monitoring

ESTABLISHING PCR TESTING IN NEPAL FOR COVID-19: CHALLENES AND OPPORTUNITIES

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Abstract

Polymerase chain reaction (PCR) invented by Kary Mullis (1983), has become the centrepiece of molecular detection of various infectious diseases including coronavirus disease 2019 (COVID-19). Many developing countries like Nepal faces various challenges and grab many future opportunities during and after establishment of molecular PCR laboratories throughout the country. This viewpoint describes the involvement of laboratory employees, development and adoption of new protocols or framework, deliberate partnership with national and international community is very efficient for the establishment of PCR laboratories. Beside this, continued alliance and nation leadership is crucial to generate a unified and sustainable PCR laboratory network in the country like Nepal. In future the established PCR laboratories can be utilized for the diagnosis of others pandemic diseases and can be used for multipurpose like in verification of infectious diseases; Oncology; Blood test; Genetic testing.

Keywords: COVID-19, Nepal, RT-PCR

STUDY OF ENDOCRINE DISRUPTING CHEMICALS (EDCs) IN NEPAL

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Abstract

Nepalese children are under severe threats of different toxic chemicals in products they use daily including toys to school stationery like an eraser. CEPHED carried out a study of Endocrine Disrupting Chemicals (EDCs) such as Phthalates in erasers and Bisphenol A (BPA) in the thermal paper as a part of the larger nine Asian countries study. The study aimed at envisioning of EDCs free Nepal. 53 eraser and 31 thermal paper samples were collected from Kathmandu Valley and Janakpur were studied. Seven types of phthalates were tested in an eraser by CPSC-CH-C1001-09.4 GC/MS, SIM mode equipment. Secondly, five derivatives of Bisphenol in all thermal paper were tested using LC-MS at WIOEH, South Korea laboratory. A finding of EDCs was very high but not regulated in Nepal at all. 38% of erasers (20 of 53) were found contaminated with phthalates, toxic to public health and the environment. The sum of all seven phthalates in 9 eraser samples (19% of total) exceeds the Korean safety limit of phthalates. The maximum phthalates in eraser was up to 25.62%. 94% of thermal paper (29 of 31) contains BPA. 84% (26 of 31) samples with detected BPA exceeded EU regulatory standards. The maximum BPA found in the thermal paper was 2.44%. The highest concentration of PBA in thermal paper were found in the samples received from parking, coffee shops, bank coupons, ATM receipts, and government offices (NEA and Bank), and are thus to be regulated. As imported erasers were found to be highly contaminated with phthalates, the import of children's stationaries including erasers needs to be strongly regulated. Phthalates and BPA should be banned or strongly regulated by enacting mandatory standards for children and regular products, like in many developed countries. Market monitoring and massive public awareness are urgent.

Key Words: Eraser, Thermal Paper, Phthalates, BPA, Children

NATURAL BACKGROUND RADIATION AT SOME LOCATIONS OF BAGMATI PROVINCE, NEPAL

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Abstract

The background radiation in the environment is contributed from natural as well as artificial radiation sources. In this work we present the finding of background radiation survey conducted in seven different district of Bagmati province. The background dose rates were measured for 141 locations of these districts using Radalert 100 survey meter. The dose rates for the locations ranged from 0.14 µSv/hr to 0.41 µSv/hr with an average of 0.25 µSv/hr. The obtained dose rates were employed to calculate the Annual Effective Dose (AED) to the general public residing in those places and the AED was found in between 1.23 mSv/yr and 3.59 mSv/yr with an average of 2.19 mSv/yr. The AED obtained were found above the world's average as well as the AED limit (1mSv/yr) set for general public for radiological protection by the International Commission for Radiation Protection (ICRP) . The higher AED due to natural sources might have been contributed by the rock formations and geology of the study area.

Keywords: Background radiation, Bagmati province, Annual effective dose.

HUMAN ORGAN TRANSPLANT

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Abstract

A 100,800 solid organ transplants and 118.4 million blood donations are performed each year in the world as recorded by WHO. Although there is no official tracked records, Human Organ Transplant Center, Nepal mentions 150 kidney transplants a year. Far from these official and legal transplants, a large number of organs are trafficked and transplanted illegally for a large amount of money. As per Global Financial Integrity, 7000 kidneys are trafficked each day and it profits between $514 million to $1 billion a year. According to the Forum for Protection of People's Rights, more than 300 people are said to be victims of human trafficking in the last half a decade. Many people lose their lives due to the unavailability of organs at the right times and this happens mainly because the organs donated have been trafficked. This project is based on complete data analysis through a web portal that aims to enable people to view the list of donors and acceptors of body organs and will have different interfaces for hospitals, individuals, and concerned authorities aiming to create transparency and easy accessibility to organ transplantation throughout the nation by enabling donors and acceptors to check out the list of organs donated or accepted at an organ transplantation center, and easily find a center available with the required organ. With the implementation of this project trafficking of human organs can be discouraged, records of donated and accepted organs can be tracked digitally, patients are available with the right type of organs at the right time, and hospitals can easily find and share surplus organs among themselves for legal transplants. Later, this model can also be extended to keep records of different medical necessities, like blood transplants making it easier for people to find right place.

Keywords: Organ transplant, Organ transplant records, Organ transplant management system

CORDIOFOLIOSIDE-A AND TINOSINENOSIDE-A AS POTENT CANDIDATE AGAINST SARS-COV-2 SPIKE AND ENVELOPE PROTEINS; AN *IN SILICO* STUDY

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Abstract

COVID-19 has been circulating worldwide and have created havoc in society resulting the loss of human life and socio-economic disruption. This infers that an effective antiviral drug against COVID-19 is crucial along with vaccinations to decrease contamination rates. A potential target of such antivirals could be the membrane components of the causative pathogen, SARS-CoV-2, for instance: spike (S) protein and envelope (E) protein. In this research, several bioinformatic tools (pkCSM, swiss ADME, and PRO TOX-II) along with several docking programs (MOE, GOLD, Autodock vina) have been deployed to screen 26 secondary metabolites derived from the *Tinospora* species- a species widely cultivated and used as an antiviral drug in the Himalayan region of Nepal.The molecular docking and binding energy study revealed that cordifolioside-A and tinosinenoside-A had a higher binding affinity and were most effective in binding to the competitive site of the spike protein. Cordifolioside A and tinosinenoside A were found to interact with Thr 430, Glu 516, and Phe 515 residues of S-RBD within a range of 1.8-3.4 Å respectively with binding energy of -25.09 and -22.75 Kcal/mol respectively. Molecular dynamics (MD) simulation studies using GROMACS further assayed the interaction between the potent compounds and binding sites of the spike protein.Our study thus recommends cordiofolioside-A and tinosinenoside-A of *Tinospora cordifolia* as viable medicinal candidates against SARS-CoV-2. *In vitro* studies on these lead candidates may ensure their candidacy as antiviral drugs against SARS-CoV-2.

Keywords: Tinospora, Spike protein, Envelope protein, Molecular docking, Molecular dynamics simulation.

ANTIBIOTIC SUSCEPTIBILITY PATTERN OF BACTERIAL ISOLATES FROM INANIMATE SURFACES OF A TERTIARY CARE HOSPITAL IN KATHMANDU

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Abstract

Hospital-acquired infections (HAIs) are one of the most significant adverse events for healthcare institutions increasing morbidity and mortality. Inanimate surfaces of hospitals have often been described as the source for outbreaks of infections. The objectives of the study were to identify the bacterial isolates from inanimate surfaces of a tertiary care hospital and determine antibiotic susceptibility pattern of the isolates. A total of 48 swab samples were collected from various target sites like door handles, bed rails, nursing stations, light switches, elevator button, help desk, tap knob, staircase railing. The samples were inoculated on Blood agar, MacConkey agar, Cetrimide agar and Mannitol salt agar and incubated at 37ºC for 24 h. The bacterial isolates were identified on the basis of colony morphology, Gram's staining, spore staining reaction and various biochemical tests. The antibiotic susceptibility pattern of the isolates was determined by using modified Kirby-Bauer disc diffusion method. A total of 76 bacterial isolates were identified and among them 56 (73.68%) were Gram positives whereas 20 (26.62%) were Gram negatives. *Bacillus* spp. (37.5%) showed a predominance among Gram positives followed by CoNS (30.36%) and *S. aureus* (21.05%) whereas *Proteus* spp. (35.0%) was the major isolate among Gram negatives followed by *Pseudomonas* spp. (26.32%) and *Citrobacter* spp. (15.0%). Among 16 isolates of *S. aureus*, 7 isolates (43.75%) were methicillin resistant. Among the bacterial isolates, nearly half of them (45.45%) were multidrug resistant (MDR).This study has shown that almost all surfaces of the hospital carry bacteria capable of causing infections. Therefore, effective infection prevention and control measures are crucial to provide high quality health care facilities for patients and a safe working environment for those who work in hospital settings.

Keywords: Hospital**,** **I**nanimate surfaces, Bacterial pathogens, Antimicrobial resistance.

DETECTION OF NDM-1 AND VIM GENES IN CARBAPENEM- RESISTANT KLEBSIELLA PNEUMONIAE ISOLATES FROM A TERTIARY HEALTH-CARE CENTER IN KATHMANDU, NEPAL

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Abstract

Klebsiella pneumoniae is one of the leading causes of nosocomial infections. Carbapenems are used as the last resort for the treatment of multidrug resistant Gram-negative bacterial infections. In recent years, resistance to these lifesaving drugs has been increasingly reported due to the production of carbapenemase. The main objective of this study was to detect the carbapenem-resistant genes bla NDM-1 and bla VIM in K. pneumoniae isolated from different clinical specimens. A total of 585 clinical specimens (urine, pus, sputum, blood, catheter tips, and others) from human subjects attended at Annapurna Neurological Institute and Allied Sciences, Kathmandu were obtained in the period between July 2018 and January 2019. The specimens were isolated and identified for K. pneumoniae. All K. pneumoniae isolates were processed for antimicrobial susceptibility testing (AST) using the disk diffusion method. The isolates were further phenotypically confirmed for carbapenemase production by the modified Hodge test (MHT) using imipenem (10 µg) and meropenem (10 µg) discs. Thus, confirmed carbapenemase- producing isolates were further screened for the production of bla NDM-1 and bla VIM using conventional polymerase chain reaction (PCR). Among the clinical isolates tested, culture positivity was 38.29% (224/585), and the prevalence of K. pneumoniae was 25.89% (58/224). On AST, K. pneumoniae exhibited resistance toward carbapenems including ertapenem, meropenem, and imipenem, while it showed the highest susceptibility rate against to tigecycline (93.1%; 54/58). Overall, AST detected 60.34% (35/58) carbapenem-resistant isolates, while the MHT phenotypically

confirmed 51.72% (30/58) isolates as carbapenemase-producers and 48.28% (28/58) as carbapenemase nonproducers. On subsequent screening for resistant genes among carbapenemase-producers by PCR assay, 80% (24/30) and 3.33% (1/30) isolates were found to be positive for bla NDM-1 and bla VIM, respectively. In the same assay among 28 carbapenem nonproducing isolates, 9 (32.14%) isolates were positive for bla NDM-1 gene while none of them were tested positive for bla VIM gene. Molecular detection of resistant genes provides greater specificity and sensitivity than those with conventional techniques, thus aiding in accurate identification of antimicrobial resistance and clinical management of the disease.

Keywords: Klebsiella pneumoniae, New Delhi metallo-beta-lactamase-1, Verona integrin encoded metallo-beta-lactamase, CarbapenemModified Hodge test, Multidrug resistance, Antibiotic susceptibility test

ASSESSMENT OF AWARENESS AND ATTITUDE TOWARDS COUNTERFEIT MEDICINES AMONG THE COMMUNITY PHARMACISTS IN THE KATHMANDU VALLEY

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Abstract

Counterfeit medicines are a significant problem globally. This is a major problem in Asia. In a developing country like Nepal, community pharmacists are the most easily accessible health care providers to the public. Hence, they should be knowledgeable about counterfeit medicines. To assess the awareness and perception regarding counterfeit medicines among community pharmacists (CPs) of Kathmandu, Lalitpur, and Bhaktapur districts, a cross-sectional study was conducted among registered community pharmacists working in retail pharmacies in the Kathmandu Valley who provided informed consent to participate. Convenient sampling method was used to collect the data from the pharmacists in this study. Among 348 CPs, who participated in the study, 252 (72.4%) were from Kathmandu, 58 (16.7%) were from Lalitpur and 38 (10.9%) were from Bhaktapur; 255 (73.3%) were aged between 20 to 30 years; 227 (65.2%) were male; 240 (69.2%) had done Diploma in Pharmacy; 204 (58.7%) had working experience of more than 5 years; and 347 (99.7%) had completed their education in Nepal. Among them, only 2.8% knew community pharmacists, who dispensed counterfeit drugs; 337 (96.8%) believed that actions should be taken against CPs knowingly dispensing counterfeit drugs; 330 (94.8%) believed that pharmacists who dispense counterfeit drugs are unprofessional; and 343 (98.6%) stated that the law against counterfeit medicines should be strengthened. Further, 110 (31.6%) respondents mentioned that vitamins and supplements are most likely to be counterfeited and 343 (98.6%) believed that it is easy to spot counterfeit drugs by their quality and price. In addition to this, 51.4% strongly disagreed with the statement that pharmacists decide to stock counterfeit medicines in their pharmacy since the quality is acceptable, and 50.9% of the respondents mentioned that they have never been offered counterfeit medicines. Our study shows that the pharmacists of Kathmandu Valley are aware of counterfeit drugs. The participants are also aware of the harmful effects of counterfeit drugs.

Keywords: Substandard drugs, Perspective, Chemist

ASSESSMENT OF RENAL PROFILE IN PATIENTS INFECTED WITH COVID-19

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Abstract

The global pandemic coronavirus disease 19 (COVID-19) emerged as an unpredicted emergency devastation at the beginning of year 2020 claimed millions of lives worldwide. This disease is responsible for the injuries of the organs such as lungs, heart, liver kidney etc. The exact mechanism of kidney injury triggered by COVID-19 is not well known yet. This study aims to assess the effect on renal profile of COVID-19 infected patients. The cross-sectional study was carried out on 150 COVID-19 patients visiting KIST Medical College and Teaching Hospital between July 2021 to September 2021. Convenience sampling method was used for sample collection from the COVID-19 patients whose renal function test was referred by the treating physicians and data was collected using a proforma tool. Descriptive statistical analysis was performed in which frequency, percentage, mean and standard deviation were calculated. Out of total 150 COVID-19 patients, mean age is 49.7±16.2 years with male dominance (65.33%). Majority of the patients (72.66%) were 40 years and above of age. Most of the patient admitted in the hospital had mild COVID-19 infections (74.66%). Forty six (30.7%) patients had high serum urea and 23 patients (15.3%) had raised creatinine level. Similarly, electrolyte imbalances such as hyponatremia and hypokalemia were found in 15.33% and 10.66% COVID-19 patients respectively.

Keywords: COVID-19, Kidney injury, Renal function derangements, Renal function test

ANTIBIOTIC SUSCEPTIBILITY PATTERN OF *ESCHERICHIA COLI* AND *KLEBSIELLA* SPP IN PATIENTS WITH URINARY TRACT INFECTION (UTI)

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Abstract

The production of β-lactamase enzymes is the most common and important resistance mechanism in Gram-negative. Carbapenem and cephalosporins resistance *Klebsiella pneumoniae* and *Escherichia coli* are the major extended-spectrum β-lactamase- (ESBL-) producing. The objective of this study was to detect the carbapenemase (KPC) enzyme spectrum in *Escherichia coli* and *Klebsiella spp*. isolated from patients diagnosed with urinary tract infections (UTI) at Nepal Police Hospital, Maharajgunj. In a cross-sectional study from December to May 2022, midstream urine samples were obtained from patients suspicious of UTI who were hospitalized or referred to Police Hospital, Maharajgung, Kathmandu. Samples were cultured in cysteine-, lactose-, and electrolyte-deficient (CLED) agar media. Samples were further characterized using agar plug diffusion method. Organisms were identified by the cultural characteristics, the morphology of growth through mycelia studies, gram stain and biochemical test. Identification of all isolates was made based on routine biochemical tests. Label, all Isolates were stored at –70°C in Tryptic Soy broth with 20% glycerol till further tests. The prevalence of KPC-producing *E. coli* and *Klebsiella spp*. was studied by the Phenotypic Confirmation of Carbapenemase producers by Modified Hodge Test (MHT). Additional molecular identification of genes will help further in conformation at the gene level. Our study showed a high prevalence of β-lactamase enzymes in *Escherichia coli* and *Klebsiella* spp in patients with urinary tract infection, which is confirmed by a phenotypic method. Amoxycillin, ceftriaxone and cefixime were found to be more resistant to *E.coli*. Amoxycillin, cefalexin and meropenem are found to be more resistant to *Klebsiella* spp.

Keywords: Antibiotic resistance, Carbapenem drugs, Extended-spectrum β-lactamase, *Klebsiella pneumoniae* carbapenemase, Urinary tract infection

HARNESSING BIOTECHNOLOGY TO ENHANCE THERAPEUTIC EFFICACY OF NEXT-GENERATION CANCER THERAPEUTICS INVOLVING LIVING CELLULAR-DRUGS

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Abstract

Adoptive transfer of naturally occurring or genetically redirected tumor-reactive T cells has emerged as one of the most successful immunotherapeutic treatments for patients with advanced hematological malignancies and solid cancers. Although these regimens can induce complete and durable tumor regressions in patients with advanced cancer, current response rates remain inadequate underscoring the need for further improvements. There is evidence that stem cell-like T cells (T_{SCM}) with enhanced capacity for self-renewal and the ability to derive potent effector T cells might be used to improve T cell persistence and long-term antitumor immunity. The goal of this study is to generate CAR-T cells with T_{SCM} phenotype that have augmented therapeutic benefits and is achieved by overexpressing the transcription factor TCF-1. $CD3^+$ T cells were activated and transduced with lentivruses expressing CD19 directed chimeric antigen receptor (CAR) and TCF-1. CAR-T phenotype and functionalities were evaluated using flowcytometer and *in vitro* co-culture with human Acute Lymphoblastic Leukemia (ALL) tumor targets. Cellular metabolism was measured with metabolic flux analyzer and CAR-T *in vivo* antitumor function was evaluated in immunodeficient mice with ALL tumor xenografts using bioluminescence imaging. Using $CD3^+$ T cells expressing the transcription factor TCF-1 at elevated levels as the host for transduction with CAR demonstrate delayed T-cell differentiation with accumulation of T_{SCM}, allowing the cells to survive, proliferate, reduce glycolytic pathway usage, and serve in a therapeutic capacity for a longer duration in mice carrying established human tumors. The study demonstrates potential to develop into Next-Gen therapy against cancer and infection.

Keywords: Cancer, Immunotherapy, CAR-T cell, Transcription factor

EFFICACY OF INTEGRATED VECTOR CONTROL INTERVENTION TO MOSQUITO VECTORS MANAGEMENT: A SYSTEMATIC REVIEW

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Abstract

Vector Borne Diseases (VBDs) are a major threat to public health and socio-economicdevelopment. Principal vector control techniques are namely chemical, physical, and biological methods which have a long and distinguished history. The World Health Organization (WHO) proposed Integrated Vector Management (IVM) guidelines for effective and sustainable vector control. The objectives of this systematic review were to analyze the existing evidence on all forms of Integrated Vector control (IVC), and evaluate efficacy of integrated vector control under integrated vector management framework. For this systematic review, we searched the articles using four databases (Scopus, PubMed, ScienceDirect, and Web of science) along with hand-searching of references. Articles from included studies were extracted, analysed and reported. We identified 849 citations of which 10 were included in the review. All studies focused IVM concept, whereas only five studies followed IVM framework. Available literature indicated that adult mosquito population and mosquitos borne diseases (MBD) cases declined significantly after integrated vector control intervention. Furthermore, some studies highlighted increasing community participation on vector control program and enforced horizontal collaboration for sustainable outcome. This systematic review demonstrates that implementation of integrated vector control intervention under the IVM strategy would facilitate reduction of vector densities. However, innovative tools on integrated vector control are urgently required and further studies on how to take account of IVM into health system sustainability remained to be elucidated.

Keywords: Vector borne disease, Vector control, Integrated vector control, Integrated vector management, Mosquitos borne disease, Health system

THE STUDY OF SURVIVAL OF *ESCHERICHIA COLI* IN DRINKING WATER AVAILABLE IN KATHMANDU VALLEY AT ROOM TEMPERATURE AND THE IMPACT OF SODIS ON SURVIVAL

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Abstract

The provision of potable water to the rural and urban population is essential to counter health hazards, as it has to abide by various physical, chemical, and microbial standards. *Escherichia coli*, one of the most frequent causes of most bacterial infections especially gastroenteritis in developing countries, is an indicator of fecal pollution in the surveillance of the bacteriological quality of the drinking water. This study was conducted to assess the survival of E. coli in water at room temperature (25-27°C) and to pinpoint the impact of sunlight on the survival of E. coli. The analysis revealed the presence of total coliform in 52% of the samples to be beyond WHO guidelines (0 CFU/ml). Correspondingly, starting from day 1, 10-fold dilutions were made from each test-tube number and then E. coli count at room temperature is done from each dilution using the pour plate method on PCA while (CFU/ml) was calculated. From test tubes no.2 to 8 from day 2 to day 8 consecutively for 8 different samples at room temperature and under the exposure of sunlight at a 45° angle for an hour. CFU/ml of E. coli of sample no.1 in dilution 10^{-5} was markedly decreased from 5.9×10^{6} on day 1 to 0 on day 8. However, under the sunlight, the CFU/ml of dilution 10^{-4} in samples 1 to 8 was 8×10^{4} to 0 in all 8 samples in dilution 10^{-5}. The findings suggest that if the water is contaminated with a low number of E. coli, it can be eliminated by keeping water at room temperature for only a few days, the number of E .coli can be greatly reduced when stored under the sunlight for at least one hour.

Keywords: E. coli, Water, Analysis, Microbial, Room temperature, SODIS

HIGH LEVEL OF PERSISTER FREQUENCY IN CLINICAL STAPHYLOCOCCAL ISOLATES

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Abstract

Both *Staphylococcus aureus* and coagulase negative staphylococci (CNS) are notorious human pathogen that causes mostly medical device associated biofilm infections. Chronic in nature, these infections are difficult to treat, mainly due to the presence of persister cells, which exhibit transient yet extreme tolerance to antibiotics. Despite tremendous clinical significance, there is lack of studies on persister cells formation among clinical bacterial isolates. Considering the importance of factors influencing persister formation, we evaluated the association of antibiotic tolerance with biofilm production, antibiotic stress, growth phase, specimen type, and dependency on staphylococcal species. Biofilm formation was detected among 375 clinical staphylococcal isolates by quantitative tissue culture plate method (TCP) and *icaAD* genes by genotypic method. The antibiotic susceptibility was determined by Kirby Bauer disc diffusion method while minimum inhibitory concentration values were obtained by agar dilution method. Persister cells were measured in the susceptible staphylococcal isolates in the presence of clinically relevant antibiotics. In the study, 161 (43%) *S. aureus* and 214 (57%) CNS was isolated from different clinical samples. TCP method detected biofilm production in (52.2%) *S. aureus* and (42.1%) in CNS isolates. The genotypic method detected *icaAD* genes in 86 (22.9%) isolates. Majority (>90%) of both biofilm producers and non-producers were sensitive to chloramphenicol and tetracycline but resistant to penicillin. Interestingly, all isolates were sensitive to vancomycin irrespective of biofilm production. While high persister frequency was observed among all staphylococci isolates in the stationary growth phase, the persister frequency in exponential growth phase was statistically high among isolates possessing *icaAD* genes compared to *icaAD* negative isolates. Understanding the factors influencing the formation and maintenance of persister cells are of utmost important aspect to design therapeutics and control recalcitrant bacterial infections.

Keywords: Biofilm, Persister cells, *icaAD* genes

ASSESSMENT OF WASTE AND OCCUPATIONAL SAFETY AND HEALTH IN OFFSET PRINTING PRESS FACILITIES IN BHARATPUR, CHITWAN

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Abstract

This study assessed the status of waste and occupational safety and health (OSH) in four offset printing press facilities Presses (A, B, C and D) in Bharatpur, Chitwan. To investigate the waste characteristics and generation rates, solid and liquid wastes generated were observed for 7days. In addition, workers' exposure to PM_1, $PM_{2.5}$, PM_{10}, CO_2 and noise were measured at different sampling points in each of the selected printing press facilities for 7days (1 hr/day). The data were entered into SPSS version-26 for analysis. The WHO AirQ+ software was used to estimate the adult lung cancer mortality owing to $PM_{2.5}$ exposures. Results showed that Press-D (1543 kg/week) had the highest solid waste generation rate, followed by Press-A (864 kg/week), Press-C (728 kg/week) and Press-B (646 kg/week). Likewise, Press-D generated the highest amount of liquid waste (92.5 L/week) and Press-B generated the least amount of liquid waste (33.6 L/week). Analysis of OSH revealed that occupational hazards were statistically significantly associated with the working department. Furthermore, $PM_{2.5}$ exposure levels were higher than the threshold limit of Nepal's IAQ standard (60 $\mu g/m^3$) in all sites. In contrast, PM_{10} exposure levels were within the permitted limit of Nepal's IAQ standard (120 $\mu g/m^3$) in Press-A and B, but not in Press-C and Press- D. CO_2 levels were higher at Press-C than at Presses(-A, B and D). However, CO_2 exposure levels were below the 1000 ppm threshold of Nepal's IAQ standard. The noise level was highest at the four-color machine. The assessment of lung cancer deaths attributable to the $PM_{2.5}$ exposure of press workers showed that the excess lung cancer mortalities attributable to $PM_{2.5}$ exposures may be reduced, if workplace $PM_{2.5}$ levels meet Nepal's IAQ standard.

Keywords: Air pollution, Exposure, Noise, Occupational hazard, Waste

CARBAPENEMASE PRODUCING MULTI DRUG RESISTANT *KLEBSIELLA PNEUMONIAE* FROM A REFERRAL HOSPITAL IN NEPAL

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Abstract

The world is facing ever-increasing problem with antibiotic resistant bacteria and is rapidly heading for post antibiotic era. Carbapenem resistant *Klebsiella pneumoniae* (CRKP) gradually emerged and thus strictly limiting options for treatment. Carbapenemases hydrolyze the wide spectrum of β-lactam antibiotics; Penicillins, Cephalosporins, Carbapenems, Monobactams, Aztreonam and can also show resistant to β-lactamase inhibitors such as Clavulanic acid, Sulbactam, and Tazobactam. This study aimed to determine the multidrug resistant (MDR), ESBL and carbapenemase producing *Klebsiella pneumoniae* from a referral hospital in Nepal. The study was carried out at the Central Department of Microbiology Tribhuvan University, Kirtipur. The clinical isolates collected from Tribhuvan University Teaching Hospital, Maharajgunj were cultured, and identified using biochemical tests. Production of ESBL, CRKP (KPC & MBL) were determined by phenotypic methods. From different clinical specimens, 177 *Klebsiella pneumoniae* were isolated and identified phenotypically. The antibiotic susceptibility pattern was determined using Kirby Bauer disk diffusion method following CLSI guidelines. Among 177 *K. pneumoniae*, 131 (74.01%) were found to be MDR. Out of 131 MDR *K. pneumoniae*, 107(81.67%) were ESBL producer determined by combined disc method as per CLSI guideline. The total 131 screened for CRKP, 50 (38.16%) were found to be CRKP positive. Among 50 CRKP, 42(84%) were KPC producer and 8 (16%) were both KPC & MBL producer. The high prevalence of MDR CRKP and plasmid mediated β-lactamase in *Klebsiella pneumoniae* emphasize the need for continuous surveillance among the patients to detect the resistant strain, strict adherence of antibiotic susceptibility test results for antibiotic therapy and the implementation of infection control measures to reduce the increasing burden of antibiotic resistance among *Klebsiella pneumoniae*.

Key words: *Klebsiella pneumoniae*, Multidrug resistant, Carbapenemase producer, ESBL

ANTICANCER ACTIVITY OF ALKALOIDS ISOLATED FROM STEPHANIA GLANDULIFERA MIERS

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Abstract

Stephania glandulifera Miers has been traditionally used to treat several diseases in Nepal. In this study, five alkaloids (proaporphine, protoberberine and tetrahydro protoberberine alkaloids) were isolated from the caudex of the *S. Glandulifera* and their cytotoxic effects were studied on LN-229 human brain glioblastoma cell line. These alkaloids were isolated for the first time from *S. glandulifera* Miers using column chromatographic techniques. Structure elucidations were performed by modern spectral analysis; Mass, 1D and 2D-NMR spectroscopy. The isolated compounds were confirmed to be tetrahydropalmatine (**1**), palmatine (**2**), stepharanine (**3**), stepholidine (**4**) and stepharine (**5**). HPLC methods for quantification of four compounds were developed. The yield of compounds **1, 2**, **4** and **5** were found as 20.6 mg, 20.4 mg, 19.9 mg and 62.3 mg per gram of plant respectively. The compounds were tested against LN-229 human brain glioblastoma cell line by Sulforhodamine B assay (SRB). Compound **5** showed anticancer activity (IC_{50}=8.1µg/mL). Antibacterial assay was done by agar well diffusion method, compound 2 showed an antibacterial effect against ATCC *Staphylococcus aureus* and Vancomycin-resistant *Staphylococcus aureus* (MIC= 0.3225 mg/mL, MBC= 0.625 mg/mL). Antioxidant property was evaluated by DPPH assay, compound 3 and 5 were found to be an antioxidant (IC_{50} = 0.1384 mg/mL and 0.2944 mg/mL). Molecular docking of the compounds was performed in acetylcholinesterse (PDBid-1QTI) using Autodock vina 1.1.2. Compound 5 showed the greatest binding affinity (-10.1 kcal/mol) better than the standard drug rivastigmine (-7.7 kcal/mol) and comparable with donepezil (-10.2 kcal/mol). Insilico pharmacokinetics was studied by Swiss ADME and pKCSM where compound 5 was the best with respect to the ADMET parameters. With this research work compound, 5 can be further studied to develop a potential drug.

Keywords: *Stephania glandulifera*, Alkaloids, Anticancer activity, Molecular docking and Insilico-Pharmacokinetics.

FASTING AND POST PRANDIAL BLOOD GLUCOSE LEVEL IN RELATION TO GLYCATED HEMOGLOBIN AS A DIAGNOSTIC TOOL FOR DIABETES MELLITUS

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Abstract

Glycated hemoglobin (HbA1c) is a marker of evaluation of long term glycemic control in diabetic patients and predicts the risks for the development and /or progression of diabetic complications. Poor glycemic control refers to persistently elevated blood glucose and HbA1c levels. The study explores the correlation between HbA1c with fasting blood glucose (FBG) and post prandial blood glucose (PPBG) to assess their utility in monitoring the glycemic control in diabetics. 101 patients attending a medical OPD were selected by simple random sampling and divided as Group 1 (HbA1c < 7% good control), Group 2 (HbA1c 7-9% fairly controlled) and Group 3 (HbA1c > 9% poorly controlled). Glycated Hb and blood glucose estimations were carried out in the fasting state as well as postprandial state. The mean FBG and PPBG in 3 groups were 109.7 18.8 mg/dl and 131.8 34.3 mg/dl for Group1, 130.2 30.02 mg/dl and 180.3 55.74 mg/dl for Group 2 and 212.2 77.19 mg/dl and 322.2 96.87 mg/dl for Group 3. There was increasing trend of mean values of PPBG, FBG with poor glycemic control which reached statistical significance (p < 0.001). A significant correlation was established between HbA1c and FBG, HbA1c and PPBG, PPBG and FBG (P = 0.01) with PPBG showing a marginally better correlation(r = 0.792 vs 0.731). HbA1c remains the gold standard in assessment of glycemic control with availability of standardized methods. In settings and conditions with limitations for using HbA1c, PPBG value expresses better correlation to HbA1c compared to FBG.

Key words: Correlation, Fasting blood sugar, HbA1c, Post Prandial blood sugar.

KNOWLEDGE, ATTITUDE AND PRACTICE OF PHARMACOVIGILANCE AMONG UNDERGRADUATE MEDICAL AND DENTAL STUDENTS OF A TERTIARY CARE TEACHING HOSPITAL

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Abstract

Under-reporting of suspected Adverse Drug Reactions (ADRs) by health professionals is a widespread problem in Nepal. To strengthen the pharmacovigilance program, medical students should be well trained about the ADR reporting from the very beginning. The objective of the present study is to assess knowledge, attitude, and practice of pharmacovigilance among undergraduate medical and dental students of a tertiary care teaching hospital. A cross-sectional study was conducted among first, second-year medical and dental students, from the first to the second week of March 2021. An online questionnaire was used to collect data. The frequency of different measures mentioned by respondents was noted. The total score was compared among different sub-groups using Mann–Whitney test. Out of 238 students, 204 students (85.7%) responded. Among them, medical students were 157 (77%) and dental students were 47 (23%). The majority were below 23 years and were male. The maximum possible score for knowledge was 9, for attitude was 8, and for practice was 7. Thus, the maximum possible total score was 24. The mean with standard deviation for knowledge, attitude and practice were 4.2±1.4, 7.1±1.2 and 1.8±1.2, respectively. The total mean was 13.11 and the total standard deviation was 2.41. The total median score for knowledge, attitude and practice were 4, 7 and 2, respectively. The total median score of medical students was not significantly different from that of dental students. Positive attitude was noted among undergraduate medical and dental students towards pharmacovigilance, but knowledge and practice were not good. Thus, the study indicates the need for integrating pharmacovigilance education in undergraduate medical curricula to prepare them for future practice.

Keywords: Cross-sectional, Nepal, Questionnaire, Under-reporting.

THYROID DYSFUNCTION IN HIV PATIENTS IN NEPAL

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Abstract

Thyroid dysfunction is one of the common endocrine disorders in HIV infected individuals.In addition, the abnormalities in thyroid function in HIV patients have also been linked with the adverse effects of prolonged antiretroviral (ART) therapy. In this study, we aimed to identify thyroid disorder in the HIV patients and study their relationship to sex and age group of the patients, and ART duration. A cross-sectional study was conducted at SRL Diagnostics Nepal, Pvt. Ltd from 6th Feb 2022 to Dec 2022. The study population included 203 HIV sero-positive patients visiting Tribhuvan University Teaching Hospital. Thyroid function test was performed using the COBASE e411 analyzer. Of the 203 patients, 22 (10.83%) had a thyroid disorder the majority being subclinical hypothyroidism (72.73%) followed by subclinical hyperthyroidism (13.63%). The frequency of thyroid disorder did not show any statistical association with the ART duration of the HIV patients (<0.05). The incidence of thyroid disorder showed an increase with the increase in the age group of the HIV patient and showed a weak statistical association (p=0.002, P= 0.274). There was no statistically significant difference in the mean thyroid hormone values among the sexes and the ART duration. However, there was a statistically significant difference in the mean values of TSH (F (3, 199) = 3.231, p = 0.023) and T3 F(3, 199) = 4.587, p = 0.004) among the different age-groups. Subclinical hypothyroidism was the most common type of thyroid dysfunction in the HIV patients. Thyroid disorder was not related to the sex of the HIV patients and the ART duration. Elderly HIV patients had higher chances of having a thyroid disorder.

Key Words: THYROID, HIV, ART, E- CLIA

VIDEO CAPSULE ENDOSCOPY FOR SUSPECTED SMALL BOWEL BLEEDING IN

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Abstract

The source of gastrointestinal (GI) bleeding is sometimes not identified after the initial evaluation with upper GI endoscopy and colonoscopy. These patients still need evaluation for suspected small bowel bleeding. The objective of the study was to evaluate the role of video capsule endoscopy (VCE) in suspected small bowel bleeding, presenting with obscure GI bleeding in Nepal. This is a retrospective study, in which the patients of GI bleeding from different hospitals of Nepal with inconclusive findings after upper GI endoscopy and colonoscopy between January 2021 and May 2022 were included. Those patients underwent VCE to look for the suspected small bowel bleeding. In the patients of small bowel lesion, the different types of etiology were analyzed. Out of 30 patients included in the study [mean age 62.5 years (standard deviation 17.3); male: 19 (63.3%), female 11 (36.7%)], the overall positive diagnostic yield with VCE was 26 (86.7%). The small bowel lesions detected were angiodysplasia in 18 (60%), non-specific ulcerative lesions in 5 (16.7%), polyp in 1 (3.3%), portal hypertensive enteropathy in 1 (3.3%), serpigenous ulcerations with fissuring and cobble-stone appearance suggestive of Crohn's disease in 1 (3.3%) and normal finding in 4 (13.3%) patients. Overall 19 (63.3%) patients had definite small bowel lesions with score P2 of Saurin classification and 7 (23.3 %) had small bowel lesion with score P1 of Saurin classification. There were no any complications after the procedure. All patients reported expulsion of the capsule within 7 days. The source of bleeding, previously labeled as obscure after UGI endoscopy and colonoscopy, was identified by VCE in majority of patients in Nepal; the suspected small bowel lesions were confirmed by VCE in those patients, where the commonest lesions were small bowel angiodysplasia, followed by non-specific ulcerative lesions.

Keywords: Video capsule endoscopy, Obscure gastrointestinal bleeding, Small bowel lesion, Nepal

ELUCIDATING THE ROLE OF NONO/P54^{NRB} IN THE TUMORIGENICITY OF BREAST CANCER

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Abstract

Breast cancer is one of the most common cancers with high mortality, highlighting the vital need to identify new therapeutic targets. Here we report that Non-POU Domain-Containing Octamer-Binding Protein **(**NONO) is overexpressed in breast cancers and validated the interaction between the WW domain of PIN1 and c-terminal Threonine-Proline (thr-pro) motifs of NONO. Bioinformatic analysis of NONO in human breast cancer, its stability and role of NONO in cell proliferation, cell cycle, apoptosis and migration/invasion of breast cancer are main objectives of this study.Yeast two-hybrid and immunofluorescence were performed to investigate protein-protein interaction. Colony formation assay, CTG assay, crystal violet assays and Flow cytometry were performed for cell viability, cell cycle and apoptosis. Data mining was performed for expression analysis of NONO in breast cancers. The Transwell chambers were employed for the migration and invasion assays. qRT PCR and Western blotting were performed to measure the mRNA and protein levels of NONO and other markers related to viability, migration, cell cycle, and apoptosis.Interestingly, the interaction of NONO with PIN1 is essential for its stability. Functionally, silencing of NONO inhibits the growth, survival, migration and invasion, epithelial-to-mesenchymal transition (EMT), and stemness of breast cancer cells. Mechanistically, depletion of NONO promotes the expression of PDL1 cell surface protein in breast cancer cells, besides inhibiting the MAPK/β-catenin pathway; and the interaction of NONO with c-Jun and β-catenin proteins displays its role in regulating the oncogenic behavior of cancer cells. Taken together, our results demonstrated an essential role of NONO in the tumorigenicity of breast cancer and could be a potential target for anti-cancerous drugs.

Keywords: PIN1, NONO, siRNA, Protein-Protein Interaction, Apoptosis, Breast Cancer

POSTER PRESENTATION

IMPROVED COVID-19 VACCINE ACCEPTANCE AFTER REGULATORY APPROVAL: A CASE STUDY FROM NEPAL

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Abstract

COVID-19 vaccine has been approved and inoculated globally, including in Nepal. While vaccine acceptance changes over time and factors determining vaccine acceptance differ depending on disease and region, limited studies have evaluated vaccine acceptance in Nepal. Here we assessed COVID-19 vaccine acceptance among Nepalese over two phases: pre and post-vaccine approval. Two Online cross sectional surveys were conducted using online Google form over two phases: pre and post-vaccine approval. We found that vaccine acceptance increased after the regulatory approval. This indicated the role of the national drug regulatory authority to convey drug safety. In addition, we analyzed the predictor(s) of vaccine acceptance. We found that the people, who believe that vaccine is an effective measure in preventing and controlling the disease, were highly likely to accept vaccination. Given that Nepal had just passed the most devastating wave of COVID-19 during our post-approval data collection, we assume that this might have also played a role in the belief that vaccination is an appropriate approach to combat the pandemic. Our results indicate that the government needs to focus on assuring the safety and effectiveness of a vaccine to enhance acceptance.

Keywords: COVID-19, Vaccine, Acceptance, Nepal, Regulatory approval

CLINICOPATHOLOGICAL PROFILE OF DENGUE INFECTION IN A TERTIARY CARE CENTRE IN NEPAL: A HOSPITAL-BASED CROSS-SECTIONAL STUDY.

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Abstract

Dengue is a mosquito-borne viral disease with a wide spectrum of presentations ranging from subclinical disease to severe dengue. Dengue is endemic to the Terai of Nepal. Interestingly, an increasing incidence has been reported from hilly areas like Kathmandu valley. This study explored the clinicopathological profile of dengue infection. A total of 84 serologically confirmed dengue cases from September to November 2019 admitted at KIST Medical College were recruited in a cross-sectional study after obtaining ethical approval. Dengue was categorized as dengue without warning signs, dengue with warning signs, and severe dengue. Clinicopathological information was recorded in the proforma by retrospectively reviewing patients' records. A descriptive statistical tool and chi-square test were carried out. Among 84 patients, 76% (64) had dengue without warning signs, 21.4% (18) had dengue with warning signs and 2.4% (2) had severe dengue. Fever was present among all patients. At presentation to hospital, anemia was observed in 23.5% (19), thrombocytopenia in 33.3% (26), hemoconcentration in 2.5% (2), and leucopenia in 68.8% (53). Similarly, elevated aspartate transaminase (AST) and alanine transaminase (ALT) was observed in 57.1% (24) and 46.4% (20)

respectively. During the course of illness, anemia was identified in 38.1% (32), thrombocytopenia in 65.5% (55), hemoconcentration in 6% (5), and leucopenia in 82.1% (69). Similarly, elevated AST and ALT was observed in 67.7% (42) and 53.2% (33) respectively. The severity of dengue was significantly associated with thrombocytopenia (0.012), leucopenia(0.021), and elevated ALT(0.021) on presentation, and hemoconcentration(0.002), thrombocytopenia(0.002), leucopenia(0.011), and elevated ALT(0.02) during the course of illness in the hospital. Most common presentation of dengue infection was fever. The most common laboratory abnormalities were leucopenia, thrombocytopenia, hemoconcentration, anemia, and elevated liver enzymes. Awareness of these clinical and laboratory parameters is important for the prompt diagnosis, severity estimation, and overall management of dengue infection.

Keywords: Biochemical, Clinical, Dengue, Hematological, Nepal, Serological

CHEMICAL PROFILING AND ANTI-OXIDANT POTENTIAL OF ESSENTIAL OILS FROM *Citrus grandis, Citrus sinensis* and *Citrus reticulata* OF NEPALESE ORIGIN

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Abstract

Citrus species of plants are among the most commercially cultivated crops around the globe. Essential oils extracted from the peel of citrus have a history of being used by humankind for centuries. These essential oils are rich in antioxidants and antimicrobial agents. This study is focused on the comparative investigation of volatile constituents and antioxidant activities of essential oils from *Citrus grandis* Osbeck, *Citrus sinensis* Osbeck and *Citrus reticulate* Blanco.The essential oils were analyzed through gas chromatography-mass spectrometry (GC–MS) and enantiomeric composition by chiral GC–MS. Similarly, the antioxidant properties were evaluated by 2, 2-diphenyl-1-picrylhydrazyl scavenging assay.GC–MS analysis showed limonene (63.76–86.59%), γ-terpinene (0.64–6.43%), β-pinene (0.15–6.09%), linalool (1.87–3.5%), sabinene(0.77–2.17%), myrcene (0.74–1.59%), α-terpineol (0.29–1.15%), and α-pinene (0.2–0.58%) as the major constituents of the essential oil of the Citrus species. For the first time, through our study, chiral terpenoids have been observed from *Citrus Grandis* essential oil. The order of antioxidant activity is as follows: *Citrus grandis* Osbeck (1.56±0.08 µL/mL)> *Citrus reticulata* Blanco (2.30±0.37µL/mL)> *Citrus sinensis* Osbeck (3.32±0.66µL/mL). All samples demonstrated stronger antioxidant activities than those of the positive control, quercetin (5.60 µL/mL). Therefore, these essential oils can be used as a safe natural antioxidant for the treatment of free radical mediated cell apoptosis and other ailments.

Keywords: Citrus, Chiral, Limonene, Terpenoids

PHYTOCHEMICAL ANALYSIS AND ANTIMICROBIAL SCREENING STUDIES OF CALOTROPIS GIGANTEA LEAVES

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Abstract

Calotropis gigantea (Apocynaceae) is a wild herb that can be used to cure a variety of ailments, including fever, indigestion, colds, coughs, asthma, and scabies.The powdered *C. gigantea* leaves was examined for ash value, extractive value, organoleptic properties, and microscopy. Also, the extract of the plant with several solvents (petroleum ether, diethyl ether, chloroform, ethyl acetate, ethanol, and water) was successively calculated. Each extract was screened for phytochemicals and evaluated for total phenolic content and total flavonoid content. The antioxidant activity of aqueous and alcohol extracts was assessed, along with the antibacterial properties of each extract.Alkaloids, steroids, saponins, terpenoids, glycosides, reducing sugars, non-reducing sugars, proteins, Alkaloids, steroids, saponins, terpenoids, glycosides, reducing sugars, non-reducing sugars, proteins, tannins, amino acids, phenols, coumarin, and quinones were found in preliminary phytochemical analyses of extracts. The aqueous extract showed greater total phenolic concentration and total flavonoids content. The DPPH scavenging assay showed dosage dependent result in both the aqueous and alcohol extracts. The alcoholic and aqueous extracts of the plant were found to be effective against E. coli in a dose-dependent manner during antibacterial screening. The recent study in the extracts of the *C. gigantea* leaves indicated the presence of antioxidants with phenolic and flavonoid compounds. Therefore, this could be potential lead molecule for antibiotic.

Keywords: Antimicrobial, Calotropis gigantea, TPC, TFC, DPPH

ANTIOXIDANT, ANTIMICROBIAL AND WOUND-HEALING ACTIVITIES OF FORMULATED HERBAL CREAM

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Abstract

Medicinal plants contain various compounds having antioxidant and antimicrobial activities that can promote wound contraction and epithelialization at an elevated rate. The current study was undertaken to assess antioxidant and antimicrobial activities of different crude plant extracts, and prepared herbal cream to evaluate its wound-healing potential. Nine different medicinal plants were collected from the Central and Western parts of Nepal. Ethanolic extracts of the plants were evaluated for detection of phenolic, flavonoid, and ascorbic acid contents. Antioxidant activity was assessed by 2, 2-diphenyl-1-picryl hydrazyl (DPPH) assay. Antimicrobial activity against *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923), *Bacillus subtilis* (ATCC 6051), *Salmonella* Typhi (clinical isolates), *Enterococcus faecalis* (ATCC 29212), *Klebsiella pneumoniae* (ATCC 700603) and *Candida albicans* (ATCC 10231) were tested by agar well diffusion method and Minimum Bactericidal Concentration (MBC) was determined by broth microdilution assay. MBC was also determined against multidrug resistant (MDR) isolates of *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Alcaligenes faecalis*. Oil and water emulsion-based cream was formulated using extracts showed maximum antimicrobial and antioxidant properties. Further, the efficacy of cream on healing wounds was studied by excision wound-healing model in mice. *Terminalia chebula* revealed highest total phenolic content (127.38±1.92 mg GAE/gm) as well as total flavonoid content (91.55±2.62 mg QE/gm) and displayed significantly higher antioxidant activity with IC_{50} value of 16.22µg/ml. Vitamin C content was found higher in *Phyllanthus emblica*. *Brucea javanica* exhibited the maximum antimicrobial activity against all the selected microorganisms with the lowest MBC values. The study showed that the cream prepared from *T. chebula* exhibited maximum wound healing effect when evaluated by excision wound-healing model in mice, concluding its possible use as a potential wound-healing agent.

Keywords: Medicinal plants, Flavonoid, DPPH, Herbal cream, Wound healing.

TRADITIONAL NEPALESE WOUND HEALING THERAPIES USING NATURAL PRODUCTS

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Abstract

Wound healing is a complex process which includes four steps such as hemostasis, inflammation, proliferation and remodeling. Wounds could be fatal if high bleeding and infection of microorganisms take place. Thus, to prevent complications and heal quickly and avoid infection various traditional methods are being used from the past. As developing countries with limited modern technologies embrace various traditional healing therapies. People are using various medicinal and animal products to cure wounds. These products promote wound healing by supporting various steps of wound healing. Some plants like *Acorus calamus L.* (Araceae) (Bojh), *Artemisia dubia* Wall ex.-Besser (Asteraceae) (Titepati), *Delphinium scabriflorum* (Titemurilo),etc, and animal products like spider web, crushed crab, honey, indian bullfrog, etc, poses various properties which promote wound healing by controlling bleeding, preventing infections, promoting epidermal cell, dermal cell, endothelial cell, immune cell for quick healing of the wound.

Keywords: Wound healing, Antiseptic, Traditional medicine, Nepal, Traditional technology

CHEMICAL COMPONENTS OF *SWERTIA CHIRAYITA* FOR COMBATING SARS-COV-2: AN *IN SILICO* PERSPECTIVE

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Abstract

In order to propose an alternate therapeutic option for controlling SARS-CoV-2 by using naturally available resources, *in silico* studies were carried out for identifying a list of hit candidates with drug like properties having better inhibitory potential. Pharmacokinetics and toxicity analysis of multiple chemical components of a plant *Swertia chirayita* yielded suitable compounds that passed Lipinski's rule, hepatotoxity and AMES toxicity. From molecular docking calculations it was found that a triterpenoid ketone, Friedelin and a triterpene, Swertanone showed best binding affinities among several compounds with the receptor M^{pro} of the virus. These phytochemicals possess binding affinities of -8.8 kCal/mol each relative to the approved drug which showed -8.7 kCal/mol. The molecular dynamics simulations of protein-ligand complexes displayed fair stability in terms of RMSD. The results thus provide a theoretical basis for future experimental work for developing effective and safe drugs for preventing COVID-19 from plant based resources.

Keywords: COVID-19, Computational simulation, M^{pro}, Therapeutics, Docking Molecular dynamics

PHARMACOKINETIC AND DOCKING ANALYSIS OF NATURAL INHIBITORS OF ALDOSE REDUCTASE FOR THE TREATMENT OF DIABETIC RETINOPATHY

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Abstract

Diabetic retinopathy (DR) is an inimical microvascular complication of diabetes-induced hyperglycemia. The polyol pathway, dependent on enzyme aldose reductase (AR), is responsible for DR in hyperglycemic individuals. Some commercially available enzyme inhibitors are prescribed drugs to manage the pathophysiology, albeit, most of them have failed to meet the requirements of being felicitous drug choice.This research is carried out to perform *in-silico* analysis of plant-derived secondary metabolites that have reported good *in-vitro* inhibitory activity against rat lens AR (RLAR) and/or recombinant human AR (RHAR) in search of natural aldose reductase inhibitors (ARIs).Plant derived secondary metabolites with reported AR inhibitory action (with IC_{50} values) were surveyed. They were subjected to pharmacokinetic and docking analysis.18 compounds depicted appropriate pharmacokinetic parameters and relevant drug-likeness characteristics, which were further subjected to docking experiments with human AR (PDB ID: 4JIR). These compounds interacted with key amino acid residues of the enzyme justifying their inhibitory action. Interestingly, isoangustone A (IC_{50}: 99.5/280.8 µM against RLAR/RHAR) formed the most stable complex with binding affinity value of -9.8 Kcal/mol, followed by lucidumol A (IC_{50}: 19.1µM against bovine lens AR) and semilicoisoflavone B (IC_{50}: 1.8/10.6µM against RLAR/RHAR) with respective binding affinities of -9.1 Kcal/mol and -9.0 Kcal/mol. These compounds exhibited strong binding affinity than epalrestat, a commercially available drug thereby pinpointing their potential to act as drug.

Keywords: Hyperglycemia, Polyol pathway, Aldose reductase inhibitors, Secondary metabolites, Pharmacokinetic parameters

STUDY OF PHYTOCHEMICAL, ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES OF MEDICINAL PLANTS

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Abstract

Various Nepalese plants with distinct medicinal benefits are used as therapeutic agents as well as food. The availability of various plants in Nepal is mostly due to its unique geographical and climatic conditions. The development of antimicrobial resistance and the adverse effects of synthetic treatment have entailed a search for natural alternative over synthetic pharmaceuticals. The main goal of the study was to screen their phytochemicals with their antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia.* Nine distinct medicinal species viz. *Cuscute Reflexa*, *Curcuma Caesia*, *Curcuma Aromatic*, *Calotropis Procera*, *Drymoria Cordata*, *Smilax Aspera*, *Melina Azedarach*, *Kaemmpferia rotunda*, and *Adiantum Philippense* were collected from different parts of Nepal. The samples were then air dried and ground. The crude methanol extracts were prepared by using absolute methanol as solvent. Agar well diffusion method was used to determine the antibacterial activity. Phytochemical screeing showed the eleven distinct phytochemicals. The crude extract exhibited significant activity against *S. aureus* however, there was not any activities against *E. coli*, *Pseudomonas* and *Klebsiella*. Total phenolic content was evaluated by Folin–Ciocalteu method. Similarly total flavonoid content was estimated by Aluminium chloride method using quercetin as a standard. The Antioxidants activity of these extract were carried out by using 2, 2-Diphenyl-1-1picrylhydrazyl radical scavenging method. Most of the plants showed significant activity.

Keywords : *Adiantum Philippense*, *Calotropis Procera*, Phytochemical, Medicinal plants

DETECTION OF BIOFLIM AND MOLECULAR CHARACTERIZATION OF *MECA* AND *ERMC* GENE FROM *STAPHYLAOCOCCUS AUREUS* ISOLATES

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Abstract

Methicillin Resistance *Staphylococcus aureus* (MRSA), one of the most important cause of hospital infection, are challenging pathogens to treat because of its resistance to many antibiotics classes. Absolute presence of *mecA* gene for defining standard MRSA has become the subject of distrust. The objective of this study was to assess the presence of *mecA* gene in MRSA. The hospital based cross-sectional prospective study was conducted in Himal Hospital, Kathmandu. The isolates were identified following standard microbiological procedures and on the basis of colony characteristics and a series of biochemical tests. Antimicrobial susceptibility test was done by Kirby Baurer disc diffusion method and Bioflim was detected by Microtiter Tissue Culture Plate. D-test method was performed to identify inducible clindamycin resistance in isolates. Resistance gene such as *mecA* and *erm*C were confirmed by PCR using specific primers. Out of 1185 samples, 78 isolates were confirmed to be *S. aureus* of which 32 (41%) were MRSA and 46 (59%) were MSSA. All MRSA isolates were resistant against levofloxacin (90.6%), ciprofloxacin (84.3%), and ofloxacin (81.2%) respectively while none of the isolates were resistant toward vancomycin and linezolids. All isolates were weak (97.4%) and moderate (2.6%) producer of bioflim. Among MRSA, 12 (37.5%) were detected with *mecA* gene and 2(6.25%) showed presence of *ermC* gene.

Keywords: MRSA, *mecA*, *ermC*, MDR, *S. aureus*

PREPARATION OF LOKTA PAPER BASED SCAFFOLD AND PAPER/HYDROXYAPATITE COMPOSITE FILM FOR BONE TISSUE REGENERATION

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Abstract

Numerous factors, such as aging, physical trauma, degenerative diseases such as osteoporosis, etc., can result in bone deterioration. Bone transplants and, more recently, tissue scaffolds are two of the most commonly used treatments for these types of disorders. Current solutions typically are not low-cost and have many challenges, such as availability of autografts, immune rejection, inadequate implant characteristics, limited oxygen diffusion, etc. Considering all these complications, our project intends to prepare Lokta paper-based scaffold and paper/hydroxyapatite composite film for bone tissue regeneration. Lokta paper is a fibrous material resembling 3D structures of tissue which can be cut, folded, rolled or manipulated into the desired shape. It is biocompatible, strongest of all papers, and also overcomes all the above-mentioned challenges. We prepared the paper scaffold by using a sequential mineralization technique to deposit hydroxyapatite onto the paper. We conducted experiments with four groups of scaffolds based on different incubation times and concentrations of mineralization solutions. The deposition of hydroxyapatite onto the paper was verified by FTIR and XRD. We found that with increase in the mineralization cycle, the hydroxyapatite content is increased and also that deposition of hydroxyapatite is independent of the mineralized solution's concentration. We prepared a paper/hydroxyapatite composite film using the solvent casting method. For this, we synthesized hydroxyapatite using the sol-gel technique for

its incorporation into the composite film. FTIR and XRD were done to verify the formation of hydroxyapatite and paper/hydroxyapatite film. Furthermore, we aim to perform thermogravimetric analysis (TGA) to determine the hydroxyapatite content, dynamic mechanical analysis (DMA) to assess the tensile modulus of the designed samples, and U2OS (Human osteosarcoma epithelial cells) cell culture and MTT assay to investigate the biocompatibility of the designed sample.

Keywords: Lokta Paper, Sequential Mineralization, Hydroxyapatite, Scaffold, Composite Film

EVALUATION OF LIPID PROFILES, DYSLIPIDEMIA AND ATHEROGENIC INDEX OF PLASMA IN DIABETIC PATIENTS

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Abstract

To study the pattern of lipid profile, dyslipidemia and atherogenic index of plasma in Diabetic patients. A case-control study was conducted among 1024 individuals; 512 diabetics and 512 were healthy controls at Kantipur General Hospital, Basundhara in between January 2019 to December, 2021. Lipid profile tests; Total Cholesterol, triglyceride, High density lipoprotein (HDLC), low density lipoprotein (LDL) was measured on automated analyzer and ratios were calculated. Almost 61.2% of patients showed dyslipidemia, 34% had hypertriglyceridemia, 5.6% female and 6.2% males showed uncontrolled glucose level in spite of medications. 73.4% had low HDL (<40mg/dl) and 93.8% had atherogenic index of plasma (AIP) >0.21. Hypo-HDL-cholesterolemia was prevalent form of dyslipidemia in our study. On genderwise analysis, all the lipid profile parameters were statistically increased at $p<0.05$. The correlation of sugar-gender on lipid profile analysis, and total lipids and atherogenic Index of plasma was found to be statistically significant at $p<0.05$. Pearson correlation coefficient of total cholesterol, triglyceride, HDL, LDL, total lipids, AIP were 0.688, 0.917, 0.069, 0.182, 0.17, 0.901, 0.744 respectively on the basis of glucose and gender. TG and VLDL showed stronger correlation coefficient. Dyslipidemia is one of the major risk factors which is widely prevalent in patients with diabetic mellitus and is more prevalent in males than females. We recommend paying more attention to serum lipids and other modifiable risk factors for its prevention with proper diet, medication, eating habits and physical exercises. AIP and total lipids determination from lipid profile is a reliable tool to identify patients who are at high risk to develop CVD and other metabolic diseases.

Keywords: Dyslipidemia, Atherogenic index of plasma (AIP), Total lipids, HDL, LDL

FORMULATION AND EVALUATION OF ORAL SUSTAINED RELEASE LIQUID FORM OF METFORMIN HCL

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Abstract

Formulation and evaluation of oral sustained release liquid form of Metformin HCL. HPMC K 100 and sodium alginate were dissolved in water and soaked overnight. Metformin Hydrochloride and Calcium Chloride were mixed with water to make second solution. The two produced solutions were combined, and the optimized sustained release dosage form of metformin HCL was obtained. The evaluation study includes the sustained release dissolution test, viscosity, compatibility, and pH of the prepared solution. The oral liquid sustained delivery of Metformin HCL is almost effective like of conventional metformin tablets in terms of Sustain release. When tested with 0.1N HCL, the viscosity of the produced solution was observed to be enhanced. The incompatibility of the excipients was determined by IR spectroscopy examination. The study revealed that the optimized formulation has shown the improved sustained release of metformin as that of conventional types of metformin. This produced solution could be very effective for elderly and dysphagic patients in the near future.

Keywords: Sodium Alginate, Metformin Hydrochloride, HPMC K 100, Sustained Release

COMPARATIVE STUDY OF SPIKE PROTEIN INHIBITION IN DIFFERENT VARIANT OF CONCERNS OF SARS-CoV-2 BY NATURAL PRODUCT (TRITERPENES); A COMPUTATIONAL APPROACH

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Abstract

Global pandemic caused by the SARS-CoV-2 virus affected the health of a major chunk of the global population. WHO has declared five variants of SARS-CoV-2 as Variants of Concern (VOCs) indicating these are of high concern to mankind in terms of transmissibility or pathogenicity. Inhibiting the interaction of the spike protein with ACE-2 could be a useful strategy for preventing viral infection. Natural products owing to their chemical diversity and structural diversity provide ample reasons to be a promising source for the treatment of different diseases.After an extensive literature study, triterpenes with antiviral activity were selected to analyze their inhibitive effect on SARS-CoV-2 proteins via the stepwise *in silico* method. They were subjected to the Lipinski test, ADMET analysis, toxicity prediction, and then molecular docking with viral proteins. The binding energy and interactions between phytochemicals and amino acid residues were analyzed.Compounds that met Lipinski's rule of five and had suitable pharmacokinetic properties were docked with spike proteins of five different VOCs of SARS-CoV-2. 25-Anhydroalisol A, Kadcotriones B, Lancifodilactone H, and Rhodoterpenoid B showed a greater binding affinity toward all docked spike proteins with favorable pharmacokinetic properties. Lancifodilactone H showed highest binding energy in the range -6.2 to -7.3 kcal/mol and 25-Anhydroalisol A in the range -5.8 to -6.8 kcal/mol for all spike proteins. The energy was significantly greater than reference compound, hydroxychloroquine (-4.5 to -5.3 kcal/mol) .They showed H-bond and different hydrophobic bonds of interaction with mutated residues of spike proteins which hint positive response to the inhibition of protein. These phytochemicals thus could potentially be used for further exploration to treat COVID-19.

Keywords: SARS-CoV-2, Triterpenes, S1 spike protein, Mutation.

SYNTHESIS, CHARACTERIZATION, AND BIOLOGICAL STUDY OF *LAUHA BHASMA*

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Abstract

Bhasmas are prepared from metallic and herbal ingredients and are also referred to as herbo-metallic preparations. *Lauha bhasma* (LB) is one of the iron-based herbo-metallic preparations used in Ayurvedic medicine for treating various ailments due to iron deficiency. This research work was carried out for the analysis of LB with Ayurvedic with modern parameters and also to analyze its physicochemical properties. The preparation of LB involves normal purification (samanya sodhana), special purification (vishesha sodhana) followed by drying under sunlight (bhanupaka), heating in a frying pan (sthalipaka), and calcination (putapaka) with Triphala kwatha as a medium under the temperature of 650 o C in an electric muffle furnace (EMF) for 1 hour. Then LB was characterized by modern instrumental methods such as Fourier Transform Infrared Spectroscopy (FTIR), X-ray Spectroscopy (XRD), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX). Prepared LB also subjected to antibacterial and cytotoxicity study and compared with market samples. The results suggested that organoleptic characters, preliminary test and physicochemical result of LB suggest that these steps were necessary to obtain a good quality of bhasma and also make it acceptable during the Bhasmikarna process. From physicochemical analysis data, it showed the negligible moisture content (0.42 %; loss on drying), total ash value (17.3 %), acid insoluble ash value (7.6 %). It was observed that LB prepared in 21 puta have the average crystalline size was found to be 57.23 nm from XRD spectra. SEM analysis shows the fine coarse structure with uniform particle size of LB. EDX graph shows the presence of Fe (75.43%) as a major element. FTIR spectra suggested the presence of different organic moieties which enhance the therapeutic action due to which bhasma shows significant antibacterial properties.

Key Words: *Lauha bhasma* (LB), EMF, FTIR, XRD, SEM, EDX.

ETIOLOGICAL CHARACTERIZATION OF INFECTIOUS VAGINITIS AMONG REPRODUCTIVE-AGED WOMEN VISITING A TERTIARY CARE CENTER IN NEPAL

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Abstract

The aim of this study was to characterize the etiology of infectious vaginitis among reproductive-aged women visiting a tertiary care hospital in Nepal. The vaginal samples were collected from each woman with abnormal vaginal discharge. Nugent's score system and Amsel's criteria were used to diagnosing BV (Bacterial Vaginosis), wet mount preparation was done to diagnose TV (Trichomonas vaginitis), and AV (Aerobic vaginitis) and VVC (*Vulvovaginal Candidiasis*) were diagnosed by the routine culture method. Clinical and Laboratory Standards Institute guidelines were used to assess the antimicrobial susceptibility profile of aerobic bacteria and *Candida* isolates. Out of a total of 141 reproductive-aged women included in the study, 60.3% presented with thin and scanty vaginal discharge, 52.5% had clear to white discharge, and 39.0% had vulvovaginal itching. The overall rate of any type of infectious vaginitis was 44.0% with the predominance of BV (19.8%) followed by AV (12.8%), VVC (11.3%), and TV (7.1%). Infectious vaginitis was frequent among women between the age of 25 and 34 years. BV was significantly associated with malodorous discharge (*P-value* = 0.002) and VVC was significantly higher in women with vulvovaginal itching (*P-value* = 0.009). The most common aerobic bacteria that caused AV was *Escherichia coli*, while *Candida albicans* represented the most common cause of VVC. Reproductive-aged women who visited a tertiary care hospital in Nepal had a significant burden of infectious vaginitis, with BV being the most common, followed by AV, VVC, and TV. Almost half of the studied cases of per vaginal discharge in reproductive age woman group showed an infectious vaginitis. Incorporating simple laboratory test in management of per vaginal discharge cases, could help in identifying specific agent and prevent misuse of drug which may be leading to drug resistance.

Keywords: Vaginal discharge, Aerobic vaginitis, Bacterial vaginosis, Candidiasis, Trichomoniasis

SECONDARY METABOLITE SCREENING AND BIOASSAY OF METHANOL EXTRACT OF *ELAEOCARPUS GANITRUS* FLOWER.

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Abstract

This study evaluated the Secondary metabolite, TPC, TFC, antioxidant, antidiabetic and antimicrobial potential methanol extrssact of the *Elaeocarpus ganitrus* flowers. The phytochemical screening of methanol extract revealed the presence of alkaloids, terpenoids, flavonoids, polyphenols, saponins, glycosides, and reducing sugars. The total phenolic content by FCR assay and total flavonoid content are 150.56 mg GAE/g (at concentration 0.644) and 84.35 mg QE/g (at concentration0.582) respectively. The antioxidant analysis by DPPH free radical scavenging method was used to analyze antioxidant potential with an IC_{50} value 70.659 µg / mL. The antidiabetic assay (α-amylase assay) was carried out by using a 3,5-dinitrosalicylic acid (DNSA) reagent with an IC_{50} value of 1717 µg/ mL. The antibacterial assay was assessed by agar well diffusion method against gram +Ve bacteria such as *Bacillus subtilis* and *Staphylococcus aureus* and gram –Ve bacteria such as *Escherichia coli* and *Klebsiella pneumonia*. The positive control Ampicillin and negative control dimethyl sulphoxide (DMSO) were used. Zone of inhibition (ZOI) was not observed against the tested organisms indicating the absence of antibacterial action. The antifungal assay was assessed by Agar well diffusion method using two different fungi; Alternaria species and Fusarium species with cycloheximide as +ve control and DMSO as –Ve control. The zone of inhibition was not observed against tested fungi indicating absence of antifungal activity. The high phenolic and flavonoid content indicate that it can be used as therapeutic agent to control diabetes and obesity and as an antioxidant.

Keywords: Secondary metabolite, TPC, TFC, Antioxidant, Antidiabetic, Antibacterial, Antifungal.

SMARTPHONE ASSISTED THIN LAYER CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF AN ANTIDIABETIC DRUG

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Abstract

Low-quality medication is a major challenge for the healthcare system globally. In this work, we report a smartphone-based thin layer chromatography (TLC) analyzer for the quantitative determination of metformin. Metformin is a commonly used drug to treat diabetic patients. We used a silica-coated fluorescent TLC plate and the acetic acid-methanol-water solvent system as a mobile phase for the separation of molecules. During the assay, metformin standard or sample solution was spotted on the fluorescent TLC plate enabling the development of TLC spots. A custom-built TLC reader containing a UV lamp and the TLC plate holder was used to take pictures of the TLC plate. The compound was identified by matching the retention factor of the sample with that of a standard compound run simultaneously. The concentration of the metformin was estimated by comparing the intensity of the spots with standard ones. Compound identification and quantification were automatically performed by an android application. The custom-built application takes the image of the TLC plate, identifies the spots and confirms the analyte of interest, calculates the mean intensity of spots, and analyzes the data. The final report is displayed on the smartphone screen. To validate the newly developed smartphone-assisted TLC analyzer, we tested 16 metformin samples collected from local pharmacies. The average metformin concentration of 500mg tablets was 494.85 ± 64.27 mg/tablet. This low-cost and easy-to-use platform for screening the quality of pharmaceutical products has the potential to be equally applicable to other ultra-violet light-absorbing pharmaceutical products. Currently, we are testing the same system for screening the quality of other antidiabetic and antibiotic drugs.

Keywords: Drug quality, Low-cost Method, Smartphone sensing, Metformin, Substandard drug detection.

ANTIBACTERIAL ACTIVITY OF NEPALESE MEDICINAL PLANTS AGAINST DIFFERENT BACTERIAL ISOLATES

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Abstract

Medicinal plants come across as the most important source of medicines and flavoring agents in the modern world. They possess hundreds of phytochemicals that have potential to stop growth of pathogenic microorganisms. As the world continues to face increasing problem of antimicrobial resistance, more researches focusing on medicinal plants are coming forward in order to unravel their potential as an alternative treatment. We conducted this research in order to assess the antibacterial activities of selected Nepalese medicinal plants extracts in different solvents. Eight medicinal plants (*Azadirachta indica, Mentha spicata, Terminalia chebula, Terminalia bellirica, Acorus calamus, Tinospora sinensis, Ocimum tenuiflorum, Aloe vera*) were collected and their extracts were prepared in water, ethanol, and chloroform separately by maceration method. Extracts were prepared using DMSO in two different concentrations i.e. 10% and 1%. Antibacterial activities of total of 24 extracts were recorded against *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa* and *Klebsiella pneumoniae* by agar well diffusion method.In general, most plant extracts showed considerable antibacterial activities against gram positive bacterium i.e. *S. aureus* compared to gram negative bacteria. The maximum zone of inhibition(26mm) was shown by 10% concentration of ethanolic extract of *Terminalia chebula* against *S. aureus.* Extracts of *Terminalia chebula* and *Terminalia bellirica* were found to be most effective of all, followed by that of *Acorus calamus* and *Ocimum tenuiflorum.* Thus, this study further confirms that these plants have promising application as a natural antibacterial agent.

Keywords: Medicinal plant extracts, Antibacterial, Agar well diffusion method, traditional medicines.

POTENTIAL AROMATIC COMPONENTS FROM NEPALESE HERBS FOR MANAGEMENT OF SEVERE ACUTE RESPIRATORY SYNDROME AND OTHER RESPIRATORY DISEASES

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Abstract

Phytochemicals have been a source of medicine with curative properties since time immemorial. There are more than 20 types of essential oils produced and exported from Nepal awaiting assessment for their therapeutic use. There are several components of bioactive compounds in aromatic medicinal plants used in Ayurvedic preparation which are known for remedial effect in respiratory diseases. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) spread made an extensive toll and its management is still challenging worldwide. There has been a progressive search for potential phytochemical lead compounds aiming for appropriate alternative antiviral drugs which can interfere with viral entry, replication and assembly to interrupt the virus life cycle. The *in silico* evaluation of major essential oil components of three medicinal aromatic plants, black cardamom (*Amomum subulatum*), soti grass (*Cymbopogon jwarancusa*) and sugandhakokila (*Cinnamomum glaucescens*) were done for their binding capacity with various receptors of SARS-CoV-2. The GROMOS force field was used for topology generation for the ligand and the receptor. After equilibrating the system for 300 ps each at NVT and NPT conditions, the production run was carried out for more than 200 ns using GROMACS code. The build-in processing tools were used for data analysis and Discovery Studio Visualizer/VMD for visualization of the complexes and monitoring the trajectory. Among aromatic compounds methyl (*E*)-cinnamate possesses better binding capacity with various receptors of SARS-CoV-2. Hemp (*Cannabis sativa*) fibers seem to be a better material for the preparation of essential oil diffuser material. The results indicate the possibility of the use of a single or concoction of components for the development of effective formulations for COVID-19 management.

Keywords: COVID-19, Essential oils, Molecular docking, Molecular dynamics, Phytochemicals

GC-MS ANALYSIS, ANTIOXIDANT, ANTIBACTERIAL, BRINE SHRIMP LETHALITY ANALYSIS, TPC, TFC AND FTIR ANALYSIS OF *CENTELLA ASIATICA* LINN.

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Abstract

Centella asiatica Linn. (Family Apiaceae), an edible and frost-tender perennial herb found during rainy season, distributed throughout tropical and subtropical regions. It is used in several traditional system of medicine for the management of central nervous system, skin and gastrointestinal disorders, wound healing, asthma, abdominal disorder, dysentery, diarrhoea, jaundice. Essential oil was extracted by hydro distillation and composition of it was determined using GC-MS system and show the presence of 6 different compounds. The most abundant are Phytol and Diethyl Phthalate. The powdered plant was subjected to extraction in Methanol, then Chloroform from cold percolation method. Chloroform extract showed 15 different compounds. 4,6-dimethyldodecane, Retinol acetate and Hexa-decanoic acid were found in abundance. Methanol and Chloroform extract of *C. asiatica* were tested for phytochemical screening which showed the positive results for flavonoid, alkaloids, glycoside, saponins. Chloroform extract of *C. asiatica* was tested for the antimicrobial activity against *Bacillus(+ve), Micrococcus(+ve), Enterobacter(-ve)* which showed inhibitory activity (ZOI) up to 8mm, 7mm and 7mm respectively. Chloroform extract showed the TPC and TFC of 107.27mg gallic acid equivalent /g of dry extract and 48.85mg quercetin equivalent /g of dry extract respectively. The LC_{50} of the sample was found to be 63.81 µg/mL in Brine shrimp lethality assay. DPPH scavenging activity showed IC_{50} value of 2134.52µg/ml. Similarly, FTIR analysis showed the presence of C=O, NO_2, □O□, □OH functional groups.

Keywords: *Centella asiatica*, GC-MS, Antioxidant, Antibacterial, Brine Shrimp

RELEVANCE OF IS*Aba1*-LINKED OXA CARBAPENEMASE GENES TO CARBAPENEM RESISTANCE AMONG CLINICAL ISOLATES OF *ACINETOBACTER BAUMANNII*

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Abstract

The emergence of carbapenem resistance has limited therapeutic options against multidrug resistant (MDR) *Acinetobacter baumannii*, posing serious public health implications. Mobile genetic element such as insertion sequence further worsens the situation by spreading and providing promoter for overexpression of neighboring oxacillinase gene. There are limited studies regarding carbapenem resistance molecular mechanisms linked with insertion sequences among *A. baumannii* isolates in Nepal. This study was thus conducted with key objective to assess insertion sequence IS*Aba1*-linked OXA carbapenemase genes and its relevance to carbapenem resistance level in *A. baumannii*. This hospital based descriptive study was conducted at Shahid Gangalal National Heart Center. Identification of *A. baumannii* was done on the basis of colony morphology, gram's staining, various biochemical tests and presence of $bla_{\text{OXA-51-like}}$ gene through polymerase chain reaction (PCR). Antibiotic susceptibility was tested by Kirby-Bauer disc diffusion method and minimum inhibitory concentration (MIC) of meropenem was assessed through agar dilution method. Molecular detection of the target genes was carried out by conventional PCR. Insertion element, IS*Aba1* associated with oxacillinase genes was detected using IS*Aba1*F and OXA-51R/OXA-23R primers. Out of the 340 bacteria isolated from 1,291 clinical specimens, only 40 (11.8%) were *A. baumannii*. All of the isolates were MDR and 30% of them were even extensively drug resistant (XDR). All isolates were resistant against meropenem on agar dilution method, with MIC value ranging from 16-256 µg/ml. All isolates co-harbored $bla_{\text{OXA-51-like}}$, $bla_{\text{OXA-23-like}}$ and IS*Aba1* genes. Among them, 2 (5%) isolates also harbored $bla_{\text{OXA-58}}$ gene. All isolates had IS*Aba1* either above $bla_{\text{OXA-23-like}}$ or $bla_{\text{OXA-51-like}}$ gene. Higher MIC_{90} value of meropenem (243.20 µg/ml) was found in *A. baumannii* cluster with IS*Aba1* upstream of both $bla_{\text{OXA-23-like}}$ and $bla_{\text{OXA-51-like}}$ genes, thus depicting their eminent role to enhanced carbapenem resistance.

Keywords: $bla_{\text{OXA-23-like}}$, $bla_{\text{OXA-51-like}}$, Insertion sequence, Mobile genetic elements, Multidrug resistance

ETHNO-MEDICINAL PRACTICE AMONG THARU, DARAI AND BOTE TRIBES IN KUMROJ AREA, CHITWAN, NEPAL

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Abstract

The ethnic people residing in different geographical belts of Nepal largely depends on traditional medication system for their primary healthcare. We conducted our studies in Kumroj Chitwan in Tharu, Darai and Bote tribes using informants or traditional healers interviews, Ethnobotanical Participatory Appraisal (EPA) and direct observations. A total of 205 medicinal plant species belonging to 179 genera and 71 families has been documented, among which Fabaceae with 25 species is the largest. Large number of plants species (about 40%) are herbs followed by tree and shrubs. Among these plants, 87 species used by Tharu, 70 species by Darai and 79 species by Bote and 32 species are common among all three communities. Total of 12 are common among 12 Darai and Bote, 18 among Darai and Tharu while 22 species are common among Bote and Tharu. Among the total plants used by different ethnic groups, for gastrointestinal- 35% , 36% and 28%; for urinary disorders- 26%, 23% and 30% ; for dermatological disorders- 18%, 21% and 26%; and for other types of ailments- 21%, 20% and 16% by Bote, Tharu and Darai communities respectively. The most common parts used are whole plants of herb, roots and leaves and common diseases treated are cuts and wounds. Bote people used leaf as common remedies while Tharu used roots in most of the diseases for treatment. The traditional medicinal practice is found gradually disappearing so proper documentation of medicinal plants with pharmacological value is of urgent need.

Keywords: Traditional knowledge, Ethnobotany, Plants, Ethnic communities

HEAVY METALS DETERMINATION FROM LEAVES OF TREES AT ROADSIDES PLANTS IN KATHMANDU VALLEY

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Abstract

Nepal is the urbanizing country in south Asia and Kathmandu is the fastest growing metropolitan city. Heavy metals are available to the ecology and elements are nutritional in the environment. This research was conducted to determine metals in plant species at roadside of Kathmandu in the years 2016 to 2017. The environmental study on roadside plants, soil and the impact of pollution are given in this research. In the study, the leaves of two plant species *Callistemon citrinus and Lagerstroemia indica* were taken from Myrtaceae and Lythraceae families. The study sites were heavily, moderately, less polluted and analysis from summer season is presented. The methods were field study, sample collection; extraction and digestion of leaves powder, bulk elemental analysis from samples were applied. The digested samples were analyzed on ICP-OES equipment for elements. The Beryllium, Cadmium, Cobalt, Chromium, Cupper, Iron, Manganese, Nickel, Lead, Vanadium and Zinc were determined by ICP-OES methodology. In *C. citrinus*, values of Iron, Manganese, Zinc, Beryllium, Copper were maximum and Cadmium, Cobalt minimum. In *L. indica*, values of Iron, Manganese, Zinc, and Beryllium were maximum and Cadmium, Cobalt was minimum. Cadmium, Lead is toxic in the environment. Human activity can increase elements levels as a result of urban industrial activities. This study helps to find plant species and availability of metals in urban sites of Kathmandu**.** Study plants are with flowers, leaves and very attractive in the roadsides. These findings on roadside environment, scientific results promoted the programs for civilized development. Ornamental atmospheric environment in the Kathmandu is acceptable for higher perspectives. The roadside soil, green concept along with different well management is significantly success from respective authorized and it protect from air pollution. The advantageous of program on environment, biological science, education, health, tourism are useful for development of country.

Keywords: Elements, Environment, ICP-OES, Plant, Sites

PHYTOCHEMICAL SCREENING, GC-MS ANALYSIS AND BIOLOGICAL ACTIVITIES OF EXTRACTS OF *ARTEMISIA VULGARIS* LINN.

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Abstract

The aerial parts of *Artemisia vulgaris* were subjected for successive extraction in solvents methanol, hexane and chloroform, respectively, and compounds present in extract were analysed by GC-MS analysis 12 different compounds were found in chloroform extract in which Germacrene was found most abundantly (33.84%). Chloroform extract showed strong antibacterial activity, which was examined against 6 bacteria using the disc diffusion method. The IC_{50} value of chloroform extract accounted for 1.50 mg/mL. The TPC content of the extract was found to be 87.75 mg gallic acid equivalent/g of dry extract, whereas TFC content was found to be 47.25 mg quercetin equivalent/g of dry extract and exhibited LC_{50} value of 0.18 mg/mL.

Keywords: *Artemisia vulgaris*, Phytochemical screening, GC-MS, Biological Activity

IN-VITRO ANTIOXIDANT, ANTIMICROBIAL AND ALPHA-GLUCOSIDASE INHIBITION OF *AMMANNIA BACCIFERA* L.

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Abstract

Ammannia baccifera L. belonging to the phenolic rich genus *Ammannia* (Lythraceae) has large ethnomedicinal importance, so the extracts of the aerial part of the plant in hexane, dichloromethane (DCM), ethyl acetate (EtOAc), methanol and 50% aqueous methanol were screened for their phytochemical diversity, to explore its true biopotentials. Test for the secondary metabolites showed a positive result for phenolics, flavonoids, glycosides, saponins, quinones, reducing sugar, tannins, steroids, and coumarin in methanolic and 50% aqueous methanolic extracts. The total phenolic content (TPC), total flavonoid content (TFC), and total tannin content (TTC) of the methanolic extract were higher than the 50% aqueous methanolic extract. The aqueous methanolic extract had a greater total sugar content than the methanolic extract. The methanolic extract (IC_{50}: 1.38 ± 0.227 µg mL^{-1}) scavenged DPPH free radical with more efficacy than the 50% aqueous methanol extract (IC_{50}: 19.96 ± 1.494 µg mL^{-1}) and was comparable to the positive control, Quercetin (IC_{50}: 1.20 ± 0.220 µg mL^{-1}). 100 mg/L of methanolic extract was tested against 12 different microbes by the Agar well diffusion method. The extract was found to be most effective against *S. epidermidis* (19.14 mm), while it was neutral against the diploid fungal strains, *C. albicans* and *S. cerevisiae*. The Minimum Microbicidal Concentration (MMC) of the extract was found to be between 0.78 to 1.56 mg/mL. While performing *in vitro* α-glucosidase inhibition activity, the methanolic extract (IC_{50}:0.12 ± 0.06 µg/mL) outperformed the standard, Acarbose (IC_{50}:5.65 ± 0.20 µg/mL).

Keywords: DPPH free radical, Antimicrobial, α -glucosidase, MMC

BIOLOGICAL EVALUATION OF N (4) ALKYL SUBSTITUTED 5-METHOXYISATIN THIOSEMICARBAZONES

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Abstract

Isatin derivatives have shown broad biological activities like antimicrobial, anticonvulsant, antimalarial, anticancer, antiviral, anti-HIV etc. 5-Methoxyisatin-4-ethyl-3-thiosemicarbazone (**L_1**) and 5-Methoxyisatin-4-methyl-3-thiosemicarbazone (**L_2**) were synthesized by the condensation of 5-Methoxyisatin with thiosemicarbazide and characterized by various spectroscopic techniques *viz.* IR, ^{1}H NMR, ^{13}C NMR, UV-Vis, HRMS and CHN elemental analysis. The cell viability *in vitro* of the synthesized compounds **L_1** and **L_2** was investigated at concentrations ranging from 10 to 100 µM and found to be greater than 50%. Therefore, the compounds showed modest anticancer activity against MCF-7 (breast cancer), A549 (lung cancer), and A431 (Skin Cancer) cells. The compound **L_1** was found to be the most potent proliferation inhibitor against the A549 and MCF-7 cells than **L_2** whereas compound **L_2** was found to be more potent proliferation inhibitor towards A431 cells than **L_1**. Among the four bacteria used for the antibacterial activity compound **L_2** was effective against *Acinetobacter baumannii* with 12.13 mm Zone of inhibition at 1mg/mL followed by *Escherichia coli* (11.83 mm) and *Klebsiella pneumonia* (6.83 mm) at tested concentration 1mg/mL. Similarly, **L_1** has shown moderate activity against all tested bacteria. The antibacterial efficacy of compound **L_1** against *Klebsiella pneumoniae* was inconclusive.

Keywords: Anticancer activity, Antibacterial activity, 5-Methoxyisatin, Proliferation, Thiosemicarbazones

MATERIAL SCIENCE AND NANOTECHNOLOGY

THEMATIC SPEAKER-INDIGENOUS

STRUCTURE-PROPERTIES CORRELATIONS IN BIOMASS-BASED AND COMPOSTABLE POLYMER COMPOSITES

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Abstract

Polymers have become not only an indispensable part of present-day civilization but also have created a kind of threat to the natural environment and lives of several living beings. There is thus a challenge for polymer scientists of developing new materials using renewable resources and sustainable technologies for converting wastes into useful and environmentally benign products. In this context, polymer composites utilizing natural fibres and agricultural wastes as reinforcing fillers into various polymeric materials have gained enormous research interest during the last decades. In this paper, we will shed light on structure-properties correlation of composite materials comprising thermosetting resins (such as epoxy resin), thermoplastics (such as copolyester and polyolefins) and elastomers (such as natural rubber) and some locally available natural fibres (such as lignocelluloses, chitin, chitosan) and nanofillers. The biodegradable poly(butylene adipate-co-terephthalate) (PBAT) has been found to offer particularly interesting alternatives to producing compostable composites materials. Also, the influence of fibre treatment on the properties of the composites was studied. It was shown that the morphology and mechanical properties of the composites can be tailored over a wide range although the materials were found to be suited for low load bearing applications.

Keywords: Biopolymer, Polymer composites, Compostable polymer, Electron microscopy

INVITED SPEAKER

STRENGTHENING RESEARCH CULTURE AT TU, NEPAL

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Abstract

Tribhuvan University, although one of the oldest and biggest university in Nepal, outputs very a limited scope of research works on theoretical and experimental Physics, mainly due to a lack of facilities such as quality instruments, laboratory space, stable infrastructure and the state-of the art equipment. Despite this situation, the research on nanomaterials at the University has been flourishing in the last few years. In fact, the Physics Department at Amrit Campus was successful in establishing the Atmospheric and Material Science Research Center (AMSRC) in 2020, with the objective of growing research culture and grooming young researchers at TU with the support of the International Science Program (ISP), Uppsala University (Sweden). With financial support from ISP, the newly established AMSRC group organized a number of programs to cultivate scholars. The center worked hard to energize students to foster both theoretical as well as experimental research activities. Currently, the researchers in this group are working towards an in-depth understanding of metal oxide semiconducting for gas sensing job. The research findings of systematic study of undoped and metals: Sn/Fe/Al/Cu/Mn doped ZnO for sensing traces of different gases is presented here. An effective but low-cost fabrication methods of spin, spray and dip coating were extensively utilized to prepare ZnO films. As-prepared samples were first characterized using XRD, SEM, FTIR, EDX and UV-vis spectrum techniques. Ultimately, these samples are used to detect traces of different gases. The gas sensing performance measurements depicted the significant response ratio of about 1000 for Cu doped ZnO based gas sensor towards ammonia vapor. This approach would help to fabricate a low cost, power consumable future stable metal oxide gas sensors.

Keywords: Research culture, Zinc oxide, Gas sensor, Sensing performance, Ammonia.

SELF-ASSEMBLED FULLERENE NANOMATERIALS FOR SENSING, ENERGY STORAGE AND BEYOND

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Abstract

Fabrication of shape-controlled crystalline fullerene nanomaterials has received considerable interest for the possible applications in diverse fields, including flexible optoelectronics field-effect transistors, light-emitting diodes, photodetectors, sensors, and energy storage. Here, we present a novel yet simple molecular recipe for the fabrication of self-assembled fullerene nano/microcrystals at a liquid-liquid interface under mild temperature and pressure conditions. We also discuss a recently developed technique for the expansion of fullerene nanomaterials into hierarchic macro- and mesopores architectures with crystallized frameworks, which showed excellent volatile organic compounds (VOC) sensing performance selective to the aromatic solvent vapors because of the extended pi-conjugation together with high porosity and large surface area. Furthermore, the electrochemical supercapacitance performance of the hierarchical micro/mesoporous carbon materials obtained by the high-temperature carbonization of the self-assembled fullerene crystals will be discussed.

DESIGNING NANOSTRUCTURED POLYMERS AND THEIR APPLICATIONS

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Abstract

Chemically modified styrene butadiene (SB) block copolymers (BCPs) with varied molecular architecture are used in this study. By optimizing process parameters, the butadiene segments were modified by an epoxidation reaction with meta-chloroperoxybenzoic acid (m-CPBA). The modified BSP was used as a template for the creation of nanostructured blends due to the polar and reactive nature of epoxidised butadiene chains. Different amounts of BCPs were mixed with DGEBA epoxy resin and cured with diaminodiphenylmethane (DDM), which cross-linked both the epoxy resin and the modified BCPs at the same time. All the blends found to be transparent due to nanostructured domain formation. The type and size of distributed nanodomains, as well as their interactions with the epoxy matrix, were found to have a significant impact on the toughening of nanostructured epoxy thermosets. Crack pinning, crack bifurcation, and debonding are all toughening mechanisms for epoxy/block copolymer blends. Additionally, the results clearly indicated that the thermal stability of neat cross-linked epoxy was retained upon the addition of epoxidised block copolymer (epBCP) well explained by the plasticization effect. The partial epoxidation of a commercial styrene/butadiene based triblock copolymer Kraton D1101 was achieved and, hence, a new toughening strategy the dual curing method using combined thermal and electron beam (EB) irradiation was defined by further optimisation of curing condition and deformation behaviour. It was found that newly developed dual curing method was rapid, more environment friendly and quite efficient. The new dual cured materials provide the possible applicability of the toughened thermosets for advanced industrial applications.

Keywords: Epoxy resin, Block copolymers, Architecture, Dual curing, Toughness

ORAL PRESENTATION

CHARACTERIZATION OF HFO-1224YD(Z), CF3I AND ISO-BUTANE BASED GAS MIXTURE FOR MRPC OPERATION

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Abstract

With excellent time and spatial resolution, the Multi-gap Resistive Plate Chambers (MRPCs) are cost-effective ionization based gaseous detectors used for Time of Flight (ToF) measurements in various particle and high energy physics experimentation. Current gas usage in MRPCs is primarily a mixture of two gases; SF6 and Freon (C2F4H2) which both have a Global Warming Potential (GWP) and Ozone Depletion Potential (ODP) of >>1000. As part of the recent studies to find the substitute for the Freon based gas mixture, we analyzed various theoretical gas parameters such as ionization property, electronegativity, quenching property, inflammability and toxicity for an alternative ecological gas. Our ecological gas which is composite mixture of AMOLEA HFO-1224yd(Z), CF3I and iso-butane (iC4H10) in 18:1:1 ratio has a GWP and ODP value of nearly zero and is found to yield better theoretical results without much compromising the detector performance as well as safety. Ecological nature of AMOLEA has been accounted on the paper whereas electronegativity and quenching property are well highlighted for CF3I and iso-butane respectively. Data based comparison between previous gas uses in MRPC and our proposed gas has been made too.

Keywords: Spatial resolution, Ionization, Gaseous detectors, Time of flight, Ecological gas

INVESTIGATION OF AMMONIA GAS SENSING BEHAVIOR OF ZINC OXIDE (ZnO) NANOSTRUCTURE BY LIGHT IRRADIATION

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Abstract

In this work, we have fabricated pristine ZnO and Aluminum (Al) doped ZnO films. The surface morphology of the films is changed by Al doping that leads to vary in the optical absorption of the films. Undoped and Al doped nanostructured ZnO thin films were deposited on the glass substrates with the spin coating approach employing Zinc Acetate dihydrate precursor solution with Aluminium Nitrate as dopant ranging from 1% to 5 %. The optical, structural and electrical characteristics were studied by UV-Vis spectroscopy, X-ray Diffraction (XRD) and I-V characteristics, respectively. The polycrystalline wurtzite structure of ZnO films were confirmed by XRD. The band gap of ZnO decreased from 3.26 eV to 3.13 eV. ZnO films were used for the fabrication of Ammonia gas sensors and were able to obtain the sensitivity of ZnO at room temperature. Among the different doping concentrations, 3% Al doped thin film showed the best result. UV light irradiation was also employed to illustrate the consequence of UV light and found that sensitivity increased by 8 % than without UV light.

Keywords: Ammonia, Doping, Irradiation, Nanostructure, Sensitivity, Zinc Oxide

SCREENING OF CORROSION INHIBITION EFFICIENCY OF PLANT EXTRACT ON MILD STEEL

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Abstract

Corrosion of metals and its alloys employed in service is an inevitable but a controllable process. One of the practical methods for controlling the impact of corrosion of metals and alloys especially in aqueous environments is by using corrosion inhibitors which are composed mainly of organic or inorganic substances. The use of corrosion inhibitors has proven to be the easiest and cheapest method for corrosion protection and prevention in acidic media. These inhibitors slow down the corrosion rate and thus prevent monetary losses due to metallic corrosion on industrial vessels, equipment, or surfaces. Inorganic and organic inhibitors are toxic and costly and thus recent focus has been turned in developing environmentally benign methods for corrosion retardation. In this study, the corrosion inhibition nature of *Mahonia nepalensis*, belonging to the family of Berberidaceae, bark extract has been analyzed on mild steel in 1M H_2SO_4 with the help of weight loss studies, potentiodynamic polarization, and electrochemical impedance spectroscopy techniques. The inhibition efficiency increased as the concentration of the extract increases. Potentiodynamic polarization results indicated that *Mahonia nepalensis* act as a mixed-type inhibitor. The maximum corrosion inhibition efficiency in organic extract was 99.79% and in aqueous extract was 90.92%. The various fraction of extract was characterized by using UV, FTIR, GCMS and SEM.

Keywords: *Mahonia nepalensis* green corrosion inhibitor, Mild steel, Electrochemical impedance spectroscopy, Polarization measurements.

HYDROTHERMAL SYNTHESIS OF COPPER OXIDE/ACTIVATED CARBON COMPOSITE FOR DYE REMOVAL FROM WATER

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Abstract

This study aimed to develop Copper oxide/ commercial activated carbon composite for dye removal from aqueous solutions. Commercial activated carbon composite was prepared by a one-step hydrothermal treatment of aqueous solution containing commercial activated carbon, Copper(II) nitrate trihydrate, ammonia, sodium hydroxide, and ethanol. Batch adsorption were conducted to study the adsorption behavior of methylene blue dye onto the CuO/CAC composite adsorbent. The percentage of methylene blue dye removal by the composite adsorbent was much higher as compared to the plain CAC. The highest percentage of methylene blue dye removal was found at pH8, adsorbent dose of 25 mg/L and contact time of 3h. The applicability of the Langmuir and Freundlich models for the methylene blue dye adsorption data was tested. Langmuir model describes the experimental data. The maximum adsorption capacity of the composite adsorbent for methylene blue dye removal was 384.6 mg/g. The results of this study show that, as synthesized composite can be potentially applied for the treatment of water contaminated by dye.

Keywords: Activated carbon, Hydrothermal, Adsorption, Dye removal, Water.

EFFECT OF HEAT TREATMENT ON NEPALESE JAGGERY

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Abstract

Jaggery is a non-centrifugal sugar obtained by concentration of sugarcane juice. Heating jaggery above its melting point forms an amorphous food product, the caramel. Sugars and caramel have been investigated to understand their thermal, spectroscopic and morphological properties using differential scanning calorimetry, ultraviolet-visible spectroscopy, infrared spectroscopy and optical microscopy. Experiments are supplemented with quantum mechanical simulations to understand the underlying mechanisms. Pure sugars are found to have heating rate-dependent melting and decomposition temperatures. In addition to phase transitions of constituent sugar crystals, jaggery shows glass transition at 64 °C. Cold crystallization phenomenon is observed in jaggery when annealed at 100 °C. Cold crystallization exotherm (at 39.7 °C) and formation of crystal from melt-quenched sugar are reported for the first time. Caramel exhibited amorphous morphology when prepared and showed the peak of 5-hydroxymethylfurfural (5-HMF) $\pi \rightarrow \pi^*$ transition at 284 nm, where absorbance increases with preparation temperature and time.

Keywords: Jaggery, Non Centrifugal Sugar, Differential Scanning Calorimetry, Caramel, Cold Crystallization

SYNTHESIS OF FLAVONOL GLYCOSIDES

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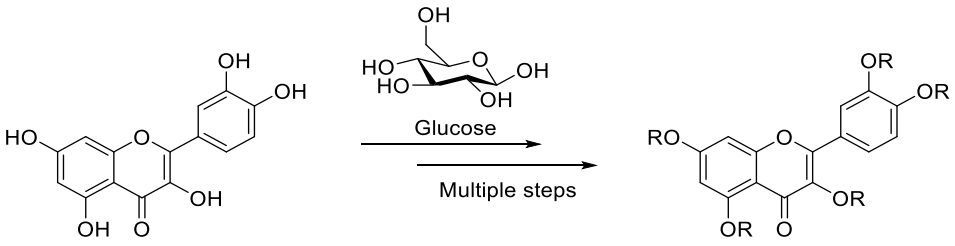
Abstract

Flavonoids are a group of natural secondary metabolites with variable phenolic structures. They are of wide interest to human health. Flavonoids are classified into various classes such as chalcones, flavones, flavonols, etc. Even though flavonoids have proven to have great impacts on human health, their use as pharmaceutical agents has been hindered by their low water solubility. This problem can be overcome by modifying them with adherence of sugar moiety i.e. through glycosylation. Glycosidic form is particularly highly water soluble that could enhance the bioavailability as compared to its aglycone form. However, flavonoid glycosides are available in a very small quantity naturally; therefore, their chemical synthesis is most important. This study was aimed to synthesize glycosylated flavonols. Commercially available quercetin was used as a starting material. It was either selectively protected by acetylation and/or followed by chemoselective de-protection to afford quercetin tetraacetates. Thus obtained tetraacetates were glycosylated in free –OH group position by using acetobromoglucose as glycosyl donor. The synthesized compounds were characterized by different spectroscopic tools. Designed synthetic pathway and the result outcome will be discussed in the presentation.



Quercetin

R = H, OAc and/or glucose
Quercetin glycoside

Keywords*:* Aglycone, Flavonoids, Flavonol, Glycosides, Glycosylation, Phenolic.

TOPOLOGICAL INSULATING PROPERTIES OF $MO_2TIC_2O_2$

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Abstract

$Mo_2TiC_2O_2$ is the Ordered Double Transitional Metal Layered Carbides (ODTMLC) derived from its parent MAX phases $Mo_2TiAlC_2O_2$ by a wet chemical etching followed by a new ablated plasma thrust method. In this method, they are oxidized at 750^{o}C under an oxygen background in the Pulsed Laser Deposition (PLD) chamber under the *Snow-plough effect*. The oxidation is assured by the Reflective High Electron Energy Diffraction (RHEED) technique at the ambient gas pressure p=0.1 mbar. The obtained M'$_2$M"$_x$X$_y$ene oxides were transferred for their topological test under Angle-resolved photoemission spectroscopy, circular dichroism test, and chemical potential analysis. An indirect energy band gap of 125meV was obtained. The sine function of α along with period π and β with period 2π shows that there is a possibility of helical spin textures in both α (electron like pocket around Γ) and β (elliptical electron like pocket around M). The chemical potential analysis shows the possibility of at least 100meV band gap creation on a single surface so that the surface charges will flow without any effect of bulk. The $Mo_2TiAlC_2O_2$ can be used as topological insulating material.

Keywords: Ordered Double Transition Metal Layered Carbide, Pulsed Laser Deposition, Reflective High Electron Energy Diffraction, Circular Dichroism, Chemical Potential Analysis, Topological insulator.

STUDY OF TOPOLOGICAL PHASE TRANSITION IN $PT_2HG_{1-X}TL_XSE_3$ FROM FIRST-PRINCIPLES

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Abstract

Jacutingaite (Pt_2HgSe_3) is a layered material with Dirac like feature in it's bulk. From our density functional theory calculations, we confirm it to be a Dirac material. Considering the replacement of Hg by Tl atom partially in $Pt_2Hg_{1-x}Tl_xSe_3$ we noted the topological phase transition from Dirac-like to insulating on the basis of density-functional theory calculations using full-potential local orbital minimal basis method (FPLO). Unlike jacutingaite, the end material Pt_2TlSe_3 is found to be have a large band gap. The main contributions to the total density of states around the Fermi level are mainly from the 5d orbitals of Pt, and 6p orbitals of Tl. Furthermore, the topological Z_2 invariant calculations suggest it to be a possible candidate of topological insulator. Further work is in progress to confirm the topological states from slab calculations.

Key words: Jacutingaite, Dirac, Density-functioina theory, Band gap, Topological insulator

ELECTRONIC, MAGNETIC AND TOPOLOGICAL PROPERTIES OF $Bi_{1-x}Mn_xTeI$ FOR SPINTRONICS DEVICE

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Abstract

The narrow band gap materials with strong spin-orbit coupling (SOC) are found popular for energy efficient devices. Among them, BiTeI is one such layered material that shows Rashba spin splitting which is responsible for transport phenomenon. On the basis of density functional theory (DFT) calculations using FPLO (full-potential local orbital) code, we studied the electronic, magnetic and topological properties of this material. Our study shows an energy band gap of 0.46 eV within full-relativistic mode. Presence of Bi due to stronger SOC opens the bulk band gap suggesting the topological features. The main contribution around the Fermi level are from the Bi-6p, I-5p and Te-5p states. Upon chemical doping with magnetic atom Mn to the Bi-site in BiTeI, the material transforms to half-metallic ferromagnetic state with spin-up channel being metallic and spin-down insulating (band gap of 1.26 eV). The effective moment is found to be 4 μB per unit cell. Wannier fitting is performed to extract the exact Hamiltonian for the topological characters, which will be reported soon. Due to narrow band gap and strong SOC, these compounds seems promising as a magnetic topological insulator. Our finding is expected to motivate experimentalist in synthesizing this material for spintronics device applications.

Key words: Spintronics, Spin-orbit coupling, Rashba spin splitting, Density functional theory, Berry curvature

MICROMECHANICAL, THERMAL, AND BIODEGRADATION OF POLYVINYL ALCOHOL ECO-COMPOSITES WITH NATURAL FIBERS AND CHITOSAN

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Abstract

In the present study, polyvinyl alcohol, nanocellulose fibers (NCSF), and chitosan (CS) having different compositions were constructed to achieve better reinforced composite films. Nanocellulose fiber was extracted from *Bauhinia vahlii* (Maloo) by delignification followed via acid hydrolysis by solvent casting method. The bio-nanocomposites films were prepared by the reinforcement of nanocellulose fiber (NCSF) and chitosan (CS) into polyvinyl alcohol (PVA) matrix at different filler loading levels (2, 4, 8, and 10 wt %). The nanocellulose fiber, chitosan, PVA, and nanocomposites films were characterized by XRD, FTIR, microscopic analysis, thermal analysis, as well as tensile strength test. Morphological studies showed that nanofillers were homogeneously dispersed in the matrix and the crystallinity increased with an increase in the nanosized filler content. The tensile test showed that elongation at break decreased with the addition of fibers (from 260.33 to 181.96 %) and chitosan (to 127.58 %) but tensile strength increased (from 15.72 to 21.44 MPa for NCSF) and (to 19.99 MPa for CS) as compared with pure PVA. The thermal stability increases in filler loaded composites as compared to pure PVA. The antimicrobial properties were studied against seven different microorganisms (*Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Acinetobacter, Klebsiella pneumonia, Bacillus subtilis*, and *Candida albicans*). Results showed a high antimicrobial property of PVA composites as compared to cellulose fiber and chitosan and hence having great potential as a biomaterial for biomedical applications.

Keyboards: Nanocellulose fiber, Polyvinyl alcohol, Composites, Decomposition, Antimicrobial properties

"SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL STUDY OF *YASHAD BHASMA*"

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Abstract

Ayurveda discussed *bhasma* of different heavy metal like calcium, iron, copper, gold, silver and zinc etc. *Yashad Bhasma* is a herbo-organometallic product of Zn metal which is used for treatment of different chronic ailments related to zinc deficiency diseases. This study revealed the synthesis of *Yashad Bhasma* accordingly of *ayurvedic* text book '*Rasa Tarangini'* as well as by modern technique. The various steps of synthesis include purification (Sodhana), heating and roasting (Jarana), levigation (Bhavana) and incineration (Marana). To standardize the quality of synthesized *Yashad Bhasma*, it was characterized by ancient techniques like organoleptic character, physicochemical analysis and classical tests as well as by modern analytical techniques viz. FTIR, XRD. Microbial analysis of *Yashad Bhasma* shows effective against all the bacterial strain studied including major food borne pathogens like *Escherichia coli, and Staphylococcus aureus.*

Keywords: Antibacterial activity, Bhasma, Nanoparticles, Yashad, Zinc-oxide

FLEXIBLE COPOLYESTER/MULTIWALLED CARBON NANOTUBES NANOCOMPOSITES BASED STRAIN SENSOR

Kedar Nath Dhakal[1, 2, 3,4], Ralf Lach[5], Wolfgang Grellmann[5], Michael Thomas Müller[4], Beate Krause[4], Jürgen Pionteck[4] and Rameshwar Adhikari[1,2, 3*]

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Abstract

Electrically conductive poly (butylene adipate-*co*-terephthalate) (PBAT)/multiwalled carbon nanotube (MWCNT) nanocomposites were prepared by melt-mixing followed by compression moulding. Piezoresistivity and strain sensing behaviour of the nanocomposites were investigated taking the relative resistance change ($\Delta R/R_0$) and its reproducibility with mechanical strain into account. Exponential-like increase of $\Delta R/R_0$ of the nanocomposites with mechanical strain during tensile stretching confirmed their piezoresistivity. Similarly, $\Delta R/R_0$ values, fitted well with 2 to 8% strain confirmed their low strain sensing potential. However, in both stretched and the relaxed states, lower $\Delta R/R_0$ values were achieved up to 1% strain, attributed to a strong relaxation of the mechanical stress and that of the resistance. Electron beam (EB) irradiation induced crosslinking of the nanocomposites was employed as a strategy to enhance the reproducibility of $\Delta R/R_0$ values targeting the controlled viscoelastic flow of polymer chains. Polymer branching and 51 and 72% of crosslinking of nanocomposites were achieved by the irradiation doses of 150, 200 and 300 kGy, respectively. The tensile (except elongation at break) and piezoresistive behaviour of the crosslinked samples were similar to that of non-

irradiated samples. Meanwhile, resistance maxima of branched and 51% crosslinked nanocomposites fitted well up to 10% strain. At 72% crosslinking, the $\Delta R/R_0$ values of the nanocomposites varied with strain in an irregular way, attributed to a strong 3D crosslinked PBAT network, not allowing the homogeneous deformation of the conductive MWCNT-network. However, resulting relaxation phenomena could not be controlled by the irradiation. Hence, moderately crosslinking the conductive nanocomposites can be a strategy to improve their strain sensing behaviour regardless the relaxation effect.

Keywords: Conductive nanocomposites, Piezoresistivity, Crosslinking, Strain sensing

ANTICORROSIVE RESPONSE OF MERCANTILE WATER-REPELLENT AND PLANT-BASED EXTRACT ON REINFORCED MILD STEEL IN CONCRETE SLAB

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Abstract

The reinforced concrete infrastructures (RCIs) are porous materials prone to corrosion damages, which are controlled by various factors like the composition of concrete, additives, and water-repellents (WRep). Different brands of commercial WRep are available in the market of Kathmandu Valley, and each has slightly different physical and chemical properties. The available WRep products have the same action of blocking the ingress of the moisture and pollutant gases to the RCIs through the concrete pores, although basic properties of each WRep product are found to be slightly different. Mixing of these commercially available WRep alone in concrete matrixes did not potentially affect the anti-corrosive response to the steel in the RCIs. Taking into such consequences, the present work explored the advantageous uses of two types of WRep, collected from the local market, and also two green-based plant extract for controlling the steel corrosion level in RCIs. The broader question of this investigation is to know whether the WRep affects the anti-corrosive response to the steel in concrete at the same patterns as usual applied the water-proofers in the concrete matrix or differently when the cast RCIs exposed in the WRep suspension for certain curing time. The concrete slab containing 1000 ppm WRep-A+ *Mangifera indica* extract exhibited a maximum corrosion inhibition, which was justified by open circuit corrosion potential (OCCP) shifting towards a more positive potential zone where the reinforced steel corrosion damage could be expected < 10%, and anticipated more effective corrosion inhibiting activities compared to other concentration of plant extract and water-proof extract used to study this work. On the other hand, the concrete slabs with 2000 ppm WRep-A, 2000 ppm WRep-B, and 1000 ppm WRep-A + *Psidium guajava* extracts also exhibited high corrosion inhibition compared with 1000 ppm WRep-A, 1000 ppm WRep-B, a company recommended WRep-B.

Keywords: Water-repellents, Anti-corrosive, Inhibition, Mangifera indica, Psidium guajava

RECOVERY OF LEAD FROM LEAD ACID BATTERY AFTER ITS END USE

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Abstract

Nowadays, in the world, recycling spent lead acid batteries has always been a research topic all over the world. Although traditional pyrometallurgical smelting is still the dominant process, it has serious environmental drawbacks. Thus a new method of direct recovery of highly pure lead grids of spent lead acid batteries via catalytic conversion, desulfurization and recrystallization process in sequence. On the basis of the analytical results of lead (Pb) and lead dioxide (PbO_2) contents in the scrap lead paste, a certain amount of waste lead grid will be used as a reductant to transform the excess PbO_2 into lead sulfate. This method will study the influence of the concentration of sulfuric acid (H_2SO_4) and catalyst and the reaction temperature on the catalytic process. The desulfurization of the extracted $PbSO_4$ and the recrystallization of PbO in sodium hydroxide solutions of different concentrations will also be investigated. Furthermore, in this work the acid and its recycling process will be discussed and calculated.

Keywords: Lead acid battery, Lead paste, Catalytic conversion, Hydrometallurgy

EFFECT OF POLAR AND NON-POLAR EXTRACT OF *ARTEMISIA VULGARIS* AS A GREEN CORROSION INHIBITOR ON MILD STEEL IN ACIDIC MEDIUM

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Abstract

Artemisia vulgaris has been studied as a green corrosion inhibitor for mild steel (MS) in 1.0 M H_2SO_4 by electrochemical and weight loss methods. Hexane and methanol extracts of the plant were prepared separately and used as an inhibitor on mild steel. After 0.5 h immersion, IE of hexane extract was found to be less (73.10%) than that of methanol extract (91.99%), whereas IE is nearly the same (96.73% in hexane extract and 96.73% in methanol extract) after 24 h immersion. It reflects the slower adsorption of hexane extract on the MS surface. The EIS showed an increase in charge transfer resistance with an increase in inhibitor concentration. Results indicate that IE increases with an increase in inhibitor concentration. IE increases up to 35ºC and decreases afterwards. High inhibition efficiency was reported at 6 h immersion and decreased afterwards with an increase in immersion time. The ATR-FTIR of the extract was carried out to ensure the presence of different functionalities in it. Adsorption of extracted molecules on the metal surface obeys the Langmuir adsorption isotherm. The computed value of G* implies that the adsorption is of mixed type. The calculated value of enthalpy and entropy supports that the process is endothermic and spontaneous. The formation of a protective film of inhibitor molecules on the MS surface was ensured using an energy-dispersive X-ray and a scanning electron microscope..

Keywords: Potentiodynamic polarization, Weight loss method, Electrochemical impedance spectroscopy, Adsorption isotherm, Phytochemicals

SYNTHESIS AND CHARACTERIZATION OF FERRIC MANGANESE BINARY OXIDE FOR DIMETHYLARSINIC ACID (DMA) REMOVAL

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Abstract

The methylated arsenic like Dimethylarsinic acid (DMA) applied as herbicides and pesticides as well as their natural presence in the environment by biomethylation of microbes can be found. While a predominant form of inorganic arsenic present in the environment is highly fascinated for removal because of its high toxicity research has shown. DMA to be a major metabolite present in the human body stimulating carcinogenic character. Hence, the removal of methylated arsenic like DMA should be considered. In this study, ferric manganese binary oxide (FMBO), ferric oxyhydroxide (FeOOH), and manganese dioxide (MnO_2) adsorbents were synthesized using the co-precipitation method. Adsorbents were characterized and batch experiments were performed for understanding the adsorption behaviour over DMA removal. The regeneration capacity of each adsorbent was performed for five consecutive cycles. Further, the adsorption mechanism was analysed by the Fourier transform infrared spectroscopy (FTIR). The results showed the synthesized adsorbents to be amorphous in nature. The scanning electron microscopy (SEM) image showed many aggregated particles with porous structures. The surface area (S_{BET}) of FMBO, FeOOH, and MnO_2 were found to be 210.46, 121.08, and 70.46 m^2/g respectively. The lower pH has a major influence on DMA removal. Adsorption data were demonstrated by applying adsorption kinetic models (pseudo-first-order and pseudo-second order) and isotherm models (Langmuir and Freundlich). Pseudo second order kinetic model and Langmuir model were better fitted simulating the adsorption process to be chemisorption with a homogeneous layer of DMA. The peak at 830 cm^{-1} and 880 cm^{-1} were attributed to the vibration of the As-O band in DMA showing adsorption onto adsorbent surface. FMBO showed higher removal capacity in comparison to FeOOH and MnO_2 implying FMBO is a promising adsorbent for DMA removal.

Keywords: Methylated arsenic, Dimethylarsinic acid, Adsorbents, Adsorption behaviour

EXTRACTION AND CHARACTERIZATION OF DYE FROM MARIGOLD FLOWER FOR FABRIC DYEING USING NATURAL MORDANTS

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Abstract

Nowadays, the scope of natural dyes has been widening due to their eco-friendly, renewable, and non-hazardous properties. The objective of this research is to extract and characterize dye from Marigold (*Tagetes erecta*) flower to use for fabrics dyeing in presence of natural mordants. The extracted dyes were characterized by ultraviolet-visible (UV-Vis) spectroscopy, scanning electron microscopy (SEM), optical microscopy (OM) and Fourier transform infrared (FTIR) spectroscopy. Phytochemical screening of extract showed the presence of various bioactive compounds. UV analysis of natural dyes showed the presence of flavonoids groups in both extracts (absorption peaks at two positions which are due to the band I and band II of flavonoid rings). FTIR results of natural dyes also showed the presence of flavonoids with phenolic groups as major constituents. The microscopic analysis showed different molecular morphology of extract in water and in ethanol. Natural dyes contained flavonoids and ether group which gives a variety of colors shades in different mordants. Natural mordants such as chuk (concentrated lemon juice), fitkiri, chun and metallic mordants (ferrous sulfate) were used for cotton fabrics dyeing. The extract was also found effective towards gram-positive bacteria as compared to gram-negative. The yellow-colored dye extracted from the flowers of *Tagetes erecta* for fabric dyeing was found effective in presence of natural mordants as compared to metallic salts as commercial mordants.

Keywords: Natural dyes, *Tagetes erecta*, Natural mordants, Dyeing

INFLUENCE OF Cu^{++} COORDINATION WITH N(4)1-(2-PYRIDYL)PIPERAZINYL ISATIN/5-HALOISATIN THIOSEMICARBAZONES ON ANTICANCER POTENCY

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Abstract

A series of novel heteroatomic compounds N(4) 1-(2-pyridyl) piperazinyl isatin/5-haloisatin thiosemicarbazones (**1-4**) and their copper(II) complexes (**5-8**) have been synthesized and characterized by elemental analysis, TGA and spectroscopic techniques; FTIR, NMR, UV-Vis, ESI-HRMS, PXRD and EPR. The PXRD and EPR studies revealed the mononuclearity and distorted square planar geometry of Cu(II) ion in the synthesized complexes coordinated through terdentate thiosemicarbazone anion and a chloride ion. The *in vitro* anti-proliferative study established the anticancer potency of these compounds against the MCF-7 (breast cancer), A431 (skin cancer) and PNT2 (normal prostrate cell). All the synthesized compounds performed anticancer potency with the significant cell growth inhibition; 32-52% and 18-96% toward the MCF-7 and A431 cells respectively. Further, the anticancer potency of thiosemicarbazones enhanced on coordination to copper(II) ion. The toxicity of thiosemicarbazones toward PNT2 was found decreased on coordination to Cu^{2+} ion. The compound **5** and **8** revealed the magnificent antiproliferative activity toward the A431 (cell growth inhibition 96%) and MCF-7 (cell growth inhibition 52%) cells respectively. The copper(II) complexes could be a potent non-platinum anticancer drugs after their study for mechanism of action on cancer cells.

Keywords: Anticancer potency, Copper(II) complex, Crystal structure, Distorted square planar geometry, Isatin thiosemicarbazones

EFFECT OF SURFACE ROUGHNESS ON THE CATHODIC POLARIZATION CURVES OF ZINC IN CHLORIDE SOLUTION

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Abstract

This study was aimed at clarifying the effect of surface roughness of zinc on the limiting current of oxygen reduction in NaCl solution. Surface of zinc electrode was abraded with SiC paper with grit size #120, #600 and # 1000 and cathodic polarization was carried out in 0.05M NaCl. It was found that the limiting current depended on the grit size of the SiC paper. The limiting current became lower by polishing the zinc surface with increasing grit size of the SiC paper. The decrease of limiting current was attributed to decrease in the surface area of the surface.

Keywords: Galvanized steel, Roughness, Atmospheric corrosion, Oxygen reduction, Limiting current

SYNTHESIS AND CHARACTERIZATION OF TITANIUM DIOXIDE NANOPARTICLES BY GREEN AND CHEMICAL SYNTHESIS METHOD AND THEIR MULTI-BRANCHED PROPERTIES

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Abstract

Titanium dioxide nanoparticles (TiO_2) is a natural abundant metal oxide usually occurs in three forms; Anatase, Brooklite and Rutile. Using green as well as chemical synthesis routine, TiO_2 nanoparticles was successfully synthesized. In green synthesis, Titanium tetra-chloride ($TiCl_4$) was used as a precursor and beetroot extract was used as a reducing and stabilizing agent because it contains flavonoid, antioxidants and phenolic acids. Precipitation method was employed in chemical synthesis.The crystallinity and purity of TiO_2 nanoparticles were investigated using X-ray diffraction (XRD). The specific functional groups responsible for the reduction of TiO_2 nanoparticles were analyzed using Fourier Transform Infrared spectroscopy (FTIR). The obtained results show that the property of TiO_2 nanoparticles was similar in both processes. The antibacterial activities of prepared TiO_2 nanoparticles were observed using gram-negative and gram-positive strains. The obtained results revealed that the green synthesized TiO_2 nanoparticles can act as a better photo-catalytic materials than the chemically synthesized. The biological activities of green synthesized TiO_2 nanoparticles are intensified compared to the chemically synthesized TiO_2 nanoparticles.

Keywords: Antibacterial activity, Beetroot, FTIR, TiO_2 nanoparticles, XRD

SHINING A SPOTLIGHT AT ART AND SPIRITUALITY IN SCIENCE

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Abstract

In this world, it is believed that the subject science is something extraordinary and incredible that only few people such as scientists, researchers have knowledge about. But people are unaware about art and spirituality that has ancient relation with science which are being prevalent in their daily life. Art is a beautiful practice that can express more than what is shown and heard. Spirituality is a practice that makes a human or any living being conscious of its own reality and makes the overall life more prosperous and meaningful. Art and spirituality have shown their contributions in science since ancient time. Many ancient people and their tribe were more developed and successful in the field of science than we are today as, they mainly focused on art and spirituality. They were way more clever, wise and intellectual than today's scientists and researchers. Due to influence of western culture and modernization art and spiritualty have been losing its value. Many ancient text books, scriptures are being lost due to lack of preservation that had stored many facts and knowledge regarding civilization in science through spirituality. In order to increase awareness among people, they should be given deep knowledge about art and spirituality. From school level, children should be taught about the ways of civilization from ancient books. By doing so, people could use science in their life with profound knowledge in art and spirituality. Every human will increase their intellectual capacity to think beyond what's seen or heard and society of such people will be great to live in. Art and spirituality are life to science.

Key words: Art, Spirituality, Intellectual, Modernization, Civilization, Profound.

DEVELOPMENT OF NATURAL ANION EXCHANGER FROM POMELO (*CITRUS MAXIMA*) PEEL FOR THE REMOVAL OF AS (V) ANION FROM WATER

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Abstract

Arsenic is consider as a toxic metalloid and is found in different water sources around the world.The use of bioadsorbent for the removal of heavy metal ions can be an alternative method to conventional water treatment methods. The study focuses on the adsorption of As(V) from an aqueous solution by pomelo (*Citrus maxima*) peel based adsorbents. This study was carried out for the development of a new, cheap, effective, green, and promising adsorbent using pomelo peel waste. The adsorption of As(V) on Fe (III) loaded Saponified pomelo peel (SPP) and Fe(III) loaded Crosslinked pomelo peel (CPP) was investigated. Fourier Transform Infrared Spectroscopy (FTIR), Energy Dispersive X-ray (EDX), Scanning Electron Microscopy(SEM) and X-Ray diffraction(XRD) analysis were used to perform instrumental characterizations of the adsorbents. The result showed that the pHpzc of adsorbents was determined to be 7.The amount of exchangeable protons existed in H^+ type pomelo peel was found be 2.68 mol H^+/kg. The amount of various functional groups such as carboxylic, lactonic, and phenolic, groups were evaluated to be 2.5, 1.75, and 2.75 mol/kg of adsorbent respectively through Boehm's titration. The optimum pH for Fe(III)-SPP and Fe(III)-CPP was found to be 2 and 3 respectively.Contact time of 5 hours was determined as the optimum time for both the adsorbents. The maximum adsorption capacity of As(V) onto Fe(III)-SPP and Fe(III)-CPP were found to be 70.1 mg/g and 64 mg/g respectively. The Langmuir adsorption isotherm and pseudo second order kinetic model gave a better explanation of the adsorption process. Fe(III)-SPP was successful in decreasing the concentration of As(V) to 0.008 mg/L which is less than the drinking water standard set by WHO. Thus, the study highlights that the adsorptive removal of As(V) from the water was found to be effective with both adsorbents.

Keywords: Arsenic, Anion, Bioadsorbent, *Citrus maxima*, Adsorption

ELECTROPOLYMERIZATION OF PYRROLE ONTO MILD STEEL SURFACE USING POTASSIUM HYDROGEN PHTHALATE AS AN ELECTROLYTE

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Abstract

Conducting polymers have been shown to be promising candidate as material coating for the protection against corrosion. Polypyrrole (PPy) is one of the well-researched polymers for corrosion protection coating which can be obtained by electro-polymerization of pyrrole on the mild steel. However, the stability of polymer coating on active metal surface depends on the electrolyte that is used for the electro-deposition and therefore it selection is very important. Electro-polymerization parameters such as solvent, electrodeposition rate or current, pH, temperature and concentration of pyrrole are found to affect the structure and properties of Polypyrrole. In this study, a highly adherent polypyrrole coating is successfully electrodeposited onto mild steel surface using Potassium Hydrogen Phthalate as an electrolyte. The formed polypyrrole is characterized using different characterization techniques. The anticorrosion behavior of the polypyrrole is also studied.

Keywords: Polypyrrole (PPy), Potassium Hydrogen Pthalate, Mild steel.

SYNTHESIS OF NEW CHALCONE O-GLUCOSIDES THROUGH GLUCOSYLATION

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Abstract

Chalcones, bearing the 1,3-diaryl-2-propen-1-one system, are an important class of natural secondary metabolites exhibiting a broad spectrum of biological activities such as anti-inflammatory, anticancer, antioxidant, antiparasitic, antibacterial, etc. Chalcones can be found in a variety of fruits (e.g. citrus, apples), vegetables (e.g. tomatoes, shallots, bean sprouts, potatoes), spices (e.g. licorice), etc. Despite of their positive effects on human health, application of chalcones as medicinal agents has been hampered by their limited water solubility. On the other hand, O-glycosides have been found considerable interest among researchers as carbohydrate derivatives exhibit interesting activities in metabolic processes. Attaching of the glycosidic moiety into the aglycones increases hydrophilicity and therefore can improve the bioavailability and drug interaction in the target cell membranes. Because of minimal quantity occurrence and availability of natural drug agents, laboratory production of such drug candidates is often essential. Herein, we present the glucosylation reactions of hydroxychalcones. Hydroxyacetophenone and benzaldehyde derivatives are cross-coupled via Claisen-Schmidt condensation to obtain the corresponding substituted chalcones. The free hydroxyl groups were then glucosylated using α-acetobromoglucose to obtain new chalcone O-glucosides. Two different strategies were employed: (a) phase transfer reaction conditions in the presence of a base K_2CO_3 and a mixture of solvents of water, DMF and $CHCl_3$; and (b) condensation in anhydrous conditions using a base KOH and dry acetone, under nitrogen atmosphere.

Keywords: Aglycone, Chalcone, Glycosides, Glycosylation.

SELECTIVE RECOVERY OF PRECIOUS METAL IONS FROM E-WASTE LEACHATE USING POLYMER ION EXCHANGE ADSORBENTS

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Abstract

In this study, printed circuit boards (PCBs) from different e-wastes were collected. Collected PCBs were then leached using non-toxic and environmental friendly leaching process. For the selective adsorption of leached ions, cross-linked polystyrene polymeric particles were synthesized by polymerization and the resulting particles were subsequently modified for the selective sorption of precious metals. Successful leaching of metal ions from PCBs were confirmed by using XRD and AAS spectroscopy. The adsorption efficiency of the polymer particles towards metal ions was studied at various different parameters. The experimental results will be presented in details.

Keywords: Waste PCB, Leaching, Polymerization, Absorption

STARCH BASED BLENDS: PREPARATION, MORPHOLOGY AND DEGRADATION BEHAVIOUR

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Abstract

Starch and its blends/composites have attracted significant attention due to the rise of environmental pollutions induced by the use of synthetic petroleum-based polymer materials. As well as the investigation of new starch sources has been motivated because of: market demand; industry demand; and food supply to meet the increase of world population. In this research starch was extracted from jackfruit seed, mango seed and potato. The properties of extracted starch were evaluated by measuring their physical properties. SEM images of representative samples revealed that potato starch granules exits in smooth granule form with oval and ellipsoid shapes whereas jackfruit starch were found as granules with round and bell shapes with some irregularity. FTIR spectra of PBAT/potato starch blends exhibited the existence of relevant functional groups of both starch and PBAT. The SEM results showed that the final solution-casted PBAT/TPS blends were porous under given preparation conditions. The degradability study proved that the loading of starch to PBAT increases the degradation process.

Keywords: Amylose content, Starch/PBAT blends, FTIR, SEM

SPECTROPHOTOMETRIC AND CONDUCTOMETRIC STUDIES ON THE INTERACTION OF SURFACTANT WITH POLYELECTROLYTE IN THE PRESENCE OF DYE IN AQUEOUS MEDIUM

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Abstract

The major goal of this work is to use conductometry and UV–Vis. techniques to investigate the influence of Methyl red (MR) on the interactions between a cationic surfactant, cetyltrimethylammonium bromide (CTAB) and an anionic polyelectrolyte, sodium polystyrene sulfonate (NaPSS) in aqueous environments. Such work has not been investigated before for such a system. By observing changes in the dye's spectra and the breaking points of conductometric curves, it is obvious that MR causes the development of surfactant aggregates. Critical aggregation concentration (CAC), apparent critical micelle concentration (CMC*), ionization degree (α), binding constant, and various other important thermodynamic parameters were determined by conductivity techniques at 298.15 ± 0.2 K. The CAC and CMC* values dropped on raising the concentration of CTAB with MR in the CTAB + NaPSS + MR system, which is caused by the substantial electrostatic interactions between CTAB/NaPSS and MR. With anionic MR, aggregation and micellization become easier, as seen by hypsochromic shift and reduction in the absorption band's intensity. The CMC of CTAB in water was determined to be 0.00091 $molL^{-1}$ but the CMC* of CTAB for the CTAB + NaPSS system was determined to be 0.001438 $molL^{-1}$ and CMC* for the CTAB + NaPSS + MR system was observed to be 0.001328 molL-1 by conductivity and 0.001310 $molL^{-1}$ by UV–Vis. spectroscopy at 298.15 ± 0.2 K. As the CTAB + NaPSS + MR system is a novel investigation, it will provide useful information in understanding various industrial processes and other areas of chemical research.

Keywords: Conductivity, CTAB, Methyl red, NaPSS, UV–Vis. Spectroscopy

GREEN SYNTHESIS OF SILVER NANOPARTICLES FROM *RHODODENDRON ARBOREUM* FLOWER EXTRACT

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Abstract

Green synthesis of silver nanoparticles is gaining worldwide attention due to their non-toxicity, and eco-friendly nature. In this study, silver nanoparticles were synthesised from bio-reduction of silver nitrate ($AgNO_3$) by *Rhododendron arboreum* flower extract. The visual change of colour from light yellow to light brown, and absorption peak at 410 to 430 nm in the UV-VIS spectra indicated the formation of AgNP. The different reaction parameters (concentration of plant extract, concentration of AgNO3, pH and reaction time) were optimized. Neutral and slightly basic pH was found to be favourable for the synthesis of AgNP.The synthesised AgNPs were characterised by UV-Vis spectroscopy, X-Ray diffraction (XRD), and Fourier Transform Infrared Spectroscopy (FTIR). The possible biomolecules responsible for reducing and stabilising the nanoparticles were believed to be flavonoids, polyphenols, and terpenoids. FTIR spectroscopy showed the presence of broad band around 3318 cm^{-1} which is attributed to the stretching vibrations of hydroxy group (O-H) (possibly phenol), and a peak at 1639 cm^{-1} corresponds to the amide bond of proteins arising due to carbonyl stretch in protein. Antioxidant activity of AgNP and flower extracts was carried out using DPPH assay, and it was found that the antioxidant activity of AgNP is lower than that of the plant extracts. The finding of this study indicates that *Rhododendron arboreum* flower extract can be utilised for synthesis of stable silver nanoparticles which have a potential application in the medicinal and drinking water purification purposes.

Keywords: Green synthesis, *Rhododendron arboreum*, Antioxidant, Silver nanoparticles.

REMEDIATION OF ARSENIC-CONTAMINATED WATER USING RAW COCONUT HUSK, RICE HUSK, IRON IMPREGNATED COCONUT, AND IRON IMPREGNATED RICE HUSK

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Abstract

Arsenic contamination has been one of the global environmental issues, reported as a contaminant in surface and groundwater from many regions of the world and considered a toxic element. Coconut husk and rice husk are agro-based adsorbents that were less expensive to extract arsenic (removal) for a permissible concentration of water. Iron Impregnated Rice Husk (IRH) and Iron Impregnated Coconut Husk (ICH) as adsorbents were successfully prepared in the laboratory. Rice Husk (RH) and Coconut Husk (CH) were purchased from the local market. These bio adsorbents were characterized by X-ray diffraction patterns (XRD), Zeta potential (ζ-potential), Particle Size, Fourier Transform Infrared Ray, and regeneration. The adsorption of +III (arsenite) and +V (arsenate) by these adsorbents was studied to know the adsorption efficiency and adsorption behavior. The batch experiments included adsorption kinetics, isotherm, and the effect of pH was studied. The adsorption of +III (arsenite), and +V (arsenate) was highly dependent upon pH and was high at pH 7 and adsorption decreased with the increase in pH. The maximum adsorption capacity of arsenite onto RH, CH, IRH, and ICH at pH 7.0 was found to be 1.39, 1.25, 1.07, and 0.98 μg/g and the removal percentage was also high. The maximum removal rate percentage of arsenite onto RH, CH, IRH, and ICH at pH 7.0 was found to be 46, 50, 100, and 95% respectively. The maximum adsorption capacity of arsenate onto RH, CH, IRH, and ICH at pH 7.0 was found to be 2.3, 0.4, 1.3, and 0.3 μg/g. Arsenate removal percentage was also high at pH 7.0 and the maximum removal rate percentage onto RH, CH, IRH, and ICH at pH 7.0 was found to be 60, 30, 100, and 55%. In the case of regeneration of both As (III) and As(V), CH was a more effective adsorbent and its removal percentage was higher than others. Therefore, these results concluded that all four adsorbents can be effective in the removal of arsenic in water.

Keywords: Arsenite, Arsenate, Adsorption, Adsorbents, pH, and Regeneration

SYNTHESIS OF ZINC OXIDE AND SILVER DOPED ZINC OXIDE NANOWIRE BY HYDROTHERMAL PROCESS FOR PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE

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Abstract

Zinc Oxide (ZnO) nanowire and silver doped Zinc Oxide (Ag doped ZnO) nanowires were synthesized using two step hydrothermal method comprising seed layer deposition and hydrothermal nanowire growth step. Hydrothermally grown nanowires were used to study photocatalytic effect. The synthesized nanowires were characterized by UV-Vis Spectroscopy, X- ray Diffraction Spectroscopy (XRD), Energy Dispersive Spectroscopy (EDS), Field Emission Scanning Electron Microscopy (FE-SEM) and High Resolution Transmission Electron Spectroscopy (HR-TEM). XRD pattern revealed crystalline morphology of the ZnO nanowire and the size estimated to be 0.5191 nm. The crystalline size of Ag doped nanowire was also estimated to be 0.7515 nm. EDX reveals the formation of pure Zinc oxide and Ag doped Zinc oxide nanowire synthesized by hydrothermal method. The synthesized wires were applied for the catalytic degradation of Methylene blue in UV of 65W. It was concluded that Ag doped ZnO nanowire degraded MB faster than ZnO nanowire.

Keywords: Crystalline, Seed layer, Spectroscopy, Transmission

POSTER PRESENTATION

STUDY ON SYNERGISTIC EFFECT OF PULSED MAGNETIC FIELD AND MAGNETITE NANOPARTICLES ON EXPOSURE TO *STAPHYLOCOCCUS AUREUS* BIOFILM

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Abstract

Staphylococcus aureus is a major cause of bacterial infections causing a serious health burden since it can adhere to the surface of medical devices and form biofilms. The biofilm mode of growth by infectious bacteria on an implant surface protects the organisms from the host immune system and antibiotic therapy. Despite different approaches such as antimicrobial coatings have been used to treat biofilms developed onto the surface biomaterials, there is still the emergence of antibiotic resistant biofilms due to continuous exposure to minimal concentration of antibiotics. Here, in our research we are using hyperthermia treatment using magnetic nanoparticles and pulsed magnetic field to treat *S. aureus* biofilms formed onto surface of a silicone biomaterial. We are trying to use MNPs synthesized using Co-precipitation method and characterize using UV-Vis Spectroscopy and XRD analysis. The resulting nanoparticles, after being coated with chitosan, will be subjected to bacterial biofilm along with a coil circuitry to produce a pulsating magnetic field that will induce the hyperthermia along the biofilm surface. This research work will provide an overview of the mechanisms and factors involved in bacterial adhesion on an implant, and a technique called 'magnetic hyperthermia' for the treatment of MRSA bacterial biofilm that will provide insight into future directions in the medical field.

Keywords: Biofilm, Nanoparticle, Biomaterial, Magnetic hyperthermia, Antibiotic therapy

CHARACTERIZATION OF 3D PRINTED BIODEGRADABLE NANOCOMPOSITE COMPRISING POLY (BUTYLENE ADIPATE-*CO*-TEREPHTHALATE) AND HYDROXYAPATITE BIOCERAMIC

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Abstract

The nanocrystalline hydroxyapatite (nano-HAp) bioceramics are used for preparing implants materials in medical fields. In this work, nano-HAp was prepared from biowaste, the bone of buffalo and characterized by different methods such as Fourier Transform Infrared (FTIR), X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The XRD result shows the crystallite size of HAp ranging from 9.75 to 40.89 nm on increasing the incineration temperature during processing, from 600 °C to 1100 °C. The SEM micrographs indicate the agglomeration with small rod-like crystals, which are in the dimension ranging from 1.75 to 2.72 µm. The nano-HAp prepared was mixed with a biodegradable aromatic aliphatic polymer poly (butylene adipate *co* terephathalate) (PBAT) in different proportion *via* solvent casting followed by melt mixing method and finally to 3-D printing to a button shape. The water adsorption, biodegradability and anti-microbial properties of the 3D printed specimens were investigated. It was found to have higher toughness than the pure polymer, due to interaction of carbonyl groups of PBAT with -OH groups of the nano-HAp. Similarly, the water absorption percentage of nanocomposites also increased. The specimens prepared in this work has good potential application in biomedical field, for instance in bone growth support.

Keywords*:* Nanocomposite, hydroxyapatite, 3D printing, biodegradable polymer, poly(butylene adipate co terephathalate) (PBAT)

AYURVEDIC *BHASMAS* WITH ANTI-CANCER PROPERTIES: OVERVIEW ON PREPARATION, NANOMEDICINAL ASPECTS AND APPLICATIONS

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Abstract

A *Bhasma* is an ash obtained through incineration. *Bhasmas* are the traditional herbo-mineral Ayurvedic formulations containing metals and minerals as major therapeutic ingredients. These formulations belong to the *Rasoushadi* class in Ayurveda and are prepared by *Bhasmikaran* (calcination) process. The objective of *Bhasmikaran* process is to transform the toxic metal/non-metal into non-toxic form with enriched therapeutic value as well as enhanced efficacy. During the process zero valent metal state gets converted to a higher oxidation state and the toxic nature of the metal oxide is destroyed while rendering medicinal properties in it. The end product of Bhasma preparation are residues of metals/minerals. In this work, we will introduce some well-known Ayurvedic *Bhasmas* having anti-cancer properties such as based on *Abhrak, Banga, Hirak, Manikya, Swarna, Yashada* etc. In particular, the basic process of Bhasma preparations, their nanomedicinal implications and applications will be reviewed and new perspectives on modernization of Bhasma synthesis will be explored.

Keywords: Nanomedicine, Bhasma, Anti-cancer property, Calcination

FABRICATION AND CHARACTERIZATION OF ZIRCONIA NANOPARTICLES LOADED CARBOXYMETHYL CELLULOSE (CMC) HYDROGELS

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Abstract

Carboxymethyl cellulose (CMC) is a component derived from cellulose, which is plentiful in nature and has been made to produce hydrogels, and absorbs a great amount of water or biological fluids. The present work explains the fabrication of noble Zirconia (ZrO_2) nanoparticles (NPs) loaded CMC hydrogels film. CMC hydrogel with excellent swelling behaviour could be prepared by adding citric acid (CA) to CMC solution and then drying the obtained paste at room temperature. The hydrophilic nature of CMC makes it possible to blend and cross-link with CA. In CMC hydrogels paste, modified ZrO_2 NPs solution was added which results in CMC hydrogel-ZrO_2-nanocomposites. The ZrO_2 NPs were synthesised by sol-gel method and modified using ascorbic acid (AA) and CA. The prepared samples were characterized by UV–Vis spectroscopy, X-ray diffraction (XRD), Fourier transform-infrared (FTIR) spectroscopy, and further monitored swelling behaviour. The formation of ZrO_2-NPs was confirmed by UV–Vis spectrophotometer, as an absorption peak around 270 nm was observed and the particle was nanometric in size calculated from XRD. FTIR spectra confirmed the formation of ZrO_2 NPs loaded CMC hydrogels. Furthermore, swelling behaviour of the sample was monitored. The characterisation and analysis revealed the creation of ZrO2 NPs in the hydrogels, while the water absorption capacity findings indicated the formation of Zirconium ion cross-linking inside the carboxymethyl cellulose chains.

Keywords: CMC, hydrogels, Zirconia Nanoparticles, UV-vis, XRD

SODIUMDODECYLE SULPHTE (SDS) AND CETRYALPERIDIUM CHLORIDE (CPC) INTERACTION IN DISTILLED WATER

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Abstract

Surfactants are surface active organic compound. They contain both hydrophobic part and hydrophilic part. Mixed surfactants are the surfactant with mixing more than two surfactants each other. It shows the distinctive properties, like ,higher surface activities, lower critical micelle concentration(CMC), lower critical aggregation concentration(CAC).Which are significant for the detergency applications. All experiments were be carried out with analytical reagent grade chemicals using distilled water. First cetylpyriridinium chloride (CPC) solution was prepared using double distilled water. Then sodium dodecyle sulphate (SDS) solutions were prepared using cetylpyriridinium chloride (CPC). The conductance of mixed surfactants were measured with digital conductivity meter Temperature of water bath was kept constant using contact thermometer. Contact thermometer and heater rod were connected with relly. Which controlled the temperature of water bath. Measurement of the conductivity of sodium dodecyle sulphate (SDS) and cetylpyriridinium chloride (CPC) in distilled water at three different temperatures (298K,308K,318K) were measured. The specific conductivity increased sharply with increase in concentration at a particular temperature. Increase in conductance with increase in temperature of the mixed surfactant solution followed the order 298K< 308K< 318K.Surfactants aggregate themselves in an aqueous solution, resulting in an aggregated surfactants from called a micelle. The concentration at which micelle forms is called critical micelle concentration (CMC). CMC increased with increase in temperature in the concentration range of 0.001 to 0.020 ML-1 mixed surfactant.

Keywords: sodium dodecyl sulphate (SDS), cetylpyriridinium chloride (CPC), ionization, specific conductivities, critical micelle concentration (CMC), mixed surfactants

SYNTHESIS AND CHARACTERIZATION OF OXOVANADIUM (IV) COMPLEX BASED COMPOSITE MATERIAL

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Abstract

This study includes the preparation and characterization of hydroxyapatite (HAp)-oxovanadium(IV) based complex composite materials. Hydroxyapatite (HAp), one of the most emerging biomaterials used in diverse biomedical application such as in orthopedic and dentistry, was prepared from goat bone. With the aim of combining useful properties of the HAp with that of 1, 2, 4- triazoles based oxovanadium(IV) triazole complexes possessing antimicrobial properties, the composite materials of triazole based oxovanadium(IV) complex-HAp were synthesized. Thus formed HAp-oxovanadium(IV) triazole based complex composite material were hence characterized by using X-ray powder diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, and with Scanning tunneling microscope (SEM). Also the various biological tests such as antifungal, antibacterial of composite material were carried out. The result showed that intermediates (Triazole, Schiff base) of the complex and complex itself show antibacterial activity against gram-positive *S. aureus* bacteria but the composite did not.

Keywords: Triazoles, Composite, HAp, XRD, FTIR, SEM,

STUDY OF PHYSICAL, MORPHOLOGICAL, THERMAL AND MICROMECHANICAL BEHAVIORS OF NATURAL FIBERS LOADED RESORCINOL FORMALDEHYDE RESIN COMPOSITES

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Abstract

The present study focuses to develop composite materials based on thermosetting polymers such as resorcinol formaldehyde using locally available natural fibers (allo fiber, cotton fiber, and filter paper) as fillers that help to explain the structure-property correlations with a special focus on morphology and deformation behaviors. Natural fibers of the various plant are chemically modified mainly by mercerization and bleaching. The differently modified natural fibers are in situ incorporated into the polymer matrix to prepare different composition composites such as 2%, 4%, 8%, and 10%. The resorcinol formaldehyde (RF) resins were synthesized by in situ polycondensation and the different composition composites of nanocellulose extracted from allo fibers (Girardinia *diversifolia*), by different chemical treatments followed by acid hydrolysis. The resorcinol formaldehyde composite was prepared by solution casting method. The different composition composites resorcinol formaldehyde resin with allo fiber composites were prepared and characterized by different techniques. Structure, morphology, mechanical, and thermal properties of matrix, filler, and composites were studied. The results showed that treated fibers showed significant differences in their morphology as compared to neat fibers. The composites prepared with treated allo fiber were found to be more compatible at the fiber-matrix interfaces suggested by FTIR spectra and SEM images of cryo-fractured surfaces of the composites. The fiber size was found to be 31.84 nm in diameter by XRD analysis. The indentation and compressive strength of the composite was found to be increased with filler loading in treated fiber-loaded composites as compared to aliphatic resin fiber composites. It shows that in aromatic polymers there is strong bonding as compared to aliphatic polymer composites and effects are also appeared in mechanical and water absorption behaviors.

Keywords: Composites, natural fibers, fiber reinforcement, resorcinol formaldehyde, compressive strength test.

AMORPHOUS CARBIN FROM MUSTARD OIL CAKE BY DIRECT PYROLYSIS

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Abstract

Amorphous carbon has been prepared using a muffle furnace by direct pyrolysis of mustard oil cake. The structure of the obtained pyrolysis product was analyzed by scanning electron microscopy (SEM), as well as X-ray photoelectron (XPS), Fourier transform infrared (FTIR) and Raman spectroscopies. The material was found to consist essentially of amorphous carbon with the presence of oxygen-containing functional groups. On analyzing the elemental composition by XPS, only carbon and oxygen atoms were observed. The lack of long-range order in the substance was attested by the appearance of weak and broad 2D peaks in the Raman spectra. On the microscopic scale, the carbon particles revealed a terrace-like morphology.

Keywords: Amorphous carbon, XPS, Raman spectroscopy, Mustard oil-cake

MICROEMULSION ASSISTED SYNTHESIS OF MAGNETITE NANOPARTICLES

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Abstract

Microemulsion method had been widely used to prepare nanoparticles of controlled shape and size. Magnetite nanoparticles (Fe_3O_4) of various sizes were synthesized using the w/o microemulsion method. Commonly available mustard oil and soybean oil were used as oil phases during synthesis. The effect of oil phase on the structure, optical band gap and morphology were studied. XRD spectra for each of the samples showed a well crystalline phase with no effect of oil phase in the crystal structure. UV spectra for the sample showed the surface plasmon resonance at nearly the same value with different band gap energies. The average size of the spheroid particles was calculated and was found to be 57 nm, 33 nm and 24 nm for hexane, mustard oil and soybean oil, respectively. This way the nanoparticles of variable sizes could be prepared by changing the nature of the oil phase.

Keywords: Magnetite, Oil phase, Optical Band Gap, Scanning Electron Microscopy

RECOVERY OF PRECIOUS (GOLD, SILVER) AND BASE METALS (COPPER) FROM ELECTRONIC WASTE

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Abstract

Globally, Electronic waste or E-waste is the fastest growing waste stream due to rapid growth in technology, planned obsolesces in the electronics industry, and an increased desire for new electronic products. E-waste contains many toxic substances which can have an adverse impact on human health and the environment if mishandled. But from an economic perspective E-waste also contains valuable substances like gold, silver, platinum, copper, zinc, etc. In this work, base metals (Copper) and precious metals (Gold, Silver) were recovered from a waste Printed Circuit Board (PCB) of a laptop by an eco-friendly hydrometallurgical process. Four steps carried out were digestion, leaching, precipitation, and purification of targeted metals. First, the waste PCB was ground into small pieces and powdered, and finally leached with 2M Sulphuric acid twice (1st and 2nd leaching) in presence of hydrogen peroxide (30%). Copper was recovered by the addition of iron in the leachate solution by a displacement reaction. For gold and silver recovery, 1st and 2nd leachate residue were leached (3rd leaching) with a less hazardous reagent, thiourea in presence of acid and ferric sulphate solution. The 3rd leachate solution was precipitated out with sodium borohydride as a reducing agent for recovering precious metallic powder. The elements in the recovered sample were detected through EDX characterization. Around 14g copper (98.77%) was recovered from 1st and 2nd leachate solution whereas about 13.712% silver and 3.909% gold were detected from 3rd leached precipitated sample.

Keywords: E-waste, Metal Recovery, Hydrometallurgical Process, Leaching, Precipitation

ANALYSIS OF THE INHIBITORY EFFECTS OF *DIOSCOREA ALATA* AND *ARACHIS HYPOGEA* LEAF EXTRACTS FOR CORROSION CONTROLLING OF MILD STEEL IN CONCRETE MATRIX

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Abstract

Due to the devastating effects of corrosion on reinforcing steel bars in reinforced concrete structures, it is necessary to address this problem. This research aimed to test the effectiveness of methanol extracts obtained from *Dioscorea alata* (Ghar Tarul) and *Arachis hypogea* (Badam) leaves on the corrosion inhibition of mild steel in a reinforced concrete matrix. The leaf extract was analyzed using FTIR, GC-MS, and phytochemical screening tests to determine the various compounds present in the methanol extract. The extent of corrosion inhibition by the extracts of these plants was studied by measuring the open circuit corrosion potential (OCCP) of slabs with and without plant extract solution in water. The different concentrations of 500, 1000, 2000, and 4000 ppm were used in the preparation of concrete slabs with dimensions of 8 mm steel bar, and OCCP values were measured weekly for 126 days of exposure. Both plants showed remarkable corrosion inhibition. However, it's greater for *Dioscorea alata* than for *Arachis hypogea*. This study will help to formulate a low-cost, non-toxic, eco-friendly, and renewable green corrosion inhibitor using plant wastes that can be used in concrete structures to prevent the corrosion of the mild steel rebar in reinforced concrete.

Keywords: Corrosion, Reinforced concrete, Corrosion inhibitor, Open circuit corrosion potential.

REMOVAL OF ARSENIC FROM WATER BY USING IRON-COPPER BINARY OXIDE AS ADSORBENT

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Abstract

Groundwater pollution by arsenic is one of the serious problems worldwide and is considered with high toxicity and carcinogenicity. To remove the arsenic concentration from drinking water, nanostructured iron-copper binary oxide (Fe-Cu), copper oxide (CuO), and ferric hydroxide (FeOOH) were synthesized in the laboratory via the co-precipitation method. Characterization of the prepared adsorbents was done by Zeta Potential (ζ-potential), Particle Size, X-Ray Diffractometer (XRD), and Fourier Transform Infrared Spectroscopy (FTIR). Batch experiments like Effect of pH, Adsorption Isotherm, and Adsorption kinetics were performed to evaluate adsorption of arsenite (As III) and arsenate (As V). Furthermore, the regeneration capacity of adsorbents was analyzed to understand the reusability properties of adsorbents. Results exhibited that Fe-Cu shows a higher removal capacity towards As(III) and As(V) than FeOOH and CuO. Adsorption of As(III) and As(V) onto Fe-Cu, FeOOH, and CuO was more favorable at pH 4.0, adsorption decreased with an increase in pH. To understand the adsorption kinetics, two models pseudo-first-order and pseudo-second-order models were fitted to the kinetic data. By comparing the correlation coefficient R^2, adsorption onto Fe-Cu can be best described with a pseudo-second-order model on As(III) and As(V). Similarly, the obtained experimental data were fitted by Langmuir and Freundlich isotherm models. Langmuir model was better fitted to describe the adsorption of As(III) and As(V) on Fe-Cu in comparison to the Freundlich model. The recyclability result showed that Fe-Cu could be easily regenerated and has a good potential for the long-term stabilities of the adsorbent. Hence, Fe-Cu showed good adsorption performance towards As(III) and As(V).

Keywords: Fe-Cu binary oxide, Adsorbent, Arsenite, Arsenate

EXPLORATION ON THE ANTI-CORROSIVE BEHAVIOR OF CHROMOLAENA ODORATA AND AGERATUM HOUSTONIANUM PLANT EXTRACTS TO STEEL IN CONCRETE STRUCTURE

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Abstract

As the majority of the conventional corrosion inhibitors are costly and environmentally harmful synthetic substances, the exploration of plant-based compounds as green corrosion inhibitors has been increasing in recent years. The present study was focused on investigating the corrosion inhibition activity of extracts obtained from leaves of *Chromolaena odorata* and *Ageratum houstonianum* in steel-reinforced concrete structures. A potential mapping method was performed to examine the inhibition efficiency of methanol extracts of these plants based on ASTM C876-91 standards. Four different concentrations of each plant extract were utilized to study the relationship of corrosion-resistant properties with the concentration of plant extracts.The corrosion tendency of reinforced steel without the use of plant extract was found to increase as the exposure period of the concrete structures increased. However, the additions of both plant extracts in various concentrations exhibited a significant effect of corrosion inhibition in the steel-reinforced concrete slabs. Particularly, 500 ppm of both plant extracts showed a nearly identical pattern of corrosion inhibition. *Chromolaena odorata* had the best corrosion inhibition capacity at 1000 ppm concentration. However, at 2000 and 4000 ppm concentrations, *Ageratum houstonianum* demonstrated superior corrosion inhibition. Among four different concentrations of the same plant extract, the corrosion preventing behavior was remarkably higher with the additions of 4000 ppm in the case of *Chromolaena odorata* and 2000 and 4000 ppm in the case of *Ageratum houstonianum* plant extract. Hence, all the obtained results agree that the leaf extracts used in this study acted as green-based corrosion inhibitors, which points out the possibility of the development of an effective as well as eco-friendly and environmentally acceptable corrosion inhibitor.

Keywords: Corrosion inhibitors, Green corrosion inhibitors, Reinforced steel, Potential mapping method.

GREEN SYNTHESIS, CHARACTERIZATION AND EVALUATION OF ANTIBACTERIAL ACTIVITY OF *ELAEOCARPUS GANITRUS* (RUDRAKSHYA) LEAF EXTRACT AVAILABLE IN NEPAL

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Abstract

The aim of the study was to synthesize and characterize ZnO-nanoparticles amalgamated with indigenous *Elaeocarpus ganitrus* (Rudrakshya) leaf extract as well as investigate their antibacterial potency against certain pathogenic microorganism.The biosynthesized ZnO NPs were characterized by UV-Vis spectroscopy, XRD, and FTIR. The antibacterial properties of the ZnO-NPS at varying concentration were assessed employing the Disc diffusion technique following standard methods. On UV spectroscopy, the peak value of ZnO and ZnO with Rudrakshya Leaf Extract (RLE) were observed to be 377.49 nm and 430.00 nm, respectively, with a wavelength range of (350- 430) nm, confirming the formation of biosynthesized ZnO NPs. This was also supported by XRD data analysis, which revealed peaks for ZnO with RLE at 2θ = 31.82°, 34.48°, 36.32°, 47.61°, 56.71°, 62.91°, and 68.19. The crystallite size derived from the XRD plot using the Scherrer equation was 19 nm and 18 nm for ZnO and ZnO with RLE, respectively. Furthermore, XRD examination revealed that all of the diffraction peaks of ZnO NPs were consistent with the hexagonal Wurtzite structure. At 5 mg/mL and 15 mg/mL, the zones of inhibition of ZNO-NPs against *S. aureus* were reported to be 6.83±0.12 mm and 8.86 ±0.06 mm, respectively. At 5 mg/ml, the zone of inhibition of ZnO-NPs with RLE against this pathogen was found to be 7.73±0.12 mm, while at 15 mg/ml, it was found to be 9.76±0.13 mm. Both ZnO-NPs and green synthesized ZnO-NPs with RLE revealed a desirable potency on *S.aureaus,* and that phytosnthesized nanoparticle exhibited enhanced activity, the use of leaf extract would improve the antibacterial property ZnO-NPs and this combination could serve as an alternative to combat *S.aureus.*

Keywords: Antibacterial activity, *Elaeocarpus ganitrus* (Rudrakshya), Green synthesis, ZnO- nanoparticles

SYNTHESIS AND CHARACTERIZATION OF 3-ACETYL COUMARIN AND 3-ACEYL-4-HYDROXY COUMARIN THIOSEMICARBAZONES AND THEIR COPPER (II) COMPLEXES.

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Abstract

Thiosemicarbazones (TSC), are biochemically important compounds exhibiting a wide range of bioactivities: anti-cancer, anti-viral, anti-microbial, antibacterial etc. Coumarins are natural compounds exhibiting remarkable biological activities such as anti-coagulant, anti-inflammatory, anti-viral, antitumor activities and also exhibits good cell permeability. Hence, conversion of coumarin into TSC derivative followed by complexion with copper (II) may have synergic effect in the biological activities. Thiosemicarbazide precursors were either obtained commercially (methyl thiosemicarbazide, ethyl thiosemicarbazide) or prepared by Scovill method (diethyl thiosemicarbazide, di-n-propylthiosemicarbazide, piperazine thiosemicarbazide and methylpiperazine thiosemicarbazide). Thiosemicarbazones (L1-L12) were prepared by the condensation of 3-acetyl or 3-acetyl-4-hydroxycoumarin with respective thiosemicarbazides at refluxing temperature for 6 hours in the presence of catalytic amount of acetic acid. Copper (II) complexes (X1-X12) were prepared by refluxing equimolar amount of $CuCl_2.2H_2O$ and thiosemicarbazones in EtOH for 3 hours. Thiosemicarbazones were yellow or orange colored and melting point was in the range of 162-208 °C whereas Cu(II) complexes were green or brown in colour and melting point was in the range of 198-248 °. The synthesized compounds were characterized by elemental analysis, IR and Uv-Vis spectroscopy. The present study indicated that coumarin moiety can be used to produce TSC ligands and their copper complexes which can be studied further for their biological activities.

Keywords. Coumarin, Cu(II) complexes, Hydroxycoumarin, IR spectroscopy, Thiosemicarbazones.

FABRICATION OF NANO-POROUS ACTIVATED CARBON AS EFFICIENT ADSORBENT USING HORSE-GRAM SEED

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Abstract

Nano porous activated carbon is gaining popularity for its efficient adsorbing capacity. Due to its high surface area and eco-friendly, it becomes a preferred choice as adsorbent for the purification of water. Considering these characteristics, Horse-gram activated carbon is utilize for the preparation of activated carbon using zinc chloride and phosphoric acid as activating agent. Thus, obtained activated carbon was characterized using proximity analysis, thermogravimetric analysis (TGA), X-ray diffraction, iodine and methylene blue adsorptions. Surface functional group present on the surface of activated carbon was determined using Boehm titration and Fourier-transform infrared spectroscopy (FTIR). The adsorption efficiency of activated carbon was determined by studying the Langmuir and Freundlich adsorption isotherms. XRD and FTIR spectra indicated that the surface of amorphous activated carbon consisted of acidic and basic functional groups. The TGA analysis of precursor and chemically activated carbon suggested that the most of the volatile compound carbonized at the temperature of 300 to 400 ^{o}C. The observed methylene blue and iodine numbers suggested that an impregnation ratio of 1:1, three hours of carbonization time and carbonization temperature of 300 ^{o}C were the optimum conditions for the development of micro and mesopores on the surface of the activated carbon prepared from gram horse powder. The maximum adsorption capacity of methylene blue was 312.5 mg/g and that of iodine were 849.32 mg/g for phosphoric acid activated carbon (PAC-300) and 810mg/g for zinc chloride activated carbon (ZAC-300). The specific surface area calculated from methylene blue adsorption was 1160.44 m^2/g for activated carbon prepared using optimum conditions. The both Langmuir and Freundlich model fit well in the methylene blue adsorption, although the coefficient of the determinant was comparatively high for the Freundlich model.

Keywords: Adsorption, Chemical activation, Iodine number, Methylene blue adsorption.

SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL ACTIVITY OF OXOVANADIUM (IV) COMPLEXES.

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Abstract

Schiff base ligands (L_1 and L_2) have been synthesized by condensing benzophenone and benzaldehyde with newly synthesized 4-amino-3(4-nitrophenyl)-5-mercapto-1,2,4-triazole respectively. Two respective oxovanadium (IV) complexes {[VO (L_1)] and [VO (L_2)]} were prepared by refluxing vanadyl sulfate with the ligand L_1 and L_2 respectively. Both the complexes and ligands were characterized by FTIR spectroscopy, XRD analysis, EDX analysis, UV-Vis spectroscopy, conductivity measurement, and cyclic voltammetry (CV) analysis. The biological activity of the ligands and their complexes was evaluated. *In-vitro* antibacterial tests were performed with two gram-negative bacteria [*Klebsiella pneumonia*, and *Escherichia coli*] and two gram-positive bacteria [*Staphylococcus aureus*, and *bacillus subtilis*], and *in-vitro* antifungal screening was accomplished against one fungal species [*Candida albicans*]. The Schiff base ligands and oxovanadium complexes show good antimicrobial potential in terms of zone of inhibition (ZOI) against the tested microbes. The α-amylase and β-glucosidase inhibitory experiments show that the compounds do not possess prominent antidiabetic activity but the antioxidant screening shows that the compounds are quite active.

Keywords: Triazole, Schiff base ligand, Vanadyl complex, Antimicrobial, Antioxidant antidiabetic.

NON-EDIBLE VEGETABLE OIL BASED LUBRICANTS: A REVIEW

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Abstract

The focus of this work is on the development of non-edible vegetable oil-based lubricants. As we know, most of the lubricant used today are derived from petroleum products that are non-renewable, non-biodegradable and toxic in nature. Thus, many researchers are putting' attention in developing vegetable oil-based lubricants possessing optimized physicochemical properties and high biodegradability, renewability, lubricity. Non-edible oils are focused to explore their utility as a bio-lubricant so as to address the two societal problems: (i) environmental problems and (ii) energy security. The vegetable oils cannot be utilized directly as base stocks or lubricants additive since they do not perform well. The oils therefore must be chemically modified before being used as biofuels or bio-lubricants. Chemical modification is generally performed by trans-esterification, epoxidation and hydroxylation. Also to improve its lubricity, the oil can be modified with different chemicals, blended with additives like anti-oxidative, dispersive, detergents and nanoparticles (such as silica, copper oxide nanoparticles, graphite, and carbon nanotubes). The produced lubricants are generally characterized by studying different physicochemical properties like density, viscosity, flash point, pour point using diverse analytical tools. In this paper, along with the general methods of preparing the biolubricants using vegetable oils, a comparative analysis of the lubricants properties as a function of chemical modification will be presented.

Keywords: Tribological behaviour, Flash point, Pour point, Chemical modification, Nano-modification.

EPOXIDIZED POLY (STYRENE-BUTADIENE-STYRENE) (ESBS)/ACID MODIFIED ZIRCONIA (ZRO_2) NANOCOMPOSITE: FABRICATION AND CHARACTERIZATION

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Abstract

A star-shaped polystyrene-block-polybutadiene-block-polystyrene (SBS) block copolymer was subjected to an epoxidation reaction using m-chloroperoxy benzoic acid (MCPBA), which led to the targeted modification of the block copolymer (eSBS). In this work, where Zirconia (ZrO_2) nanoparticles were synthesized by sol-gel method and surface modified by organic acid, and the eSBS was used for the preparation of nanocomposite. An eSBS was dissolved in chloroform and surface modified ZrO_2 solution was mixed in different weight percentages for the preparation of nanocomposite. The sample was characterized by XRD, FTIR, and optical microscopy. The XRD result of zirconia was found in the nanometric range. The results of FTIR confirmed the formation of eSBS/ZrO_2 nanocomposites and optical microscopy indicates the homogenous dispersion of ZrO_2 nanomaterial in the polymer matrix.

Keywords: ZrO_2 nanoparticles, Surface modification, Epoxidized Poly (Styrene-Butadiene-Styrene).

GREEN SYNTHESIS OF SILVER NANOPARTICLE FOR ANTICANCER APPLICATION

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Abstract

The focus of this paper is on the green synthesis of silver nanoparticles utilizing the leaf extract of *Choerospondias axillaries* (lapsi). When aqueous silver ions were exposed to leaf extract, they were reduced resulting in the formation of silver nanoparticles. The silver nanoparticles that are produced will be analyzed further using a UV visible spectrophotometer, X-ray diffraction (XRD), and Fourier transform infrared spectroscopy (FTIR). Green synthesis of silver nanoparticles has emerged as a promising prospect for a new cancer prevention biomarker, combining the unique properties of silver nanoparticles with plants' antioxidant and anticancer properties to attack tumor cells while sparing healthy cells. Furthermore, these green synthesized particles have higher biological activity than artificial particles in medication distribution, overcoming the time-consuming and potentially dangerous side effects of today's drug delivery technology.

Keywords: *Choerospondias axillaris*, Silver nitrate, Silver nanoparticles, UV-vis, XRD, FTIR, Application

MECHANICAL AND ELECTRICAL PROPERTIES OF CONJUGATED POLYMERS

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Abstract

Since their discovery in the 1960s, conjugated polymers (CPs) have captivated researchers due to their peculiar electrical conductivity properties like metals and deformability like the conventional polymers. Salient features that pull CPs at the centre of attention is low cost, environment stability, electrical and mechanical properties. Intensive studies of their electrical properties as well as mechanical properties are studied in recent years. However, the correlation between these two properties is not well understood. A comprehensive micromechanical and electrical properties of some commercially available CPs will be carried out which is expected to help to establish a correlation between them. Various microscopic methods will be used to study the morphology of polymers and the Microindentation technique for micromechanical properties. Surface and electrical properties will be assessed employing contact angle measurements and four-probe techniques respectively. Apprehending the correlation between mechanical and electrical properties will find a gateway of more precisely adjusting the structure properties correlations of the CPs.

Keywords: Conducting polymers, Doping, Microscopy, Morphology, Surface characterization

FOOD SECURITY AND GREEN ECONOMY

THEMATIC SPEAKER

RENEWABLE ENERGY AND SUSTAINABLE FOOD SECURITY

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Abstract

The world's increasing population together with the amount of calories needed to meet dietaryrequirements has intensified food security concerns. As a result, the world's energy demand has correspondingly risen mainly due to the preference for sophisticated food production (usually energy–demanding), as well as mechanisation of the food supply chain. Renewable energy has been pivotal in meeting the above demands by means of energy for food processing, storage and transport. Renewable energy sources are becoming an increasingly important alternative source of energy in the agricultural sector. Globally, agro-based countries are facing energy and water scarcity problems despite other problems of low productivity and soil conservation. Increased food production to meet rising demand of increasing population will also be a great challenge for agriculture. Energy and water scarcity are two major obstacles to sustainable agriculture and food security. Sustainable agriculture is related to agriculture production system without damaging the environment and future generations and food security is access by all people at all time for active and healthy living at present plus ability to provide in future. The increase of renewable energy will reduce dependence on fossil fuel and will reduce import bill and provide greater saving to the country with great environmental contribution for reduction of greenhouse gases with ultimate target mitigate the climate change. Several non-fossil fuel based renewable energy sources including solar, wind, biomass, hydroelectric and geothermal are the option to solve the problems of energy and water scarcity problems which will ultimately become instrumental in elimination of environmental damages and climate change. Food security and bioenergy have positive synergies as alluded. For example, bioenergy demand may cause higher prices to boost local economies. This paper attempt to explain the role of renewable energy sources in agricultural sector as a means of enhancing sustainable food security in the country and presents the existing technologies, policies and emerging opportunities in renewable energy application in the agricultural sector.

Keyword: Renewable energy, Sustainable development, Food security, Natural resources

INVITED SPEAKER

RECENT DEVELOPMENTS IN TECHNIQUES OF YARSAGUMBA (*OPHIOCORDYCEPS SINENSIS*) CULTIVATION ON MOTH LARVAE

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Abstract

There have been many researches to establish *in vitro* culture of Yarsagumba in common mycological media. Agar and broth media are highly useful to observe the mycelium growth characteristics and conidiation of the vegetative phase of Yarsagumba in laboratory. However, the reproductive phase of Yarsagumba, which is the main trade item, is a complex developmental process, growing on mummified moth larvae in the natural alpine grasslands of northern parts of Nepal, Bhutan and India and the neighboring regions of the Tibetan Plateau of China. After decades of research and trials, Chinese scientists have successfully developed the reproductive phase of Yarsagumba by *ex situ* infection of *Thitarodes* moth larvae (Lepidoptera) and growing them in the laboratory by simulating the environment of the alpine region until the mature sexual stage of the fungal fruiting bodies are developed. Yarsagumba is a high-valued alpine insect-herb of Nepal and the surrounding countries, leading to economic activities from collection, trading to local dealers and ultimately exporting to the Chinese-populated cities of Hong Kong, Macao, Taiwan and nearby countries Singapore, Thailand etc. Nonetheless, conservation of Yarsagumba has become a challenging task due to the adverse effects of human activities on the alpine vegetation and habitat loss of moths. Some backgrounds of Yarsagumba in our context and the recent developments in its cultivation techniques will be presented with the view of disseminating the information to young, enthusiastic scientists and researchers of Nepal and developing the skill for commercial growing to uplift the economic activities of the country. Further, the presentation will provide insight into the diversity of other insect-mushrooms in mid-hills and high hills of Nepal.

Keywords: Yarsagumba, Ophiocordyceps sinensis, Insect-herb, Insect-mushroom, Himalayan Gold

UNDERSTANDING LAND USE ZONING / PLANNING FOR FOOD SECURITY FROM TELECOUPLING CONCEPT

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Abstract

In the global context, meeting the growing demand for food has always been a challenge. The World Bank report published in 2014 highlighted about local level food crises in a decades back and continuation of food price volatility that indicates the vulnerability of the world's food system. It is anticipated that, by 2050 world will need to feed 9 billion people and a 70% increment in global agriculture production is required to meet the demand. Although this demand is of global relevance, they are local, in nature, because the effects of food demand are felt locally. Considering that the food security and land use are very connected across multiple dimensions like spatial, temporal and organizational scales, it is important to understand land use from a global perspective. However, local actions in the use of land effects global issues on food security, it has now a concern of each country to have proper land use zoning/ planning. In addition, short term food security approaches must not be adopted, sacrificing environmental aspects because this is the foundation for long term food security. Food availability, food access and food utilization are dimensions of food security. All these three dimensions are connected in shaping the use of land. Also, the demand for food from distance and nations' capability of food to fulfill the food demand also triggers how the land has been used globally. Hence, telecoupling effects on land use dynamics can be minimized by an effort to produce food locally by reducing global trade. The overall goal is to understand the various possible/ adopted intervention related to land use that supports local food production, thus minimizing telecoupling land use dynamics.

Keywords: Telecoupling, Food Security, Land Use Planning/ Zoning

INVITED SPEAKER

INDIGENOUS KNOWLEDGE OF WILD USEFUL PLANTS UTILIZATION AND CONSERVATION

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Abstract

Wild plant resources play an important role in Nepal for food security, nutrition and primary health care of ethnic communities. However, this role, its utilization pattern and conservation are poorly studied in many regions of the country. In addition, abundance and use of many of these wild useful plants have been decreasing, which calls for conservation and cultivation of priority species. To improve ethnobotanical research and encourage suitable methodology, this paper presents methods used to collect data in the multidisciplinary study in Makawanpur district, Nepal. This study also addressed differences in traditional knowledge on wild medicinal and edible plants use among ethnic groups as well as develop priority list of species for conservation and domestication efforts in future. Measuring the importance useful plant species to indigenous community is one of the major concern in quantitative ethnobotany. Relative cultural importance (RCI) indices such as informant consensus factor (ICF), frequency of citation (FC), cultural importance index (CI), use value (UV), and fidelity level (FL) etc and free listing were applied in ethnobotany to calculate relationships between knowledge on utilization of plant resources, and to compare cultural salience of plants among ethnic groups. Priority setting approach for conservation and domestication were based on nine variables related to priorities for tastes, market demand, occurrence in homegardens, wide use among ethnic groups, broad altitude range, harvest season, level of threat as perceived by local community, preference for consumption, and possibility for processing. The presented ethnobotanical study of relative cultural importance (RCI) indices and priority setting approach can help to priorities species with highest potential for conservation by integrating ethnobotanical, socio-economic, and biophysical information. Possibilities for up scaling priority approach also need to be tested in other regions of Nepal.

Keywords: Ethnicity, Ethnobotany, Medicinal plants, Edible plants, Traditional knowledge.

SPECIAL TALK, NAST

OPTIMIZATION OF EXTRACTION METHODS FOR LUTEIN FROM TAGETES

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Abstract

Lutein is a dihydroxy carotenoid or xanthophyll most commonly extracted from petals of *Tagetes* species. Lutein is used as a food supplement specially maintaining the health of macula. It is also used as food colorants and primarily responsible for the intensive yellow-orange color. Poultry industry uses these primarily as the feed additives to color egg yolks (orange) and poultry skin (yellow). The objective of the study was to extract Lutein, an active component of marigold flower (*Tagetes erecta*) by means of chemical methods and supercritical carbon dioxide. The condition at which a maximum yield of lutein obtained is 325 bar and 40 ^{o}C. Extracts were analysed for Lutein by UV and GC MS techniques. The extraction of Lutein with hexane and supercritical extraction were compared. The yield of Lutein was more than 0.3 % in supercritical extraction technique. Supercritical extraction technique has higher yield, less processing steps and selectivity over the conventional chemical method.

Keywords: Lutein, *Tagetes erecta*, Supercritical fluid extraction

ORAL PRESENTATION

UV-VIS SPECTRA OF PURE MUSTARD OIL AND ITS VARIANTS

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Abstract

UV-Visible spectroscopy is a non-invasive, fast, efficient, and cheap method to prove the quality of mustard oils. Three samples of pure mustard oils have been collected from Khokana, Lalitpur and their UV-Visible spectra in the range of 295 nm - 850 nm have been recorded. The pure and roasted Nepali mustard oil showed two distinct absorbance peaks in the range of 300 nm - 350 nm while the pure and roasted Indian oil as well as pure and unroasted mustard oil showed only one characteristic peak in the investigated wavelength range. Moreover, the characteristic peak present at around 450 nm infers the possibility of the presence of Maillard reaction products in mustard oils; more in the oils from roasted mustard than the unroasted ones. The observed data have been attempted to correlate with the purity of the oil samples.

Keywords: Absorbance, Adulteration, Mustard Oil, UV-Visible Spectroscopy

FACTORS AFFECTING THE PRODUCTION OF BIODIESEL

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Abstract

Biodiesel is one of the alternatives to conventional diesel. Both edible and non-edible sources can produce biodiesel. Edible sources, including mustard, soybean and sunflower and non-edible such as castor, Jatropha and animal fats, are the major sources of biodiesel production due to their availability and high conversion rate. One of the major drawbacks of biodiesel is higher fatty acid content and higher viscosity content. This research focuses on steps to reduce free fatty acids through esterification and transesterification processes and operating parameters such as concentration of acid and base catalyst, reaction time, agitation speed, and water temperature for washing for the production and recovery of biodiesel. On a laboratory scale, various samples of biodiesel are prepared from discarded cooking oil, palm oil, soybean oil, and buffalo tallow. For higher free fatty content biodiesel, two-step transesterification is the best option where moderate H_2SO_4 concentration and lower KOH concentration at higher reaction rpm and reaction one hour gives higher yield. In contrast, for lower FFA content oil, single-step transesterification is the best option where at lower KOH concentration and at higher rpm and reaction time of one hour gives the higher yield. It is found that the water's temperature directly affects the recovery percentage, and repetition of washing is reduced from 5 steps to 3 while using water at a temperature above 60°C.

Keywords: Biodiesel, Free Fatty Acid (FFA), Reaction time, Catalyst concentration, Agitation speed (RPM)

FEASIBILITY STUDY OF ORGANIC FARMING SYSTEM AT BHIMAD MUNICIPALITY

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Abstract

Bhimad Municipality lies in Tanahun district of Nepal with the agricultural land of about 7,856 hectares. We conducted the feasibility study on if Bhimad could be developed as the organic model municipality. Survey was carried out in all 10 wards of Bhimad to know their perception on organic farming. Soil samples were collected to investigate its nutrient content and microbial load. The disease occurrence was also recorded according to description and field visit. Phosphate solubilizing bacteria were isolated to see its plant growth promoting efficacy in tomato. The survey results in Bhimad showed 45% of youth are involved in agriculture. The problems farmers are facing were animal terror, lack of technical assistance, and proper marketing. Loss of agricultural products were seemed to be due to lack of knowledge on management of diseases and proper use of pesticides. Many diseases were prevalent causing loss of food and cash crop in the area. Soil pH of the area was near to neutral and best for most of the crops. NPK nutrient content were lower in majority of soil sample collected. Among 145 PSB isolates, 2 showed significant effect on plant growth promotion of tomato. Although, farmers in the area were knowledgeable about the grants and donation provided by government for agriculture. They were unaware about the advantages of organic farming and its emerging scope. Most of the farmers were highly willing to change to organic farming system. The finding of this study showed that there is need for awareness, education and training on the uses of bioinoculants to the farmers and promotion of organic farming. Additionally, research and development of new techniques to promote and improve organic agricultural products which can enhance the socioeconomic status of the farmers.

Keywords: Bhimad, Organic Farming, PSB

MICROENCAPSULATION OF SPIRULINA PROTEIN HYDROLYSATE AND ITS PROPERTIES FOR FOOD/FEED SUPPLEMENT

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Abstract

Spirulina is a microalga having exceptional nutritional value, especially rich in protein content with numerous other biological and therapeutics properties. Since these biologically active ingredients are prone to environmental degradation, the objective of the present study is to microencapsulate the protein hydrolysate of Spirulina using different coating materials so that it can be promoted as a food supplement. The encapsulation was done by extrusion method coated with alginate, chitosan, and carboxymethyl cellulose. Size, encapsulation efficiency morphology, temperature stability, and in vitro release property of the microcapsules were studied. All the prepared microcapsules can resist acidic medium, whereas remarkably release protein under alkaline conditions. The result showed that the microcapsules coated with alginate and chitosan exhibit the most heat stability along with the controlled release property. The in vitro release property showed that dry capsules have a more sustained release mechanism than fresh microcapsules. Thus, prepared microcapsules can be used as a source of protein in our daily food supplement which helps to meet the demand in today's world for healthy and nutritious food.A better understanding of this encapsulation technique will ease the incorporation of bioactive peptides into a variety of food products, and impart functional properties associated with lipid membranes and polysaccharides.

Keywords: Spirulina, Protein, Biopolymer, Encapsulation, Nutraceuticals

IMPORTANCE OF TREES OUTSIDE FOREST FOR FRUIT YIELD

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Abstract

Study was conducted for assessment of the food (fruits, nuts and fruit related spices) as a part of provisioning services on Trees Outside Forest (TOF hereafter) in Kathmandu valley of central Nepal. Inventory was performed in 209 randomly selected points by Excel using circular plots with 20 m radius. Total of 6210 TOF were recorded belonging to 150 species, 111 genera and 57 families. Total of 1085 TOF with merchantable values of fruits, nuts and spices were recorded in 133 plots that belonged to 40 species, 28 genera and 20 families. Average tree density was 236.35/ha while average density of fruit bearing trees was 41.30/ha. Out of 40 species, 35 were important for fruits, four were important for nuts and one was important for fruit related spices. Based on the average yield and average local market prices of these fruits, total of NPR 573145.98 ($ 4824.46/ha) was the total merchantable cost. The study explored the importance of TOF in the aspect of food (fruits, nuts and fruit related spices) production in Kathmandu valley and provides the baseline data useful for planning suggesting a need for appropriate species selection for plantation.

Keywords: Food security, Livelihood, Green economy, Urbanization, Kathmandu valley.

MYCOTOXIN ASSESSMENT, ISOLATION AND IDENTIFICATION OF MOLD FROM MAIZE AND PEANUT SAMPLE OF BHAKTAPUR DISTRICT

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Abstract

The failure of food safety leads to food insecurity that further influences human health. Food and feed contamination by mycotoxins is a significant problem for creating food insecurity. Aflatoxin and fumonisin are the mycotoxins of greatest agro-economic importance, produced by toxigenic species of *Aspergillus* and *Fusarium* as secondary metabolites. These two mycotoxins that co-occur in food and feed were studied in the samples of maize (popcorn and maize), corn grits (chyakhla), maize flour and peanut collected from Bhaktapur district, Nepal. The most commonly employed methods for quantification of these two mycotoxins by a one-step lateral flow immune-chromatographic assay using with Agra Vision Reader. This study revealed that among these samples, 84% contained total aflatoxin level lower than maximum permitted limit (MPL) and 10% contained level slightly greater than MPL and 6% crossed the level more than 500 ppb. However none of the sample showed total fumonisin level greater than maximum permitted limit (MPL) The isolation and identification of mold revealed that most of the samples were contaminated by species of *Aspergillus* followed by *Fusarium* and *Penicillium*.

Keywords: Rapid Detection, Aflatoxin, Fumonisin, Mold

FORMULATION AND STUDY OF DRYING CHARACTERISTICS OF BROAD BEAN INCORPORATED MASYAURA

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Abstract

Masyaura is traditionally prepared by mixing soaked black gram with vegetable solids, followed by subsequent sun or solar drying. The objectives of this research was to incorporate Neglected and Under-utilized Species(NUS) crop, broad bean with partially replacing black gram, and study the drying characteristics and physicochemical properties of *Masyaura*. In this study, three samples were formulated using linear programming which gave different proportions of black gram, broad bean and taro tuber and were denoted by A (containing 17% broad bean), B (containing 23% broad bean) and C (containing 25% broad bean prior to cabinet drying at optimized time and temperature i.e. 60 ºC for 6.824 hours obtained by using two factor response modeling simulation tool. Finally, two samples namely sample A and sample B were selected based on balance of nutrients at best possible price and were subjected to physiochemical (Ranganna, 2010), sensory(duo-trio and triangle test) and statistical analysis using MS-Excel (2013).The results showed that drying rate of sample A and Sample B was found to be 0.00486 and 0.00661 kg water/kg dried sample/min.m^2 respectively. The drying time of sample A and sample B was calculated as 9.39 hours and 9.77 hours respectively. Among the two samples, the sample A was best in terms of nutrients, price and sensory attributes. The lower and upper value of moisture, ash, protein, crude fiber and calcium of broad bean incorporated *Masyaura* were 9.045 and 9.361%, 3.188 and 3.772%, 11.681% and 12.819%, 1.98% and 2.11% and 64.79mg per 100g and 67.47mg per 100g respectively. This research showed that the broad bean incorporated *Masyaura* with change in taste and product ingredients was as accepted as the traditional *Masyaura* found in the market and this product can become valuable by utilizing Neglected and under-utilized broad bean and can be manufactured at commercial scale.

Keywords: Drying rate and drying curve, Process optimization, Linear programming, Sensory analysis, Two factor response modelling

MOLECULAR IDENTIFICATION OF *BACTROCERA MINAX* CHINESE CITRUS FLY (DIPTERA: TEPHRITIDAE) IN NEPAL

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Abstract

An accurate identification at a species level is often the first step in successfully controlling, mitigating and managing insect pests. Species identification utilizing molecular approaches can complement morphological identification. Tephritid fruit fly insects can be identified quickly using DNA barcode. In this study, we used DNA barcoding method to identify a destructive citrus insect, Chinese fruit fly (Bactrocera minax) in Nepal using sequencing of mitochondrial cytochrome c oxidase I (COI) gene.

Key words: Bactrocera, Chinese citrus fly, DNA barcode, Molecular study

BIOTECHNOLOGICALLY DERIVED EDIBLE COTTONSEED: EXPLORING THE PLANT-BASED PROTEIN TO IMPROVE HUMAN NUTRITION

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Abstract

Global production of cottonseed contains ~10.8 trillion grsams of protein which can meet the basic protein requirements of ~590 million people at a rate of 50 g/day. However, gossypol, a toxic terpenoid present in seed glands, renders cottonseed unfit as food for human consumption or as feed for nonruminants. RNAi, under the control of a seed-specific promoter, was used to selectively silence *δ-cadinene synthase* gene to reduce gossypol levels in the seed by 97% without affecting the levels of gossypol and related terpenoids in the vegetative parts of the plant where they are needed for defense against insects and diseases. The resulting Ultra-low Gossypol Cottonseed (ULGCS) is considered safe as food or as feed for more efficient (both, in terms of feed conversion ratio and protein conversion ratio) monogastric animals. Field trials conducted over multiple years in multiple states confirm the stability and heritability of the trait with no diminution of fiber/seed yield, quality or agronomic performance. A ULGCS event, TAM66274, was deregulated by USDA-APHIS and FDA concluded its food safety consultation and concurred with our determination of its safety. Global adoption of TAM66274, with more efficient and expanded usage of its protein, has the potential to significantly improve nutrition security and boost farmers' income without requiring additional inputs or acreage under cultivation, thus making cotton farming more sustainable.

Key words: ULGCS, Edible cotton, *δ-cadinene synthase*, RNAi, Cotton protein

ASSESSMENT OF DEGREE OF IODINE MIXING IN IODIZED SALTS MARKETED IN NEPAL

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Abstract

Iodine is a vital element needed for the human body for the production of thyroid hormone and its deficiency leads to several severe disorders such as brain damage, endemic goiter, dwarfism, etc. Therefore, Iodine Deficiency Disorders (IDD) are concerned with public health as well as the economic development of the nation. Although iodized salt has been now accessed in most areas of Nepal, the quality of available salt is poor, or incorrectly iodized, or salt that has been correctly iodized deteriorates due to excessive or long-term exposure to moisture, light, heat, and contaminants. The purpose of the study was to assess the degree of iodine mixing in different brands of iodized salts commonly marketed in Nepal. Iodized salt is considered to be satisfactorily homogeneous if the coefficient of variation (CV) is no larger than 10%. Four different brands of iodized salts; namely Aayo free flow refined (brand A), Bhanu refined (brand B), New Shakti refined (brand C), and Dhike crystal (brand D) were analyzed, and as the result, the confidence intervals for the coefficient of variation of iodized salt were found between 0.42 and 0.62 at 95% confidence level. It could be concluded that the iodized salts of all the brands were perfectly mixed as the coefficient of variation was found to be 6.92 %. In the individual analysis of each brand; A, B and C were found to be properly mixed as their coefficient of variation was less than 10 % whereas brand D was found improperly mixed as its coefficient of variation was far greater than 10 %. The iodine content of the Iodized Salt as it is being produced should be constantly controlled, preferably through "in line" product sampling and iodine content analysis at short intervals.

Keywords: Iodine, Sodium Chloride, Brands, Efficiency

STUDY ON OVER ALL MIGRATION OF MICRO PLASTIC IN DISTILLED WATER AND NON-ALCOHOLIC BEVERAGES

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Abstract

Nowadays, plastics are being used as packing materials for all kinds of materials such as food, juice, clothes, shoes, gift etc. due to its advance properties such as lightweight, durability, easy to excess, low cost, versatility and many more. Among them food in packing materials directly connects with human health. Food itself being edible chemicals during handling, storing, transferring, till it reaches to consumer, it interacts with the plastic packaging container which cause deterioration in plastic in micro/nano range and migration of these micro/nano sized plastic, "Microplastic" component to food occurs which directly affects the human health. In this study overall migration of different plastic packaging on to the water and non-alcoholic beverages were determined by using IS 9845: 1998 method. Samples of different brands of water and non-alcoholic beverages were collected from local market. Food simulants distilled water and 3% acetic acid (w/v) were used. Distilled water for aqueous/non acidic foods (pH ≥ 5) without fat and 3% acetic acid for aqueous, acidic food (pH≤ 5) without fat at 40 °C/10 days were used as per Bureau of Indian Standards IS - 9845-1998. 0.38 mg/L to 0.54 mg/L migration of microplastic was found in mineral water. In case of non-alcoholic beverages overall migration ranges from 0.2933 to 75.75056 mg/L.

Keywords: Microplastics, Simulant, Plastic, Distilled water, Migration

PREPARATION OF JAM FROM DIFFERENT FRUIT VARIETIES

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Abstract

Fruits are considered as crucial part of our daily diet. They provide significant number of vitamins, minerals, fiber and carbohydrates to humans. However, fruits are highly perishable products and thus are susceptible to spoilage. One of the most effective ways to scale back nutrient-loss in fruits is to process and preserve them in properly edible forms. Jam is a fruit solid gel made from the pulp of a single fruit or mixed fruits by boiling the fruit pulp with sugar, pectin, acid and other ingredients (preservatives, coloring agents, limited amount of fruit peels and flavoring materials). Five different varieties of Seasonal fruits viz. apple, guava, amla, strawberry and kiwi were taken for the preparation of jam. They were washed thoroughly with distilled water to remove all the dust and following it a potato peeler was used to remove the peel. The fruits were then cut into small piece using a sterile knife. The seeds were manually removed from fruits wherever it was applicable. Pieces of fruit were then crushed using electric grinder to prepare pulp. One kilogram of fruit pulp was mixed with 600 grams of sugar and was heated in order to remove the excess moisture. The mixture was stirred regularly during heating. Following it fresh lemon juice, one gram of pectin powder was added to it and was allowed to boil till optimum point was achieved. After removing the excess water and obtaining the required TSS 68.0 ± 1degree brix, heating of the mixture was stopped. The jam was filled in clear glass bottles while it was still hot (temperature over 82 ° C) and was stored in refrigerator at 4^{o} C. This study showed that seasonal fruits can be prevented from loss and can be processed into more stable forms such as jams to extend their shelf-life.

Keywords: Fruits, Jam, Pectin, Sugar

LEAF AGE-DEPENDENT EFFECT OF ENVIRONMENTAL CONDITIONS ON CAROTENOID BIOSYNTHESIS IN ARABIDOPSIS THALIANA

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Abstract

Carotenoids are 40-carbon-containing lipophilic isoprenoid pigments synthesized in plastids and are essential for the proper development and functioning of plants. In leaves, carotenoids facilitate plastid development, absorption of solar radiation, and photoprotection of chloroplasts. Also, the carotenoid-derived apocarotenoid phytohormones abscisic acid and strigolactones involve in stress tolerance and shoot branching, respectively. In this study, we explored how the level of carotenoids changes in Arabidopsis leaves of different ages in response to elevated CO_2 and short exposure to darkness, cold, and warm conditions. We found that the level of total and individual carotenoids was higher (60-80%) in young leaves compared to mature leaves. Exposure to elevated CO_2 increased the level of carotenoids in the recently emerged young leaves, whereas remain unchanged in the mature leaves. A short (24 hours) exposure to warmer conditions (32 ^{o}C) also increased the level of carotenoids in young leaves and that in the mature leaves was unaffected. In contrast, exposure to cold (7 ^{o}C) and darkness for 24 hours substantially decreased the level of carotenoids in young leaves, yet the level of pigments was unaffected in old leaves. Exposure to 32 ^{o}C and 7 ^{o}C increased and reduced the biosynthesis and/or accumulation of carotenoids in both leaf types as evidenced by the level of phytoene accumulation in the respective leaves. Intriguingly, carotenoid biosynthetic pathway was switched off in both leaf types during the dark as evidenced by the absence of phytoene. Like carotenoids, the level of chlorophylls showed a similar response to the environmental treatments. We conclude that the recently emerged young leaves of Arabidopsis were efficient in carotenoid biosynthesis compared to the older leaves. Also, young leaves were highly plastic in customizing the photosynthetic pigment pool, while mature leaves showed strong resilience in response to environmental perturbations.

Keywords: Carotenoids, Chloroplast, Photosynthesis, Leaf, Arabidopsis

EFFECT OF PLASMA TREATMENT ON THE SPROUTING OF *KWATI* BEANS

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Abstract

Plasma, also known as the fourth state of matter, can be applied for various agricultural purposes (insecticide, sterilization, growth enhancement, fertilizers, etc.). Atmospheric pressure plasma is produced using gliding arc discharge and is used for enhancing sprouting of local *kwati* beans. The effect of direct treatment of the seeds as well as application of plasma activated water has been studied. The source for plasma production has been designed and fabricated locally and the plasma is characterized by electrical and optical methods. The different beans exhibit diverse responses to the plasma treatment; however, the sprouting in all cases is improved. The direct treatment of seeds reduces the contact angle thereby increasing the hydrophilic nature of the treated beans. This helps in faster sprouting of the beans. In addition, use of plasma activated water further enhances the sprouting due to increased reactive oxygen and nitrogen species in the activated water. Preliminary results on plasma generation, its characterization and effect in the sprouting of *kwati* beans will be presented.

Keywords: Contact angle, Gliding arc discharge, Plasma activated water, Plasma treatment, Seed germination

INVESTIGATION OF LOCALLY AVAILABLE PLANTS TO PRODUCE ANIMAL FEED FOR IMPROVED LIVESTOCK NUTRITION

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Abstract

Livestock is an important livelihood source, especially in agriculture-economy countries like Nepal. While more than 44.47% land area of Nepal is covered by forest, scarcity of feed materials with abundant nutrition in the dry winter season is the major cause of the low productivity of Nepalese livestock farming in south-east Asia. This research project addressed livestock feed scarcity and lack of nutrition by utilizing the leaves available in the forest resource. The main objective of the research project was to produce livestock feed from locally available plants, which is high in nutrition, cheap and easily available as a replacement to the expensive commercial feed. For adequate data collection, surveys were conducted at the local level to gather information about the condition of livestock feed and the identification and availability of plant species in the community forest. Samples of plant leaves collected were sent to NARC for the lab analysis and determination of nutrient availability. The fallen plant leaves were initially collected in bulk, dried in the sun for a few days, cut into small pieces, and ground into fine particles. Thus, obtained particles were heated, adding molasses and then compressed to convert into airtight blocks for easy storage and portability. Finally, the product was sent to NARC for analysis and fed to local animals like cows, goats, and hens. With a positive outcome, further research on its effect on meat, milk and egg production and animal health is to be done. Considering 22 thousand community forests and the vast pool of plant species and available nutrients, this product can replace the ordinary commercial feed in small quantities (5-10%), directly contributing to the national economy.

Keywords: Livestock farming, Animal Nutrition, Pellets, Plant Leaves, NARC, Commercial Feed, Agriculture-economy

ENHANCING AGRICULTURAL PRODUCTIVITY USING ATMOSPHERIC PRESSURE PLASMA

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Abstract

Atmospheric pressure plasma have found applications in different fields leading to improvement of the quality of human life such as food safety (inactivation of microbial contamination, bacteria free food), health (cancer treatment, wound healing, blood coagulation, dental treatment), micro-fabrication (etching, chemical vapor deposition), agriculture (insecticide, sterilization, germination, growth enhancement, fertilizers), environmental science (treatment of polluted air and water), etc. Recent advances made in production of dc gliding arc discharge and dielectric barrier discharge using local resources, their characterization using electrical and optical methods, and their applications in agriculture will be presented. It is observed that direct treatment of seeds (coriander seed and mushroom) by atmospheric pressure plasma of dc gliding arc discharge decreases the contact angle of the treated seeds. This is accompanied by higher water absorbance and faster germination. Plasma activated water, produced by exposing the water to plasma, has reduced pH value and increased conductivity which is then used for irrigating various agricultural products. Our activities directed towards enhancing agricultural productivity by using the combined effect of direct treatment and the plasma activated water will be discussed; as well as in deactivation of E. *coli* and S. *aureus* in water will also be presented by using air dielectric barrier discharge.

Keywords: Contact angle, Plasma treatment, Seed germination, Bacteria inactivation

EVALUATION OF NUTRITIONAL, PHYTOCHEMICAL, AND ANTIOXIDANT PROPERTIES OF *GUIZOTIA ABYSSINICA* (L.F.) CASS. SEEDS

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Abstract

Guizotia abyssinica (L.f.) Cass. is a herbaceous plant cultivated in different countries throughout temperate and tropical zone including Nepal and India. It is commonly known as *filunge or jhuse til* and the seeds of the plant are traditionally used as food additive, spices and flavoring agents in Nepal. The objective of this study was to assess the nutritional, phytochemical, and antioxidant, activities of the seeds of *Zuigotia abbysinicia* collected from Panchthar district of eastern Nepal. The results revealed that moisture, carbohydrates, protein, fat, fiber and ash content of the seeds was 8.5 ± 0.35 %, 6.87±0.8%, 25.23 ± 0.50%, 33.36 ± 0.75%, 21.58 ± 0.1%, and 4.45 ± 0.1% respectively. The sample contained abundant amount of phenolics (477.77 ± 1.5 µg/mL) and moderate amount of flavonoids (33.63 ± 1.9 µg/mL), abundant amount of ascorbic acid (216.88 ± 1.7 µg/mL) and excess amount of β-carotene (205.1± 0.02 µg/mL) and lycopene (134.49 ±0.05 µg/mL). It showed good antioxidant ability with IC_{50} value of 107.83 µg/ml. The findings of the present study shows that the seed is a good source of protein, fat, and fiber and phenolics and *β*-carotene and lycopene. It is also a good source of antioxidant.

Keywords: *Guizotia abyssinica* (L.f.) Cass. Seeds, Antioxidant activity, Phytochemicals, Proximate composition.

PROCESS AND DEVELOPMENT OF WINE MAKING FROM MULBERRY FRUIT AND ITS QUALITY ANALYSIS

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Abstract

The aim of the study was to screen local yeast strain to process the fermentation of wine from mulberry and its sensory quality evaluations and Total quality analysis. Total 10 samples, 3 Marcha, 6 Grapes and 1 baker's yeast from local market of Kathmandu valley for the isolation and identification of local yeast strain were collected and proceeded along with 1 industrial wine yeast (Laffort Company, France) for comparative analysis. Among the 10 samples, only 9 yeasts were isolated and subjected for their H 2 S testing (on LAA media) and isolates (S01,S09 and STAND) were found non hydrogen sulphide producer which was further subjected for fermentative capacity test (in YFB broth at 2% concentration of each sugars: Glucose, Sucrose, Fructose, Lactose and Dextrose with Durham tube), then the tolerance test were done where Alcohol tolerance(at 10%, 13% and 15% alcohol concentration), sugar tolerance(10°, 20°, 30°, 40° and 50° brix),Temperature tolerance and P H tolerance (at 3, 3.5, 4 and 5) were performed and observed in YEP broth. Isolates (S01, S09 and STAND) showed tolerance and growth capacity at 13% and 15% alcoholic concentration, whereas P H tolerance at 3-5, sugar tolerance at brix 10 0 -30 0 , temperature tolerance at 25 0 C and 35 0 C and fermentation showed in different sugars were screened. And finally, subjected for wine fermentation (with initial Brix 23 o and P H 4.6). Wine fermented by isolates S09, and STAND (alcohol concentration 13% and 12%) were evaluated through sensory analysis. At last, it was concluded that Mulberry fruit was suitable for wine production and fulfill the search of quality wine in future.

Keywords: Marcha, Grapes, Baker's Yeast, Saccharomyces cerevisiae, Mulberry

ENERGY EFFICIENT REFUSE DERIVED FUEL FROM PLASTIC AND PAPER WASTE

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Abstract

The study is about the production of energy efficient Refuse Derived Fuel (RDF) from plastic and paper waste. Specific paper waste (cardboards) and instant noodle wrappers (Wai Wai plastic wrappers) were used with the general objective of producing RDF as a substitute for fuelwood in kilns of Bhaktapur. RDF briquettes were produced by mixing 50 percent by weight of each of the raw materials. Cylindrical briquettes were produced from shredded raw materials using a screw extruder briquetting machine at the die temperature of 140°C. Energy content, physical properties, and proximate analysis (following the methods as described in Japanese Industrial Standards, JIS 8812) of the raw materials as well as produced RDF were studied. Emissions (SPM, CO, CO_2, NO_x, SO_x) from firing the kiln using RDF were monitored. Likewise, the cost of the RDF fuel briquettes was evaluated to get a market value in comparison to fuelwood. The results revealed that the produced RDF qualifies to be used as a fuel with a calorific value of 5316 Kcal/kg and density of 1761.174 Kg/m^3. Based on moisture content, volatile matter content, ash content, and fixed carbon were observed to be within the tolerance limits. They were tested as a substitute for fuelwood in a flower pot baking kiln in Thimi and AIT-designed Institutional Gasifier Stove (IGS). Reductions in emissions were recorded while burning RDF in comparison to fuelwood, also within the limits of promulgated standards. The cost of RDF briquettes Rs. 22.975/kg was also significantly lower than that of fuelwood. The test results showed that the performance of RDF was better than wood in terms of quality and quantity.

Keywords: Refuse Derived Fuel, Proximate analysis, Emission, Cost evaluation

"PROCESS OPTIMIZATION AND QUALITY EVALUATION OF KIWIFRUIT (*ACTINIDIA DELICIOSA)* WINE MAKING"

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Abstract

Fruits, being highly perishable commodities, they have to be either consumed fresh or processed into various products. At present, interest in functional food is rising rapidly, and fruit wines, being considered a functional drink, are attracting the attention of winemakers and consumers. Kiwifruit *(Actinidia deliciosa)* has a good source of vitamin C, exceeding that of orange, pear and apples. In this study, Optimization of process conditions for alcoholic wine production from Kiwifruit *(Actinidia deliciosa)* was achieved using 2 level full factorial designs with centre points. The factors that were considered were pulp, initial sugar concentration, and yeast *(Saccharomyces cerevisiae)* concentration with specific gravity of the wine as the response. Fermentation was carried out in two separate temperature conditions i.e. ambient temperature and controlled temperature (29^0C) inside the incubator. The raw materials (kiwi pulp) was analysed for TSS, pH, Vitamin C, titrable acidity and reducing sugar content prior to fermentation. During the primary fermentation period TSS, pH, and acidity were anlalysed at the interval of 2 days and specific gravity was analysed after the primary fermentation. The statistical tools confirmed curvature to be significant which showed that higher order model can predict the process well when augmented to Response Surface Method that estimates quadratic terms. Linear model generated can be used to predict response at the factorial points only because of the significant curvature. Minimization optimization predicted specific gravity of the wine to be 0.9780 at 75% of pulp content, initial sugar concentration of 24%, and yeast concentration of 0.706% at desirability of 0.9757. The optimum conditions were validated with little error of 0.14% confirming the adequacy of the model in predicting the process.

Keywords: Specific Gravity, Factorial design, Saccharomyces Cerevesiae.

STUDY ON CHEMICAL AND MICROBIOLOGICAL PROPERTIES OF FRUIT JUICE INCORPORATED PROBIOTIC *DAHI*

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Abstract

Dahi is an indigenous Nepalese fermented milk product known for its nutritive value and therapeutic values. The main aim of this study was to isolate and identify probiotics culture (on the basis of their colony morphology and some biochemical tests such as catalase, oxidase, CO_2 production, salt tolerance, carbohydrate fermentation and growth at different temperatures, acid resistance and bile salt resistance test) and to determine chemical and microbial properties of fruit juice incorporated probiotic *dahi*. The probiotics strains were isolated from sample (Gundruk, Radish pickle and Local *dahi*) using MRS agar as growth medium. Fruit juice (apple and papaya) at 10% was incorporated to prepare probiotics *dahi* and was analyzed. The morphological and biochemical results showed that all the isolated strains were comprised of the genus *Lactobacillus*. The probiotic potentiality of isolated strains showed positive results to the test namely resistance to acid and resistance to bile salt. It was found that fat, protein, ash content and total solid was not significance difference ($P>0.05$) than plain *dahi*, but there was significance increase in carbohydrate content for apple (4.75%) and papaya (4.78%) probiotics *dahi*. The total viable count increased significantly ($P<0.05$) while total coliform count and yeast and mold count decreased significantly ($P<0.05$) with plain *dahi*. Total viable count was maximum for apple probiotics *dahi* (5.83×10^7) and least value was observed for plain *dahi* (2.43×10^7). It can be suggested that *dahi* contained sufficient ($>10^6$) amount of culture to be defined as probiotics. The total coliform and yeast and mold count was significantly decreased ($P<0.05$) for probiotics *dahi*. It can be concluded that the fruit juice incorporated *dahi* contained significant number of probiotics by using selected starter. The functional and therapeutic value of local *dahi* can be enriched with fruit juice and probiotics content.

Keywords: Dahi, Probiotic, Total viable count and Morphology

POSTER PRESENTATION

PREPARATION OF CANDY FROM DIFFERENT FRUITS

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Abstract

Candies are palatable food item, composed of sweet taste and high calorie. Fruits are an essential component of our everyday nutrition. They supply humans with a substantial amount of vitamins, minerals, and carbs. Fruits, on the other hand, are highly perishable and consequently prone to spoiling. Processing and preserving fruits in suitably edible forms is one of the most efficient techniques to reduce nutritional loss. Four different varieties of Seasonal fruits viz. apple, guava, orange and kiwi were taken for the preparation of candy. The fully matured fruits were washed thoroughly by potable water. Fruits were peeled with a stainless steel knife. Fruits pulps without seeds were cut into 2cm pieces. Then the slices were blanched in hot water at 95℃ for 10 minutes and rinsed in tap water. Then the slices were drained out. After drained, the slices were dipped into 25%Brix syrup and heated slowly until 30, 35, 40, 45 and 50% Brix at 12 hours interval. The ratio of the fruit to syrup was maintained at 1:3 by adding syrup. At this stage 5% citric acid was added. After 24 hours interval, the material was cooked until the syrup attained 60 and 70% Brix. Then the slices were drained and dipped in water to remove adhering syrup. The sugar impregnated slices were dried in the solar dryer until the product reached the moisture content of 10%. Then the candy pieces were packed in polyethylene at room temperature (28-32℃). This study showed that seasonal fruits can be preserved by processing them into more stable forms, such as candy, to increase their shelf life.

Keywords: Candy, Fruits, Sugar

CANNING OF FISH AND MUSHROOM FOR PRESERVATION

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Abstract

Fish and mushrooms are good source of macronutrients like proteins, lipids, ash as well as micronutrients like vitamins and minerals. Both fish and mushrooms are rich in nutrients but are highly perishable. The prolong use and storage thus needs a sound preservation technique. Canning is one of the highly effective techniques that can be implemented in order to preserve fish and mushrooms. Two species of fish (Bachhuwa and Chhari) and mushroom were taken for canning process. Traditional Nepali spices viz. Tej paat, Marica, Timur and garlic were used to add flavors to the fish. Three kilograms of fish were bought from local markets of Kathmandu valley followed by washing and keeping it for about 3-4 hrs. in brine solution. It was then washed with distilled water and was placed in a sterile jar leaving head space of an inch. It was then spice-cooked for 5 mins and was covered and sterilized using an autoclave for 30 minutes. Sterile jar was allowed to cool and was placed in an inverted position for about 20 minutes to remove any air space if present. The similar protocol was followed for mushroom canning but except it was autoclaved only for 15 minutes. The fish canned jar was autoclaved twice in order to reduce the microbial counts of the dominant or dangerous microorganisms to a safe level. Canned fish was free of pathogen since no bacterial growth was observed after performing microbial count after 4th week of canning (sterilizing). This experiment thus shows the potential of canned fish and its local market in Nepal as well.

Key words: Canning, Microbial count, Nepalese spices, Sterilization

THE OCCURRENCE OF *BACILLUS CEREUS* IN ICE-CREAM SOLD IN POKHARA

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Abstract

Psychrotolerant *Bacillus cereus*, found in frozen dairy products like ice-cream, causes food poisoning due to its emetic toxin. However, *B. cereus* contamination in ice-cream sold in Pokhara has not been reported yet. This study investigated the occurrence of *B. cereus* in ice-cream samples of nine different brands in Pokhara in January-February, 2021. A total of 108 ice-cream samples were collected from the local vendors and transported to the laboratory for microbiological analysis. Bacterial contamination was examined by heterotrophic plate count technique using plate count agar. Presumption enumeration of *B. cereus* was done using Mannitol Egg Yolk Polymyxin Agar (MYPA) followed by identification of suspected pink colonies as *B. cereus* by microscopic and biochemical tests. Antibiotic susceptibility of the isolates against six antibiotics - Co-Trimoxazole, Levofloxacin, Piperacillin/Tazobactum, Chloramphenical, Erythromycin, and Ciprofloxacin was tested by agar disc diffusion method. Heterotrophic plate count revealed 91.67% (n=99) ice-cream samples were contaminated with average count of 5.25±0.78 log CFU/gm.The maximum bacterial count was observed in open cone ice-cream samples of all nine brands with average of 5.49±0.73 log CFU/gm., where as that of minimum was found in sealed cone samples (4.99±0.51 log CFU/gm). Presumptive *B. cereus* contamination was observed in 16.67% (n=18) ice-cream samples with average count of 3.52±0.25 log CFU/gm. Out of nine brands, 5 brands were contaminated with *B. cereus*. We found that sealed cone ice-cream was comparatively safer as *B. cereus* was not detected in any of the samples, and heterotrophic plate count was also minimum. Antibiotic susceptibility testing showed that *B. cereus* isolates were susceptible to all tested antibiotics except Piperacillin/Tazobactum. While further research is required, our study indicates the possibility of potential health hazard due to ice-cream consumption, so regular food surveillance is recommended.

Keywords: Ice-cream, Bacterial contamination, *Bacillus cereus*, Antibiotic susceptibility

CLONING, EXPRESSION, AND PURIFICATION OF AMYLASE GENE FROM A THERMOPHILIC BACTERIA, ANOXYBACILLUS KAMCHATKENSIS NASTPD13

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Abstract

Alpha amylases are important industrial enzymes that cleave α-1,4-glycosidic linkages in starch molecules to generate smaller polymers of glucose units. They are naturally produced by different species of bacteria and fungi. Amylases occupy about 25-30% of the world enzyme market and have numerous industrial applications such in food, fermentation, detergent, paper, textile, pharmaceutical, and fine chemical industries, *etc*. This study aimed at cloning and heterologous expression of an amylase gene from a thermophilic bacterium *Anoxybacillus kamchatkanensis* NASTPD13 isolated from Paudwar Hotspring, Nepal. The amylase gene was successfully amplified, cloned in pET-21b vector and overexpressed into *Eischerichia coli* BL21 DH5α. The clone's gene was verified by Sequencing. Sequence analysis revealed an open reading frame (ORF) of amylase had 1839 bp encoding a protein of 613 amino acid residues with catalytic binding domain (CBD20). The amylase assay was performed by 3,5- dinitrosalicylic acid (DNS) assay. The recombinant amylase exhibited significant starch hydrolysis activity.

Keywords: *Anoxybacillus*, Amylase, Overexpression, *E. coli*

ISOLATION AND CHARACTERIZATION OF LACTIC ACID BACTERIA FROM FERMENTED BAMBOO SHOOT (*TAMA*) AND its EFFICIENCY IN *TAMA* PRODUCTION

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Abstract

The objective was to isolate and characterize lactic acid bacteria (LAB) from the fermented bamboo shoot (*tama*) and determine the nutritional parameters of *tama*. A total of 20 different *tama* samples were collected from 20 districts of Nepal. The *tama* samples were inoculated on de Mann Rogosa Sharpe medium for the isolation of lactobacilli. The LAB were identified on the basis of morphological and biochemical characteristics. The species were subjected for screening on MRS medium with 1 % $CaCO_3$ to observe the zone of clearance. The isolated bacteria showing highest zone of clearance were subjected for the fermentation of raw bamboo shoot. Out of 30 isolated bacterial strains of 20 districts, 16 were *Lactobacillus* spp., 6 were *Streptococcus* and 6 were *Pediococcus* spp. and 2 were *Leuconostoc* spp. Four bacterial isolates on the basis of highest zone of clearance due to acid production were S (Ashan) 10mm, F (Greenland market) 9mm, R (Rolpa) 9mm and J (Dolakha) 8mm, respectively. In homo/heterofermentative test of bacteria, samples of Greenland market, Dolkha and Rolpa were homofermentative and that of Ashan was heterofermentative. Cultured *tama* consisted of high amount of protein (22.75%) and acid value (0.95%). Ash content was highest in sample from Rolpa (7.88%) and moisture was highest in sample from Greenland market (91.40%). There is significant difference in acid value and ash content in samples and no significant difference in moisture content of samples based on the places. The lactic acid bacteria (LAB) with higher amount of lactic acid production shown by larger zone of clearance in MRS plate containing 1% $CaCO_3$ showed good homofermentative behavior which could be used for the production of fermented *tama* products.

Keywords: Heterofermentative, Homofermentative, LABs, *Tama*.

PREPARATION OF NON-VEGETARIAN *MASAURA* AND ITS COMPARISON WITH TRADITIONAL VERSION

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Abstract

Masaura is a traditional sun-dried vegetable ball made with a combination of various or single minced vegetables with black lentils. However, other lentils are also in use. Since the fresh vegetables are highly perishable and are seasonal *masaura* become an alternative nutritious food item. Traditionally, only vegetables are used to prepare *masaura* but in the present study, we use meat to prepare *masura*. The objective of the present study is the preparation, and quality evaluation of *masaura* prepared with different ingredients. Here, three types of samples were prepared, first, the traditional one with taro and black lentils, the second with chicken and black lentils, and the third one is buff and black lentils. *Masaura* was prepared by grinding, mincing, mixing, and cabinet drying at a temperature of 60 degrees till the moisture remained 10 % of the total weight. Physicochemical analysis, sensory analysis, and proximate analysis of all the prepared samples were studied. The study shows that all the sample has constant moisture till 60 days from preparation. The protein content of the chicken *masaura* is higher than others is 45.28%. The Carbohydrate content of vegetables, chicken, and buff *masaura* was found to be 63.8%, 27.12%, and 52.12% respectively. The energy was calculated as 341, 419.3, and 394.14 kcal/100g from the sample taro, chicken, and buff respectively. Among all the samples, *masaura* from the chicken was found best in terms of various quality attributes. It can be concluded that nutritious *masaura* can be prepared by using meat and vegetable apart from the traditional one.

Keywords: Traditional food, *Masaura*, Taro, Nutritional analysis,

COMPARATIVE STUDY ON THE PRODUCTION OF LOCAL NEPALESE ALCOHOL USING TRADITIONAL AND MODIFIED LABORATORY METHOD.

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Abstract

Alcohol has been consumed as refresher in Nepal since centuries. However, the production of local beverages is still facing obstacles compared to industrial liquors. The probable reason could be the lack of standard protocol, the amount and types of raw materials used by the locals to produce alcohol which varies quality of liquors. This study aims to compare the alcohol production between traditionally practiced methods and optimized lab conditions using locally available Marcha and to isolate the yeast strains present in Marcha .Based on different criteria (pH, temperature, brix, agitation) optimization of alcohol production was performed. To prepare corn based alcoholic beverage, corn flour and malted barley were used as fermentation media. The yeast source used was Marcha. Following optimized parameters during fermentation and distillation, it was found that the yield ratio increases by double as compared to traditional method. Gas Chromatography showed that the distillate contained 42% ethanol and only a trace amount of other impurities like methanol. Ten yeast strains were isolated from six randomly collected samples of Marcha using Yeast Malt Agar. Based on microscopic observation, biochemical tests and molecular analysis, five strains were selected as possible *Saccharomyces* strain. The selected yeast strains showed tolerant characteristics to stressful conditions like temperature and salinity. They were able to grow at 37° in presence of 1.5M NaCl. These isolates tolerated up to 15% (v/v) ethanol. The selected isolates were able to ferment glucose, galatose, sucrose, maltose, raffinose but not lactose. Mixed culture of isolated yeast strains was found to be possible replacement to commercial brewing yeast.

Keywords: Alcohol, Marcha, Fermentation, Distillation, Saccharomyces spp.

EFFECT OF GERMINATION ON CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF AMARANTH GRAIN

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Abstract

Changes in chemical composition and nutritive value of amaranth grain (*Amaranthus hypochondriacus* L.) during germination were investigated. Amaranth grain grown in Dolakha, Nepal was steeped in water for 12h, drained and then germinated at room temperature for up to 72h. Chemical composition, nutrients and anti-nutrients were analyzed at 24h, 48h and 72h of germination time. Significant difference ($p \leq 0.05$) was found in all the values of the parameters analyzed at these germination times. In the germination time of 24h, 48h and 72h, the moisture content increased by 4.21, 5.71 and 6.08 fold; protein increased by 7.74, 13.8 and 22.74%; crude fiber increased by 22.8, 59.67 and 73.72% and ash content increased by 8.79, 12.82 and 15.38% respectively. The fat content decreased by 28.21, 58.89 and 79.32% and carbohydrate content decreased by 0.8, 2.05 and 2.88% respectively. Starch content decreased by 7.1, 9.98 and 13.31% whereas reducing sugar and total sugar content increased by 2.17, 3.44 and 5.28 fold and 2.44, 3.23 and 4.5 fold respectively. The minerals iron increased by 29.29, 85.42 and 103.95%; calcium increased by 21.9, 29.55 and 38.08%; sodium increased by 14, 50.02 and 63.28%; potassium increased by 8.19, 15.82 and 19.79%; phosphorous increased by 11.64, 20.85 and 27.34% and vitamin C increased by 42.41, 66.31 and 81.22% respectively. The anti-nutrients tannin decreased by 19.83, 33.04 and 45.59%; oxalate decreased by 21.62, 37.72 and 48.24% and phytic acid decreased by 22.14, 50.79 and 56.37% respectively. Total phenolic compound also increased by 43.81, 126.62 and 202.51% showing increased antioxidant activity by 35.86, 63.58 and 76.26% respectively. The study showed significant improvement in nutritive value and functional property of amaranth during the course of germination.

Keywords: Minerals, Anti-nutrients, vitamin C, Carbohydrate, Amaranth germination.

NUTRITIVE VALUE AND ANTIOXIDANT ABILITY OF FRESH JUICE OF *PHYLLANTHUS EMBLICA* FRUITS

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Abstract

Phyllanthus emblica (Phyllanthaceae), a small to medium-sized tree is distributed throughout Nepal between 100-2000 m. *The fruits are eaten fresh and also used to make pickle. The present study was carried out to evaluate the* physico-chemical, nutritional and *antioxidant property* of the fresh juice of *Phyllanthus emblica* fruits. The study revealed that the juice was acidic in nature and contains 1.26 ± 0.2mg/mL of protein and 10.86 ± 0.3mg/mL of carbohydrate. Total soluble solid, total solid, titrable acidity, specific gravity and viscosity of the juice were recorded as 12.5^{o}Bx, 12.45%, 2.83%, 1.045gm/ml and 2.06Ps respectively. The moisture and ash content of the sample was found to be 87.55% ± 0.5 and 0.52% ± 0.06 respectively. The juice was rich in ascorbic acid, total phenolics and flavonoids and showed excellent antioxidant activity. The present analysis indicates that the fruit juice of *Phyllanthus emblica* is good source of natural antioxidants.

Key words: Wild edible fruits, *Phyllanthus emblica*, Juice, Antioxidant activity, Proximate analysis, Phytochemicals

DETERMINATION OF PROXIMATE, PHYTOCHEMICAL, ANTIOXIDENT AND ANTIMICROBIAL PROPERTIES OF DIFFERENT SPICES

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Abstract

The study was done under the Food Green City program at NAST and the aim of this study was to determine the proximate, phytochemical, antioxident, and Antimicrobial properties of different spices by following standard protocol. Altogether 11 spices samples *Cuminum cyminum L.* (Cumin), *Coriandrum sativum* L.(Coriander), *Brassica juncea L.*(Mustard), *Foeniculum vulgare Mill.*(fennel), *Thymus vulgaris L.*(thyme seed), *Lepidium sativum L.*(Garden cress), *Linum usitatissimum L.*(flaxseed), *Pimpinella anisum*(Aniseed), *Raphanus sativus* seed(radish seeds), *Nigella sativa*(Black cumin), *Trigonella foenum-graecum L.*(fenugreek seeds). The moisture content was determined on a dry weight basis.The highest moisture content was shown by radish seeds of 13.4% and the lowest by Garden cress of 2.9%.The highest ash content was shown by fennel seeds of 13.4 and the lowest was shown by mustard of 1.5%. In qualitative test, most of the samples showed presence of saponin, reducing sugars, terpenoids, steroids,alkaloids,tannins and flavonoids. However, in four samples, flavonoid and quinone was absent. The antimicrobial test of all the samples were performed by well diffusion method.The organisms used were *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa and klebsiella pneumonia.* In *E.coli,* the *Coriandrum sativum* L inhibited maximum zone of inhibition of 8mm at 400µg/mL concentration and *Thymus vulgaris L* inhibited minimum zone of inhibition of 3mm at 300µg/mL concentration. In *Pseudomonas aeruginosa, Cuminum cyminum L, Thymus vulgaris L, Coriandrum sativum* L and *Pimpinella anisum* showed zone of inhibition of 8mm, 6mm, 6mm and 3mm respectively at 300µg/ml concentration at 400µg concentration the following samples showed 10mm,5mm,7mm,4mm. No zone of inhibition was shown in *klebsiella pneumoniae.* Further, proximate, phytochemical, antimicrobial and antioxidant properties of the samples is still to be done.

Keywords: Spices, Antimicrobial activity, Phytochemical, Antioxidant, Proximate analysis

CONTAMINATION LEVEL, ANTIBIOTIC RESISTANCE PATTERN AND PLASMID PROFILE OF BACTERIA ISOLTED FROM GROUND WATER IN KATHMANDU VALLEY.

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Abstract

Water is essential to life. The existence of all forms of life is dependent on an adequate water supply. In Kathmandu valley, a large urban center in Nepal, ground water and surface water are the main sources of drinking water as the population has increased in Kathmandu valley half of the valleys water supply is derived from groundwater for various uses like for drinking water, for domestic uses etc. Chemical and microbial contamination of ground water is a serious problem of Kathmandu valley this study was carried out to determine the microbial counts, antibiotics susceptibility and plasmid profile of bacteria isolates from ground water of Kathmandu valley. In this study , water sample were collected from different site of Kathmandu valley and the physio-chemical parameters of water sample were performed i.e. total hardness, chloride, ammonia, iron , nitrate, turbidity ,PH, Temperature , electrical conductivity using standard protocols. The turbidity, conductivity, ammonia, nitrate, pH and iron content were found to be higher than Nation drinking water quality standard (NDWQS). Which is 38%, 3%, 41%, 4%, 15%, and 56% respectively .The total bacteria and coliform counts were determined using pour plating method and also using standard membrane filtration technique to quantify the bacterial contamination. The organism isolated are *E.coli*, *Klebsiella* and *shigella* respectively. Further identification of organisms, their antibiotic susceptibility test and plasmid profile of bacteria is to be done.

Keyword: Antibiotic susceptibility, Coliforms, Ground water, Plasmid profile

STUDY OF PROXIMATE, PHYTOCHEMICAL, ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES OF PLANTS USED IN HERBAL TEA

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Abstract

Herbal teas are increasingly being popular as various studies have revealed their health beneficial roles like antidiabetic, antiallergic, antioxidant property etc. The study was done under Food Green City program at NAST and the aim was to study the proximate compositions, phytochemicals, antioxidants and antimicrobial activity of common plants used in herbal tea preparation. Nine different plant samples viz. *Matricaria chamomila*, *Zanthoxylum armatum*, *Perilla frutescens*, *Cymbopogon citratus*, *Cinnamomum tamala*, *Gomphrena globosa*, *Tinospora cordifolia*, *Ocimum tenuiflorum* and *Mentha* × *piperita* were collected from various location in Nepal and were studied. The highest amount of protein content was found in *O. tenuiflorum* (12.12 ± 0.4 %) and the lowest in *T. cordifolia* (5.6 ± 0.51 %.). Similarly, the highest amount of fat content was found in *Z. armatum* (13.2 ± 0.36 %) and the lowest was exhibited by *T. Cordifolia* (around 1.4 ± 0.6 %). The highest amount of phenolic content was observed in *G. globosa* which was 350.76 ± 0.6 µg per 100 mg of sample and the lowest amount was seen in *T. cordifolia* which was 68.10 ± 0.5 µg per 100 mg of sample in terms of Gallic Acid Equivalent (GAE). The highest amount of lycopene content was observed in *O. tenuiflorum* which was 0.833 ± 0.03 µg and the lowest amount was observed in *C. citratus* which was 0.146 ± 0.05 µg per 100 mg of the samples. Similarly, the highest concentration of β-Carotene was exhibited by *C. citratus* which was 1.172 ± 0.06 µg and the lowest concentration was seen in *G. globosa* which was 0.332 ± 0.03 µg per 100 mg of the samples. The plants were found to possess substantial amount of phytochemicals. Other parameters like antioxidant activity, ascorbic acid content etc. are still being studied.

Keywords: Antibacterial activity, Herbal tea, Phenolic content, Phytochemicals

OPTIMIZATION AND BIOCHEMICAL CHARACTERIZATION OF THERMOSTABLE AMYLASE FROM ANOXYBACILLUS KAMCHATKENSIS NASTPD13 ISOLATED FROM HOT SPRING OF NEPAL

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Abstract

Amylases are crucial enzymes that hydrolyze internal glycosidic linkages in starch and similar polysaccharides. Starch is an important food product and also a versatile material used worldwide for different industrial and non-industrial applications. An efficient amylase producer i.e *Anoxybacillus kamchatkensis* NASTPD13 isolated from Paudwar hot spring was selected for optimization and characterization. The organism was optimized for a high amount of amylase production at 55^{o}C, pH 10 in a media containing 2.5 % starch as carbon source, and 0.5% tryptone as nitrogen source at 3 days of incubation. The organism was then incubated in optimized conditions for three days and was subjected to purification by ammonium sulfate precipitation, dialysis, and column chromatography. The purified enzyme showed optimum activity at 60^{o}C, pH 6 on 30 minutes of incubation. The enzyme was quite stable at high temperatures and it retained its activity even upon incubation at 100^{o}C for 1 hour. It also retained maximum activity after 25 days of incubation when stored at a temperature of -20^{o}C. As to our results, *Anoxybacillus kamchatkensis* NASTPD13 is a thermophilic bacteria that can produce a high amount of amylase at higher temperatures and thus this characteristic can be utilized for several benefits, especially in the fields of food processing, biodegradation, and several other industries.

Keywords: Amylase, Anoxybacillus, Thermophile, NASTPD13

COMPARATIVE STUDY OF PROXIMATE COMPOSITION, PHENOLIC COMPOUND, ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF PEEL & PULP OF DIFFERENT FRUITS.

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Abstract

The study was done under the Food Green City program at NAST and the aim was to compare the proximate composition, phenolic compound, antioxidant and anti-microbial activities of peel and pulp of different fruits. Six types of fruit, Persea americana (Avocado), Hylocereus undatus (Dragon Fruit), Carica papaya (Papaya), Actinidia deliciosa (Kiwi Fruit), Vitis vinifera (Grapes), and Citrus X sinensis (Orange), were collected from the local market of Kathmandu valley. The moisture content was determined on a fresh weight basis. The results revealed that dragon fruit peel (D1) showed the highest moisture contained 90.03% and the lowest in avocado peel (A1) which was 67.04%. Similarly, the highest amount of ash content was found in kiwi pulp (K2) which was 8.75% and the lowest in avocado pulp (A2) which was 1.05%. Similarly, the highest fat content was found in avocado pulp (A2) which was 19.80% and the lowest in grape pulp (G2) which was 1.02%. The phytochemical analysis of extracts revealed the presence of saponin, reducing sugar, terpenoids, steroids, alkaloid, tannins, and flavonoids in most of the samples. In antimicrobial activity studied against Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae and Pseudomonas aeruginosa, Staphylococcus aureus was inhibited by grapes pulp with a maximum zone of inhibition of 20mm at the concentration of 400µg/ml and Escherichia coli was inhibited by kiwi pulp with least zone of inhibition of 7mm at the concentration of 300µg/ml. Most of the extracts were least effective against Klebsiella pneumonia. These results showed that the peel and pulp of fruits were rich in bioactive compounds, ash, and fat and suggest its use as an additional source of food, food preservatives, and medicinal formulation for human consumption. Other parameters like fiber content, antioxidant activity, ascorbic acid content, protein content, flavonoid, total phenolic content etc. are still being studied.

Keywords: Peel, Pulp, Antioxidant activity, Proximate analysis, Phytochemicals.

ENGINEERING AND SUSTAINABLE DEVELOPMENT

THEMATIC SPEAKER

ENGINEERING AND SUSTAINABLE DEVELOPMENT

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Abstract

Engineering is vital for any society. The well-being and robustness of any society are dependent on the acquired technological development. The promotion of different engineering discipline plays a key role in the sustainable development of society. Engineering is continuously being developed and updated so that it can enlighten and improve the lifestyle of the community. Engineering drives economic growth and alleviates poverty through basic infrastructure development. Individuals working as engineers can provide services and train future generations of engineers, scientists, technologists, economists, and politicians who will bear the brunt of leading and directing this world of ours into the future. In addition, the Government of Nepal needs to proactively conduct various studies to determine the roles and responsibilities of the 70,700 engineers so that maximum efforts of the engineers can be utilized for the sustainable development of the Nation. With the development of federal system of Nepal, the reach of engineers has reached to ground level i.e. in different municipality, but the access to engineers has been limited to technical aspects only. The lack of engineers in policy and planning along with managing of fund has restricted engineers to fully utilize their capacity for sustainable development of the nation.

Keywords: Engineering, Sustainable development, Technologies

INVITED SPEAKER

NEPAL'S CLEAN ENERGY TRANSITION FOR NET ZERO EMISSIONS BY 2045

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Abstract

Nepal has set goal to achieve net zero emissions by 2045 through the Long Term Strategy announced subsequent to the second Nationally Determined Contribution (NDC). The second NDC has identified energy sector as the major mitigation sector contributing towards emissions reduction through activity based and policy targets. According to Economic Survey published by Ministry of Finance in 2022, traditional biomass (firewood, agriculture residue and cattle dung), commercial sources (petroleum products, coal and grid electricity) and renewables (micro mini hydro, solar and biogas) contribute 65%, 32% and 3% respectively in the Nepal's total energy mix. To achieve the net zero emissions goal, Nepal needs to meet the electricity generation targets of 15,000 MW by 2030, set up and pursue high targets of electricity generation beyond 2030, and achieve a drastic reduction in the use of traditional biomass and petroleum products by transitioning towards electric cooking and electric vehicles. This paper presents the status of Nepal's energy sector, briefly describes the goals set under the 2nd NDC and discusses on the clean energy transition priorities with respect to accomplishing the net zero emissions commitment of the nation.

Keywords: Emissions Reduction, Renewable Energy, NDC

ORAL PRESENTATION

PERFORMANCE ANALYSIS OF A HYDROPOWER SIDE INTAKE USING ANSYS-FLUENT

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Abstract

The hydraulic performance of a hydropower side intake can be analysed with the physical and Numerical simulation. The software ANSYS Fluent is used for the numerical simulations to find the velocity contour, pressure contours, velocity vectors, and vorticity at characteristic horizontal and vertical planes. As a case study, the three side intakes of the Betan Karnali Hydroelectric Project have been provided to pass the design discharge of 536 m^3/s during the dry season and maximum discharge of 551.37 m^3/s during the wet season from the reservoir. The head-loss due to piers, bell mouth and transition from rectangular to circular section has been compared with the calculation from the empirical formula. The 3D model and tetrahedral meshing have been prepared and set with the boundary condition for the simulation. It is found that the geometry of intake with response to the reservoir influences the symmetric flow through each opening of intake. A comparison has been made for the modified geometry concerning the original geometry. The symmetric flow in modified geometry shows better hydraulic performance than the original geometry.

Keywords: Physical and Numerical Simulation, Head loss, Hydraulic Performance, Hydroelectric Project, *3-D model*

FACTORS AFFECTING THE PRODUCTION OF BIODIESEL

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Abstract

Biodiesel is one of the alternatives to conventional diesel. Both edible and non-edible sources can produce biodiesel. Edible sources, including mustard, soybean and sunflower and non-edible such as castor, Jatropha and animal fats, are the major sources of biodiesel production due to their availability and high conversion rate. One of the major drawbacks of biodiesel is higher fatty acid content and higher viscosity content. This research focuses on steps to reduce free fatty acids through esterification and transesterification processes and operating parameters such as concentration of acid and base catalyst, reaction time, agitation speed, and water temperature for washing for the production and recovery of biodiesel. On a laboratory scale, various samples of biodiesel are prepared from discarded cooking oil, palm oil, soybean oil, and buffalo tallow. For higher free fatty content biodiesel, two-step transesterification is the best option where moderate H_2SO_4 concentration and lower KOH concentration at higher reaction rpm and reaction one hour gives higher yield. In contrast, for lower FFA content oil, single-step transesterification is the best option where at lower KOH concentration and at higher rpm and reaction time of one hour gives the higher yield. It is found that the water's temperature directly affects the recovery percentage, and repetition of washing is reduced from 5 steps to 3 while using water at a temperature above 60°C.

Keywords: Biodiesel, Free Fatty Acid (FFA), Reaction time, Catalyst concentration, Agitation speed (RPM)

DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF MIXED-MODE SOLAR TUNNEL DRYER FOR BUFFALO MEAT BY FORCED CONVECTION

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Abstract

In context of Nepal, the consumption and preservation of meat product has been in practice since ages. The conventional way of preserving meat for longer period is by using open sun drying technique which can contaminate the meat. In addition, the direct UV rays of the sun can damage the meat and hampers the quality of dried meat which may not be suitable for consumption. The liquid components in the meat may evaporate in open air and the flavor of the meat may decline. This technique can take longer period of time to dehydrate the meat product. Mixed mode solar dryer is a revolutionary method to undertake the challenges which uses both solar heated air and direct solar energy. This study focuses on design, fabrication and performance evaluation of solar mixed mode tunnel dryer by forced convection for buffalo meat. It was designed for the purpose of drying 4kg meat for humid sub-tropical climatic condition. The components of drying system included V-corrugated collector of 2 m² area, drying chamber and DC fan. With designed drying time of 7.7 hours, the dryer was subjected to three dry runs with no meat, 1.5kg meat and 4.5kg meat respectively before final test with design load of 4kg meat was carried out. Incident solar irradiance, air temperature relative humidity of air and weight of meat at equal intervals were recorded. It took 12 sunshine hours for drying designed load of buffalo meat to 1.57 kg final weight and maximum collector efficiency was recorded as 30.39% during the month of November.

Keywords: Preservation of meat, Solar mixed mode dryer, Sub-tropical climate, V-corrugated collector.

LABORATORY AND IN-SITU TEST OF ROCK MASS FOR THE DESIGN OF TUNNEL SUPPORT IN NEPAL

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Abstract

Laboratory testing is the basis for studying rock mechanics, and design parameters in tunnel, underground or rock engineering projects. This paper presents a series of laboratory experiments and in-situ measurements of intact rock collected from different hydropower projects in Nepalese Himalaya to design the necessary tunnel support at existing in-situ site conditions. The Tunnels of Hydropower projects such as Super Madi, Dordi, Upper Dordi, and Tanahun were visited for the sample collection and in-situ strength testing. Fifty-nine intact rock samples were collected and tested in the Rock Mechanics and Rock Engineering laboratory in the Department of Civil Engineering, Kathmandu University, according to ASTM and ISRM standards. The tests conducted were Uniaxial compression, Point load, and Brazilian tensile strength tests. Schmidt hammer was used to measure the in-situ strength of rock mass. The mechanical parameters of surrounding rock mass, such as uniaxial compressive strength, tensile strength, elastic modulus, Poisson's ratio, and internal friction angle, were obtained from the intact rock using Generalized Hoek Brown Failure Criteria for Finite Element Modelling (FEM) of the tunnel. Under in-situ site conditions, the damage characteristics of rock mass around the tunnel are analyzed, and necessary tunnel support is designed. For ensuring the stability of tunnel support, gravity-induced failures such as block failure, wedge failure, plane failure and stress-induced failures such as squeezing are considered against tensile strength, compressive strength and shear strength in prevailing in-situ stress and induced stress due to heading and benching of tunnel excavation. The support system consisting of anchor rock bolts, steel ribs and reinforced concrete has been used as the support. It is suggested that the method should be adopted as it guides designing the safe and efficient support system of the tunnel for the case of Nepal Himalaya.

Keywords: Laboratory testing, Rock Mechanics, Tunnel, Finite Element Modelling, Generalized Hoek Brown Failure Criteria

EFFECT OF JACKETING ON SEISMIC PERFORMANCE OF BRIDGE PIER

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Abstract

Most of the highway bridges are getting older and have low seismic capacity. In order to enhance the seismic capacity of bridges jacketing technique are used. This paper presents the effect of jacketing on the seismic performance of the bridge pier. Nonlinear Static (Pushover) analysis was used to determine the capacity of the bridge pier. Nonlinear Time History analysis was used to determine the seismic demand to the bridge pier. The main objective of the study is to quantify the effect of jacketing (steel jacketing, Reinforced Concrete jacketing, CFRP jacketing) on the seismic performance of the bridge pier using fragility curve with the help of software (CSI Bridge). The probability of exceeding the different defined damage state with respect to demand was determined and First Order Second Order method (FOSM) was used to develop the fragility curve. From the study, it is found that there is significant enhancement in the seismic performance of the bridge pier after the use of jacketing.

Keywords: Seismic Performance, Fragility curve, Damage state, Pushover analysis, Time history analysis.

SYNTHESIS AND CHARACTERIZATION OF ACTIVATED CARBON DERIVED FROM TRIPHALA SEEDS STONE FOR ENERGY DEVICES

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Abstract

Nanoporous carbon materials exhibit high surface area due to well-defined pore structure. Because of which the activated carbon prepared from biomass could be suitable low-cost electrode materials for high performance electrochemical supercapacitors. Here we prepare the novel nano-porous activated carbon from Triphala in a definite ratio of Harro, Barro and Amala seeds stone. The prepared activated carbon is characterized by Iodine and Methylene blue adsorption properties. Here Zinc Chloride is used as an activating agent for the precursor. The effect of carbonization time and carbonization temperature was studied. The experimental result indicates that at a mixing ratio 1:1 carbonized for 4h at 400^0C for the Triphala seeds stone shows high value of iodine number and methylene blue number as 1015.43mgg^{-1} and 375.77mgg^{-1} respectively. The surface area and the pore volume of the sample were found as 1073.64m^{2}g^{-1} and 0.8841cm^{3}g^{-1} respectively. The high value of iodine number and methylene blue number indicate that the prepared sample have well-defined micro and mesopore structure with high surface area and pore volume. This shows that prepared nanoporous carbon material led to their excellent electrochemical supercapacitance performance.

Key words: Biomass, electrochemical performance, Supercapacitor, Nano-porous, Chemical activation

IMPACTS OF AND FACTORS AFFECTING RED-LIGHT VIOLATION BEHAVIOR OF PEDESTRIANS: A COMPARATIVE REVIEW

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Abstract

Among all the reasons for pedestrian-vehicular crashes in signalized crosswalks, pedestrians' red-light violations are one of the main ones. At the signalized crosswalks, normally, pedestrians are sequentially separated from vehicles (unlike unsignalized crosswalks) because of traffic signals. However, in unfortunate circumstances, pedestrians' signal violations, especially red-light running (RLR), can expose them to vehicles leading to potentially fatal crashes. Contemporary literature hosts a myriad of profound findings on the red-light violation behavior of pedestrians. Most of the relevant literature falls under the human behavior prediction modeling, employing social parameters such as platoon behavior, violation imitation and demographics. They are also relevant to, non-social parameters such as pedestrians' waiting time, geometric parameters, traffic/flow attributes and even environmental conditions. It utilizes logistic regression, one of the most popular machine learning algorithms falling under the Supervised Learning Technique. As per the literature, studies investigating the impact of social and non-social factors on risky crossing behavior were conducted in developed countries, but only a few types of research have been conducted on LMICs. The ever-increasing growth of the urban population in developing countries, such as Nepal, commands immediate attention to the safety-related issues of pedestrians. Zhang et al. (2016) concluded that with every 1000 increase in population there would be a 1.4% increase in pedestrian accidents. Further, pedestrians in LDCs such as Nepal are less likely to comply with the rules and regulations due to incompetent enforcement and poor infrastructure. Thus a study concerning RLR violation behavior of pedestrians and the contributing factors towards it is of the utmost importance in LDCs like Nepal to plan and design safe crossing facilities. Understanding pedestrian behavior in urban areas (specifically signalized crosswalks) might go a long way in building a safe and efficient pedestrian facility.

Keywords: Red Light Running, Crosswalks, Pedestrian Behavior, Supervised Learning Technique, Pedestrian-Vehicular Crashes

REMODEL CYBERSECURITY POLICIES FOR INCREASED FLEXIBILITY IN THE E-GOVERNANCE, OF NEPAL

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Abstract

The cyber security policy adopted for e-governance in Nepal is currently unable to address the changing needs due to the rapidly growing use of information and communication technology. Furthermore, the weak cyber security regulation and policy, and lack of skilled specialists create more challenges in responding to cyber incidents. State of the art cyber security policy is required for the secure and uninterrupted functioning of any e-governance. The main objective of this study is to identify cyber security issues in e-governance that needs to be considered by policy-makers. Other objectives are to classify threats, identify services and mechanisms to protect from threats, and to recommend developing a cyber-security policy's life cycle. This study found that developing nations often take the existing cyber security policy from developed nations as a reference. For example, the Department of Information Technology, Nepal, has created a national organization for cyber security defense, the so-called Computer Emergency Response Team (NP CERT), based on an organizational framework like developed countries. The cyber security policy should be tailored and updated according to Nation's unique requirements. The activity of updating the cyber security policy is not a one-time process. It requires continuous effort to design and develop the required policy, and this study recommends the necessary steps. Finally, it recommends the development life cycle of the cyber security policy for e-governance, in Nepal.

Keywords: Information and Communication Technology, Cyber Risk, Computer Emergency Response Team, Forensic investigation, Cyber Crime

VIBRATION MONITORING IN ELECTROMECHANICAL COMPONENTS OF HYDROPOWER

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Abstract

The increase in vibration level in electromechanical equipment viz. turbine-generator reduces the expected life of bearings, and seals and produces damages to the equipment by generating heat and the vibration that occurs in the unbalance state. It could reach dangerous levels for hydraulic turbines. Monitoring vibration of the electromechanical equipment of hydropower improves the performance of the equipment by minimizing the damage and breakdown chances, and lengthen the equipment life. Vibration problems on turbine runner and rotor is caused by mechanical imbalance, hydraulic imbalance, misalignment, cavitation, turbine bearing instability, rough zone operation, improper lubrication of mechanical parts, defective bearing, breakage of wicket gate linkage, cracked or chipped blades, and shafts. In rotor, vibration is also caused by the rubbing of rotor. Vibration in the hydraulic turbine is due to extreme force fluctuations caused by cavitation and the problems then shift to other components like gear and generator in long run. The amplitude of vibration needs regular tracking in any machinery equipment, and if helps us to identify and predict the severity and time to maintain the particular equipment. The breakdown maintenance time could be delayed by monitoring and evaluating the parameters observed. Fluke 810 Vibration Tester was used to study the vibration level of some hydropower plants in Nepal. The real-time monitoring of the electromechanical equipment with vibration tester has given the reliability of maintenance practices to avoid the severe damages. In this paper, the cause of vibration, its impact, remedies, and the vibration monitoring method in electromechanical equipment are studied.

Keywords: Hydropower, Electromechanical, Vibration tester

AN OVERVIEW OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE FIELD OF GEOTECHNICAL ENGINEERING

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Abstract

Geotechnical engineering is the study of earth materials to design construction on, in, or with geo-materials, i.e., soil and rock. It is mainly based on empirical, mathematical, and statistical methods. However, since soil and rocks are complex in their behavior, there is high uncertainty regarding modeling and design. With the help of high-performance computers, sensors, data visualization, and enhanced soil testing, remarkable scientific growth in this specialization have a significant history. In recent years, the application of artificial intelligence (AI) has been a major topic in geotechnical engineering. This paper presents a detailed review of the application of AL methods and algorithms in geotechnical engineering based on published literature and articles. AI systems are used to predict many aspects of geotechnical engineering where uncertainty exists such as rock and soil properties; prediction of settlement, bearing capacity, and liquefaction; long-term performance of pavements; and rock fall and slope stability evaluations, tunneling and tunnel boring machines. These systems are used wherein human interventions are difficult concerning the safety of workers and engineers and minimization of economic losses. The most extensively used AI method is an artificial neural network (ANN), followed by SVM, ResNet, AlexNet, FIS, and LSTM. From the observation, it can be concluded that AI systems have been successfully used to solve various problems in geotechnical engineering with better performance than traditional methods. However, its practical applicability is still a major issue as it requires a high level of expertise. The study shows that the accuracy and performance of these AI methods are largely dependent on the number of datasets and input parameters. This paper presents the methods of artificial intelligence and concludes further research and practical application in geotechnical engineering.

Keywords: Geo-Materials, Soil and Rock, Big-Data, Tunneling, Occupational Safety, Artificial Neural Network

CURTAIN GROUTING AT MIDDLE TAMOR HYDROPOWER DAM: DESIGN BASIS, METHOD AND LESSON LEARNED

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Abstract

Middle Tamor Hydropower Project (MTHP) is a 73 MW run-of-river (RoR) project located in Taplejung district, Province No. 1, Nepal. The water of Tamor River is diverted by constructing the 10.5 m high and 55 m long overflow concrete gravity floating dam. The weir is constructed over the alluvial deposit, mainly fine-grained sand. The stability of this kind of floating dam can be impacted by the uplift force caused by the water seeping under the dam. A 7 m deep cut-off wall, an upstream apron slab, and a geo-liner have been provisioned in the design to minimize the seepage underneath the dam. As the foundation of the weir comprises fine-grained sand which is permeable, the necessity of the impermeable layer across the weir was identified. This impermeable layer across the weir was achieved by curtain grouting. Thirty-eight holes were drilled up to 17 m in two rows in a staggered pattern. These boreholes were injected with neat cement grout of water-cement ratio 0.5 without any additives with injection pressure up to 15 bar. The bottom-top grouting approach with a single mechanical packer was opted to ensure a design methodology that complies with the standard practice in Geotechnical Engineering. Seventy-one tons of cement were consumed during this grouting process. The methodology has performed satisfactorily considering the limited equipment, experience and timeline.

Keywords: Gravity Floating Dam, Dam Stability, Cut-off Wall, Seepage, Cement Curtain, Uplift Pressure, Geotechnical Engineering.

ENERGY-EXERGY ANALYSIS OF BIODIESEL BLENDS PRODUCED FROM WASTE COOKING OIL ON A SINGLE-CYLINDER DI ENGINE

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Abstract

The present work includes the effect of various blends (5%, 10%, 15%, 20%, and 25% concentration by volume) of biodiesel produced from waste cooking oil (WCO) of mixed nature, with diesel on a thermal map. Biodiesel grade oil was obtained by using mixed waste cooking oil undergoing single-step transesterification with methanol as alcohol and Potassium hydroxide (KOH) as the catalyst. The conversion rate was found to be 91% and the fuel property of blends of WCO was comparable to diesel. The blends of WCO were tested on a single-cylinder diesel engine with a 17.5 compression ratio at 1500 rpm with a load varying from 0.5 kg to 12 kg. From the first law of thermodynamics, heat generated in the combustion chamber is converted to useful work i.e. heat equivalent to brake power (HBP), and losses are heat loss in jacket cooling water, heat loss in the exhaust gas, and heat loss due to radiation. From the thermal balance sheet, it was found that HBP of blends of WCO was lower than conventional diesel and the optimum blending ratio was found to be 20 % WCO where the difference between HBP of both tested samples is marginal. The result indicates that blends of WCO offer lower exhaust gas temperature than diesel and with the rise in blending ratio, the exhaust gas temperature (EGT) of blends of WCO decreases.

Keywords: Thermal balance sheet, Heat equivalent to brake power (HBP), Heat loss in jacket cooling water (HJW), Heat loss in the exhaust gas (HExg), Heat loss due to radiation (HRad), Waste cooking oil (WCO), Exhaust gas temperature (EGT)

SBAS BASED AIRCRAFT FLIGHT PROCEDURE ANALYSIS IN NEPAL

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Abstract

Global Navigation Satellite Systems (GNSS) is a key to the Performance-Based Navigation (PBN) that has been adopted worldwide in aircraft navigation services. As a contracting state of the International Civil Aviation Organization (ICAO), Nepal is committed to the PBN plan to enhance the efficiency of Nepalese airspace and air navigation services. There are dedicated short-term, mid-term, and long-term plans to improve the technologies in aircraft procedures design, navigation systems, and surveillance systems, mostly based on the use of GNSS. The GNSS working group at NASO thrives to facilitate the GNSS capacity-building program for aviation and is collaborating with a group of undergraduate and graduate engineering students from various universities to generate competent manpower. The current project explores the existing limitations in the CNS/ATM technologies in Nepal that can be overcome by the use of GNSS. In a mountainous country such as Nepal where the installation of ground-based navigation aids is not suitable, the benefits of GNSS-based flight procedures and surveillance are immense. In particular, for the approach and landing phases, the vertically guided procedures using the GNSS Space-Based Augmentation Services (SBAS) is a proven procedure that can substantially modernize Nepalese airspace. Therefore, the project has characterized the SBAS performances in Nepal and has proposed the implementation of SBAS-based flight procedures. The project is a first of its kind in Nepal as the existing literature do not provide any evidence of GNSS performance analysis for PBN implementation. The technical assessments of the Nepalese aviation sector by international companies have regularly stressed a need of GNSS centric CNS and relevant skilled GNSS manpower in the CNS/ATM sector.

Keywords: PBN, GNSS, CNS/ATM and SBAS

FRACTAL CHARACTERISTICS OF THE SEISMIC SWARM SUCCEEDING THE 2015 GORKHA EARTHQUAKE IN NEPAL

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Abstract

This study discusses the regional distribution of the b-value, box-counting fractal dimension (D_0) and correlation fractal dimension (D_2) of the 2017-2019 seismic swarm. The swarm location was about 30 km north of the epicentre of the 2015 Gorkha earthquakes in the high topography of the Manaslu-Himalchuli range. The b-values are estimated from the maximum likelihood approach, while fractal dimensions are estimated from the generalized fractal dimension approach. Using the overlapping moving window method, we study temporal variations in b-value, D_0 and D_2. The b-value estimated was 1.82 ± 0.02 for the swarm sequence, its maximum value was 2.97 ± 0.14, and its minimum value was 1.81 ± 0.07 for different temporal windows. D_0 values range from 0.55 ± 0.02 to 1.68 ± 0.08 for different temporal windows and correlation fractal dimension ranges from 0.27 ± 0.07 to 0.78 ± 0.02 for the same windows. A positive correlation between fractal dimensions and a negative correlation between fractal dimensions and the b-value were observed in the study. The seismic moment released during the 2017-2019 swarm was around 2.0×10^{17}Nm. The large b-value (1.82) obtained for the whole sequence signifies the typical characteristic of swarm earthquakes. The variation in b and D can be related to the highly heterogeneous environment caused by the thermal cracking of the weak zone. Furthermore, effective stress might have been reduced by the high permeability and a supply of pore fluids, causing the failure of isolated and small asperities and consequently the earthquakes in clusters. The occurrence of swarms may be associated with the formation of new fractures in the newly formed lithosphere.

Keywords: Swarm activity, Temporal variation, b-value, Fractal dimension, Positive and negative correlation

STRUCTURAL RESPONSE OF PANEL BRIDGES FOR DIFFERENT CONFIGURATIONS: A COMPARATIVE ANALYSIS

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Abstract

This paper presents dynamic vehicle load analysis on panel bridges for different panel configurations for the purpose of finding the best structural configurations from a vehicle loading point of view. Panel bridges are modular bridge systems composed of steel panels connected together by pins and flexible in their behaviour. These flexible systems of the panel bridges are more susceptible to dynamic vehicle loadings. Four panels of different member configurations were modelled and pushover analysis has been carried out in order to determine the collapse load capacity of each panel. The maximum vehicle loading responses were obtained using the time history vehicle loading analysis considering the ramp functions and compared for the different panel configurations.

Keywords: Panel bridges, Dynamic vehicle loading, Pushover analysis, Time history analysis.

RAPID DAMAGE ASSESSMENT OF RESIDENTIAL BUILDINGS AFTER GORKHA EARTHQUAKE 2015

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Abstract

The Gorkha earthquake occurred on 25th April, 2015 with a magnitude of 7.8. Many buildings were damaged in the earthquake. It was required to know the condition of buildings and whether they could be used for occupancy or not. Rapid damage assessment of residential buildings was conducted immediately after the Gorkha earthquake 2015 in several affected areas in Kathmandu and out of the valley. The damages in the building were studied and categorized into five damage grades from minor damages to severe damages. This paper covers the damage patterns, and on rapid damage assessment, it was recommended whether buildings are safe occupancy or can be used after retrofitting or not safe and reconstruction requirement.

Keywords: Rapid Damage Assessment, Damage Grade, Safe Occupation, Retrofitting, Reconstruction, Damage Patterns

LOCATING THE OPTIMAL EV CHARGING STATIONS FOR PUBLIC VEHICLES: A CASE STUDY OF KATHMANDU VALLEY

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Abstract

The location of existing and proposed charging stations inside Kathmandu valley are established randomly, focusing on private vehicles, and are unable to meet the possible future demand for public electric buses. No specific model considering the future need, traffic density, and energy consumption pattern for public electric bus networks has been developed to determine the optimal location of the charging station. The main objective of this project is to provide insights into the optimal location of electric vehicle charging stations for public transport systems inside Kathmandu valley. Along with this, constraints other objectives are to develop a mathematical model that can optimally locate charging stations for public buses considering various technical constraints, and minimizing the overall cost. And to assess the optimal battery size requirements, energy consumption, charging profiles, etc. under various operating temperatures (e.g., 0°C, 15°C, and 30°C) of public buses. A large-scale linear programming-based mathematical model subjected to various technical constraints was developed in Python using the CPLEX optimization library platform to generate the optimal results on battery capacity, charging points for an exogenously provided traffic density, and vehicle routes. Four separate mathematical models were prepared for each considered city. The model generates an optimal charging profile for each operating condition and bus route at an hourly time step in the year 2030.

Keywords: Energy Consumption, Electric bus, Public Transport, Charging station, Optimal location, Battery capacity

PERFORMANCE AND COMBUSTION CHARACTERISTICS OF BLENDS OF CRUDE PLASTIC FUEL IN A SINGLE CYLINDER DI ENGINE

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Abstract

The investigation is carried out on blends of crude plastic fuel (CPF) with conventional diesel up to 30% blending ratio on a single-cylinder constant rpm diesel engine equipped with eddy current dynamometer in 4 hole nozzle, and at a compression ratio of 15.Waste plastic fuel is obtained from thermal pyrolysis at a temperature of 450°C in a one kg batch reactor. CPF contains hydrocarbon with carbon numbers ranging from C8 to C26. Fuel properties of blends of CPF are comparable to that of diesel. Engine performance parameters such as indicated power, specific fuel consumption, mechanical efficiency, brake thermal efficiency, thermal balance sheet, and exhaust gas temperature are studied along with the combustion parameters such as peak cylinder pressure, net heat release, cumulative heat release, and mean gas temperature. It has been found that with the rise of blending ratio, indicated power and specific fuel consumption increase while the exhaust gas temperature decreases. Break thermal efficiency of blends of plastic fuel are higher than diesel at low load but with the rise of load, brake thermal efficiency of blends of plastic oil decreases than that of diesel. The peak cylinder pressure and cumulative heat release of blends of CPF are found higher than diesel while the net heat release and mean gas temperature of blends of CPF are slightly lower than diesel. It is shown that the engine can run with the blends of plastic oil up to 30% by volume without any modification and there is a small margin of difference in the performance and combustion characteristics of blends of plastic oil in comparison to diesel.

Keywords: Crude plastic fuel (CPF), Heat balance sheet, Peak cylinder pressure, Net heat release, Specific fuel consumption, Indicated power, Exhaust gas temperature

ASSESSING GREEN UREA PRODUCTION POTENTIAL FROM MUNICIPAL WASTE IN NEPAL

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Abstract

Nepal, being an agricultural country, is still dependent on fertilizers, and is well known for delays and scarcity. Seeking ways for importing natural gas for the urea production in the age where the whole world is dedicated to comply with the Paris agreement to reduce fossils fuel consumption and CO_2 emission seems contradictory. Solid waste, which is the major composition of decomposable and combustible waste, and its uncontrolled decomposition of organic waste in landfills, if left untreated, lead to the discharge of methane (CH4). Methane, a potent GHG, traps approximately 85 times more heat than CO_2 through the first 20 years from the day it is discharged. This paper examines a novel waste to chemical process produce green urea from waste. The analysis is based using of the ASPEN PLUS software. Result shows that out of 1045 tons of Municipal Solid Waste, 540 Tons of green Urea can be produced per day with the net total investment of 500 million dollars. The study also shows that Electricity plays a vital role in determining the selling price of the product.

Keywords: GHG, Fertilizers, Gasification, Landfill, Fossil Fuel

SUSTAINABILITY OF NEWAR BUILDINGS IN SEISMIC CONDITION

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Abstract

Newar architecture represents Kathmandu Valley's traditional building practices that play an important role in world heritage status. The technology is climate-friendly, cost-effective and culturally important. However, it was not emphasized during the post-earthquake reconstruction phase, as if the technology is not earthquake resistant. During the research, a Newar residential building with all traditional seismic resistance elements can withstand earthquake hazards demanded by National Building Code. However, it was observed that the presence of all traditional seismic resisting elements in a single building is rare. The cause is a lack of proper transfer of knowledge and proper documentation. Hence it is important to document the construction technology of Newar buildings with proper seismic analysis and include it in the National Building Code of Nepal, related policy documents and the concerned syllabus.

Keywords: Newar Architecture, National Building Code, Post-Earthquake, Reconstruction, Earthquake Hazard

SCIENCE-BASED DECISION ANALYSIS TOOL FOR INDIVIDUALS: EMPOWERING INNOVATORS IN INFORMED DECISION MAKING

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Abstract

The paper's main objective is to make the scientific community aware of the Analytic Hierarchy Process (AHP) based Multiple Criteria Decision Making (MCDM) mobile application DecisionMentor, which was developed in Nepal and endorsed by the expert community and is being utilized globally. The other objective of the paper is to build awareness of the value of decision analysis in research and development, focusing on science and technology for innovation and entrepreneurship. The deliberation of the paper and presentation will be basically on how the transformation of twenty-plus years of practice of research in real-life complex decision analysis triggered us to come out with our product for the benefit of common people. The focus is developing DecisionMentor for people needing scientific value-added decision analysis tools in their figure tips. The DecisionMentor mobile app was presented at the International Symposium on the Analytic Hierarchy Process, 2020 (ISAHP2020) and was well accepted. The paper will brief on other citations and coverage of DecisionMentor in the international scientific community in the subject matter.

Keywords: Analytic Hierarchy Process, Multiple Criteria Decision Making, Multi-Criteria Analysis, DecisionMentor, Mobile Application

DANFE SPACE MISSION: SATELLITE SYSTEM-ON-CHIP DEMONSTRATION MISSION FOR DISASTER MANAGEMENT USING CUBESATS IN NEPAL

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Abstract

CubeSats have found widespread use in recent years, not only in education but also for commercial purposes. CubeSats are now also being used for earth observations and remote sensing applications. Nepal has diverse geography with weak geology which makes it a disaster-prone country. Using CubeSats constellation, natural disasters like Glacial Lake Outburst Flood (GLOF), landslides, flash floods, drought and climate change can be predicted in real time. In recent years, glacial lakes, hilly region basins and fertile lands are monitored using ground sensors based on local cellular networks. Due to irregular terrain, the network coverage area is limited. For any time, any data, CubeSats can play a vital role in disaster management and early warning systems. CubeSats constellation can be used for store and forward using Ground Sensor Terminals for disaster alert systems. While the constellation helps in disaster management, the development of CubeSats still takes a couple of years. This paper presents on orbit verification of novel ultra-low power Satellite System-on-Chip (SSoC) that can be used to simplify hardware and minimize the development cost and time of satellite. The single SSoC can replace On-Board Computer and Communication systems of the satellite. The SSoC is based on the high-performance dual core processors with built-in LoRa radio operating at 150MHz to 960MHz frequency. The SSoC is integrated in payload designed for a 3U CubeSat. The payload has undergone qualification level space environment testing and is being readied for flight model. The payload is expected to be launched within 2022. If the mission is successful, the future CubeSats constellation for natural disaster management can be developed cost effectively within a short period.

Keywords: Constellation, Ground Sensor Terminal, LoRa, Store and Forward, Disaster Management

RECOGNITION OF DEEP-SEATED LANDSLIDE TOPOGRAPHY AND THEIR USES TO FORECAST THE SHALLOW LANDSLIDES

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Abstract

Deep-seated landslides are a gravity-induced processes affecting large portion of slopes evolving over a long period and might persists intact in topography from dormant to active stages. Deep-seated landslides are caused by the geological structure of the deep layer while movement of weathered residual soil and colluvium mass causes the shallow landslides. A deep-seated landslides topography usually contains number of shallow landslides, being enhanced by deep-seated landslides. The topographic features of DGSDs such as double ridges, multiple ridges, trenches, tension cracks, uphill facing scarps (antislope scarps or counter scarps), downthrown blocks, buckling folds, toe bulging, and secondary mass movements etc. are in used to recognize the deep-seated landslides. It is required to evaluate and address the shortcomings and gap in research with deep-seated landslides topography recognition, its phenomenon and processes and use of them in forecasting shallow landslides, through selecting the ideal sites and developing the landslide inventory mapping, exploring the role of topography, geology and geomorphology for recognition of deep-seated landslides and developing the qualitative and/or quantitative statistical relationship between the deep-seated landslides and shallow landslides. This can be done through desk study, field study, laboratory testing, data interpretation and analysis and the research is expected to result the geological map, topographic map, landslide inventory map, identification of parameters recognizing deep-seated landslides topography, different parametric map and the statistical parametric relationship between deep-seated landslides and shallow landslides and methodology for forecasting the shallow landslides. The research is expected to complete within tenure of six months, giving a new finding as well as direction for future research.

Keywords: Topography, Deep-seated landslides, Shallow landslides

DESIGN AND USE OF UNDERGROUND STRUCTURE IN NEPAL HIMALAYAS – CASE STUDY OF KU RESEARCH TUNNEL

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Abstract

Nepal is a mountainous country with opportunities for underground structures for optimum space utilization. The country's topography, in addition to the weak geology, has created severe failures resulting in loss of time and economy. The construction methodology adopted in the country puts priority upon empirical methods and heavy support linings for stabilization. However, the weak nature of the Himalayan geology, added to the presence of faults and discontinuities, requires critical analysis of the existing design procedures. Numerical modeling can provide acceptable results for optimum design of the structures, which is seldom practiced in the region. In this regard, Kathmandu University has been constructing a tunnel within its premise, implementing numerical analysis and empirical methods for design and analysis. The KU Research Tunnel passes through a shallow overburden in a weak and fractured rock mass (meta-sandstone) with overlying structures. The tunnel of diameter 3.9 meters, has been designed as passageway below the university's hillock and poses challenges of squeezing and groundwater. The overall structure will consist of a cavern, of 6x6x20 meters, to be utilized as a laboratory after completion. The rock mass of the region has been classified based on Barton's Rock Quality Index values which classify the rock as very poor ($Q \approx 0.5$), and the supports have been designed accordingly. The support has been designed and optimized for the weak rock mass based on current practices adopted in the region. Upon completion of the tunnel, a framework will be developed for liner requirements, adapted to the weak rock of the Himalayas based on continuous instrumentation and numerical modeling. The tunnel will also serve the purpose of an observatory tunnel for practitioners, researchers and students, and the data collected will aid future constructions in the country.

Keywords: Himalayan Tunnels, Space Utilization, Barton's Rock Quality Index, Rock Mass Classification, Squeezing, Numerical Modeling, KU Research Tunnel, Underground Structures

EFFECT OF CEMENT AND STONE DUST ON COMPRESSIVE STRENGTH OF KUPONDOLE CLAY.

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Abstract

In the pavement design of road, a subgrade with weak soil gives poor performance. So, soil-cement mixture, a method of soil modification with the help of artificial bonds formed by the cement, has its applications in geotechnical fields to improve the subgrade and enhance the stability of the road embankment. The geotechnical field is also determined to familiarize innovative methods of reusing stone dust, an unwelcome product of stone and aggregate crushers, for soil stabilization. This study backs to bring about the mix of stone dust and Portland cement as stabilizing material for Kupondole-Clay hauled from the depth of subgrade level. The extracted clay was air dried, powdered and sieved through 425 microns to ensure well mix with cement and stone dust in approaching laboratory tests. Atterberg's test (Liquid limit, Plastic Limit) and unconfined compressive strength (UCS) test were performed in the clay with (30%) and without (0%) stone dust under various cement mixes (2%, 4%, 6% and 8%). The UCS data were compared for all the test samples for 28 days of curing. The adding of stone dust reduced the plasticity index of the clay. Meanwhile, the cement addition in the clay firstly increased and hence decreased the plasticity index of clay. The same trend was followed for the clay sample mixed with 30% stone dust. The unconfined compressive strength (UCS) value showed gradual increase in with the increasing cement content for different test samples of varying plasticity index. The results obtained from the compressive strength tests for cement mix were compared for two cases, with and without addition of 30% stone dust in the clay. The result analysis confirmed that the stone dust and cement addition brought improvements in the strength of the weak soil.

Keywords: Cement Clay stabilization, Unconfined Compressive Strength (UCS), Plasticity Index, Compaction.

BRIDGE QUALITY INDEXING BASED ON NON-DESTRUCTIVE TESTS AND VIBRATION CHARACTERISTICS

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Abstract

This paper presents the use of non-destructive tests (NDT) to assess the structural condition of Reinforced Concrete (RC) bridges. Typical damages to in-service concrete bridges include rebar corrosion, void formation delamination, cracks, wear, and surface blemishes. Detecting the damages is very important to plan a repair and rehabilitation of the bridges to prevent catastrophic failures. In-service RC bridges are selected based on the life served. NDTs, namely the Ultrasonic Pulse Velocity Test (UPVT), rebound hammer test, and electrical resistivity test, are used to determine structural health, i.e. degradation of strength of concrete, the extent of the corrosion, determination of potential voids, cracks, determination of modulus of elasticity. For pilot testing, one of the selected bridges was tested. Based on the different NDT parameters and outputs, a bridge quality index is proposed for assessing the condition of RC in-service bridges.

Keywords: Reinforced Concrete Bridge, Ultrasonic Pulse Velocity Test, Rebound Hammer Test, Electrical Resistivity Test, Structural Health

POSTER PRESENTATION

ELECTRICITY PRICE MODELLING TO ALLOCATE TRANSMISSION LINE COST BURDEN AMONG BBIN COUNTRIES USING COOPERATIVE GAME THEORY

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Abstract

There is rapid growth of electricity demand in Eastern South Asian countries (Bangladesh, Bhutan, India and Nepal). However, the resources and demand are scattered unevenly in the region. The countries of this sub region have already agreed to Paris Agreement's goal to keep average global temperature well below 2°C above the preindustrial levels. This share of resources in the power generation mix, and different load pattern and demand in the member countries have created increased opportunity for electricity trade. The region is divided into four nodes and five power lines. Five interconnections between India-Nepal, India-Bhutan, India-Bangladesh, Nepal-Bangladesh, and Bhutan-Bangladesh is be constructed. Even though the electricity trade is present in this region, there is an absence of scientific method of electricity pricing. This study deals with quantifying the benefits of electricity trade along with suggesting the cost-benefit techniques. Cost benefit allocation of the interconnections will be analyzed according to the marginal contribution of each country to the grand coalition. Accordingly, Game Theory concepts (Shapely Value) is used in our analysis. Moreover, we employ the concept of cooperative game theory to attempt to distribute fairly the cost of transmission line within the interconnections. The investigation is performed using a dynamic optimal power generation mix model. The expected result will be able to show the optimal solution, saving the cost of each member countries.

Keywords: Electricity trade, energy model, temporal resolution, multi-regional model, game theory Concepts, shapely Value.

SPACE SCIENCE AND GEOFORMATION

THEMATIC SPEAKER

SCIENCE FOR SOCIETAL BENEFITS: GEOINFORMATION AND LAND MANAGEMENT FOR DISASTER RISK REDUCTION

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Abstract

Nepal is prone to multiple hazards that occurs due to diverse topography and climatic conditions. A brief country profile on DRR and Management shows Nepal is the 20th topmost disaster-prone country in the world, and ranked 4th, 11th and 30th with regard to relative vulnerability to climate change, earthquake and flood hazards respectively among 200 countries. Similarly, Nepal Disaster Risk Reduction Portal shows the monsoon season of 2021 (from June, 2021 to October 2021), recorded devastating cases of loss of human lives such as 136 deaths, 45 missing, and 144 injured. Similarly, 845 houses were completely and 169 houses were partially damaged even in the first 10 days of the monsoon season of this year, 10 deaths and 21 missing cases have been recorded during monsoon (June to October 2021) . Similarly, the severe damage and casualties caused by the earthquake in 2015 is another example. Tremendous efforts are being made in Nepal to reduce the potential risks of such disasters under the Sendai Framework for DRR adopted by the United Nations on March 18, 2015. The framework aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets in individual, communities and countries over the next 15 years. However, there is still gaps in integrating geo-information and land management parameters with disaster management. Therefore, the efforts of DRR in Nepal can be made more effective, if sufficient disaster risk information are made available, specifically location based disaster risk information, and risk maps. At the same time, adequate approaches of land management such as risk sensitive land use planning can implement the activities related to DRR. Hence, the aim is to highlight how geoinformation and land management can contribute in enhancing the effectiveness of DRR, ultimately to benefit the society at large.

Keywords: Disaster, Disaster Risk Reduction (DRR), Geo-information, Land Management, Land Use Planning,

INVITED SPEAKER

ROLE OF A SPACE AGENCY IN NEPAL'S CONTEXT

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Abstract

Nepal Academy of Science and Technology's NepalSat-1 ushered in a new era in Nepal's history. With the successful 28-month operation of a kilogram of satellite into space, Nepal now strives to further improve its national space infrastructure through the research, development, and launch of next-generation space systems through ongoing Danfe and Munal satellite projects at Space Systems Laboratory-KUHS. However, questions largely remain on how a nationally recognized space agency can to be implemented and further questions still remain on its necessity. The Government of Nepal's Ministry of Education, Science and Technology's Space Division has formed a Space Committee consisting of government and non-government entities to discuss, understand and prepare a basis for a full study on short and long-term strategic reports for a space agency. This paper looks into the infant, mature, and very mature space agencies and programs from 30+ countries, provides a succinct summary of the committee's meetings, and finally, provides an overview of what a space agency's role should be in Nepal, how the country can play to its strength and what the best way forward for this nation in space should be.

Keywords: Space Agency, Space R&D, Space Infrastructure

ORAL PRESENTATION

COMPATIBLE MAPPING OF TYPE P IN MENGER SPACE

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Abstract

Probabilistic Metric Space, one of the generalizations of metric space introduced by Austrian Mathematician Karl's Menger in 1942, called Menger Space. The study of this space expanded rapidly after pioneer work of B. Schweizer and A. Sklar in 1960. In 1972, V.M. Sehgal and A.T. Bharucha Reid had introduced contraction mapping in probabilistic Metric Space as generalization of Banach contraction principle given by S. Banach in 1922 in metric space and also introduced fixed point results in Menger space. In 1991, S.N. Mishra is the Mathematician who first extended the notion of Compatibility in probabilistic metric space as Jungck introduced it in Metric space and K. Jha & KB Manandhar introduced K- Compatible mapping in Metric space and extended it in Fuzzy metric space in 2014. The objective of presentation is to show different compatible mappings in Menger space/Probabilistic metric space. And introducing Compatible Mapping of type **P** in Menger Space with example and common fixed point results in Menger space for four self- mappings.

Keywords: T-norm, Menger space, Compatible mapping, Common fixed point

ANALYZING THE RELATION BETWEEN CORONAL MASS EJECTIONS AND SOLAR FLARES IN SOLAR CYCLE-24

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Abstract

Solar flares and Coronal Mass Ejections (CMEs), the most spectacular events on the Sun, release the stored magnetic energy from the solar atmosphere. Flare is the intense emission of electromagnetic radiation from a localized region, whereas CME is the expulsion of a large amount of plasma from the solar atmosphere. The standard model (CSHKP) explains flares and CMEs as different manifestations of the same energy release process. However, they are not associated with each other all the time. The association between flares and CMEs is a crucial research area in solar physics. The main goal of this study is to analyze flares in the Solar Cycle-24. Solar flares have different classes as X-, M-, C-, B-, and A-class flares in the order of decreasing soft X-rays (SXR) intensity. The second goal of this study is to investigate the association of X-class flares with CMEs. We combined the GOES X-ray lists provided by the National Oceanic and Atmospheric Administration (NOAA) and the flare information provided by the Lockheed Martin Solar & Astrophysics Laboratory (LMSAL) to create a catalog of all the flares observed between 2010 - 2019. We analyzed the variation of flares with solar cycle using this catalog. We used SDO/AIA 193 Å and white-light data from LASCO to see the association of flares with CMEs. We carried out our analysis on the JHelioviewer.

Keywords: Solar cycle-24, Solar flares, CMEs,

IMPACTS AND CHALLENGES OF 'MENTEE TURNING INTO MENTOR' APPROACH VIA SPACE ROBOTICS WORKSHOP FOR COMMUNITY SCHOOL STUDENTS

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Abstract

Enhancing confidence among the students from community schools is one of the biggest challenges we are facing. Thus, with an objective to enhance 4C, namely Collaboration, Communication, Creativity, Critical Thinking, skills in community school students, 'Space Robotics Workshop' was conducted by Nepal Astronomical Society (NASO) in support of Nepal Academy of Science and Technology (NAST). The workshop included an interactive session on space robotics and an engineering session where students were divided into groups to assemble a model robot from scratch and operate it successfully. This paper will present about the workshop and the motive behind organizing such workshops which is capacity building among the junior high school students from the community school inside the Kathmandu valley. Also, it will share about the results obtained from the approaches we used to expand networking and exposure among students having similar project ideas. Moreover, the challenges in organizing such activities and the impact among students and mentors, senior high school students, will also be discussed in detail.

Keywords: Space Science, 4C in Education, High School Program, Interactive Learning, Capacity Building

FLIGHT CREW ALERTING FUNCTIONS AND ITS ROLE IN PREVENTING AIR MISHAPS

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Abstract

This paper explores different flight crew alerting functions in the Cockpit. It describes, explains and elaborates on the various dimensions of a flight crew alerting function and addresses its importance in avoiding air mishaps. Flight Crew Alerting functions are an essential and integral part of the emergency system in the aircraft. The evolution of the modern avionics in the Cockpit brought a new dimension to the range of electronics used in alerting the crew. This paper describes the different alerting functions available in the Cockpit, what does it, and how does it help in avoiding/preventing air mishaps. The aircraft can always plunge into an awful situation where the flight crew must be alert and act upon the direction of those functions installed to prevent the worse. With the evolution of avionics, airway travel is considered the safest way. This reputation is hugely contributed by those alerting functions and how they perform tasks. The previously published journals, research papers, articles, and the pilot's guide are thoroughly analyzed to produce the final form of this paper. The data and statistics were taken from reputed websites and books. This paper will contribute a lot to understanding the general concepts about the alerting functions in the Cockpit and their inevitable role in preventing air mishaps.

Keywords: Aircraft Emergency System, Flight safety, Avionics, Cockpit

A STUDY OF A PERSISTENT EQUATORIAL CORONAL HOLE

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Abstract

Coronal holes are the darkest and least active region of sun. They are associated with low density plasma covered the partial surface of heliosphere due to change in magnetic field or rapid expanding magnetic field. This paper reviews the measurement of physical parameter like flow speed, density, pressure, temperature, magnetic field and Dst which represent plasma properties in a coronal hole that heat the solar corona and accelerate the solar wind. Here a long time appearance coronal hole is selected from all of 2018 and 2019 with the help of data uploaded by SDO NASA, CDAWeb and Helioviewer. On the study of different OMNI data, it is found that plasma speed, pressure and temperature are drastically raised when a coronal hole is formed on the sun`s corona. The number of ions on the Sunsphere is also increased to the most which may be the cause of solar wind and can hit earth atmosphere as geomagnetic strome. On the comparison with normal condition, it clarify that that type of variation on physical parameter shows the evidence for the possibility of future strome. That's why different activities on sun like formation of a coronal hole are might be the reason of climate change and radiation effect on earth. These observations point the different features of a coronal hole and more discussion about plasma physics. Despite of our incomplete knowledge and lack of opportunity in the field of space science in the contest of Nepal much progress has been done towards understanding the space and more about coronal holes.

Keywords: Solar Cycle-24, Coronal Hole, Plasma Particles

MULTI CRITEIA ANALYSIS FOR IDENTIFYING SUITABLE DUMPING SITE: A CASE STUDY ON KANCHANPUR

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Abstract

A major challenge in urban and developing areas is a lack of adequate land for solid waste dumping and Not in My Back Yard "NIMBY". Hence, waste management has been a challenge in Kanchanpur for the past two decades. Previous studies had concentrated on determining the nature of solid waste in the Kanchanpur District but the suitable site selection based on spatial criteria and also addressing "NIMBY" is not adopted for the case study area. Therefore, this study aims at identify appropriate locations dumping sites in Kanchanpur. The methodology adopted to select the best dumping site is, the Geographic Information System (GIS) environment and Multi Criteria Decision Analysis (MCDA). The Analytical Hierarchy Process (AHP) was applied to allocate weightage based on several factors such as Land Use, Road, River, Settlement, and Slope were all elements evaluated while picking optimum sites. The spatial analysis tools such as Clip, Dissolve, and Extract by Mask, Euclidean distance, slope, resample, and reclassification were applied. Finally, a weighted overlay method was adopted to obtain the raster map with suitability level. The factors used for analysis were classified accordingly, with classes divided into five suitability levels: Restricted, Less Suitable, Moderately Suitable, Suitable, and Most Suitable. The weights assigned for Land Use were 12%, 13% for Road, 21% for River, 49% for Settlement, and 5% for Slope. Weighted overlay revealed that 29.1% of the study area was restricted, 65.3% was less suited, and 5.5% was suitable. The ideal locations for dumping site in Kanchanpur were identified in Raikar Bichawa, Krishnapur, Jhalari, and Suda.

Keywords: Waste, GIS, MCDA, Analytical hierarchy process, Suitability Analysis

DREAM CHASER ORBITAL LANDING MISSION: A FEASIBILITY ANALYSIS IN LANDING IN NEPALESE AIRPORT

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Abstract

The United Nations Office for Outer Space Affairs (UNOOSA) and the Sierra Nevada Corporation (SNC) signed an agreement to use the Dream Chaser Space Orbital Mission for the promotion of science technology in UN member states, developing countries in particular. Furthermore, the SNC has given its intent to land the Dream Chaser Space Plane in a suitable civilian airport anywhere in the world. Nepal Astronomical Society (NASO) presented its interest to take part in such a mission during the call for interest, in UNOOSA, Vienna, 2019. Since then, NASO has set the vision to conduct a feasibility analysis on landing the Dream Chaser in an airport in Nepal. As an active non-profit organization facilitating the promotion of space technologies and applications in support of the Sustainable Development Goals (SDGs), also the motto of UNOOSA and the Dream Chaser Mission, NASO has conducted an engineering project for students from different universities to analyze the feasibility of landing the Space Plane in Nepal. A Model-Based Systems Engineering (MBSE) approach is used for the stakeholder's analysis, requirements elicitation, functional analysis, and design synthesis. Global Navigation Satellite Systems (GNSS) is identified as a key technology that has the potential to enable navigation and surveillance services for the Dream Chaser approach and landing. The monitoring and control procedures (analogy to the Air Traffic Control (ATM)) for an effective terminal area energy management of the Dream Chaser are designed based on the functional analysis. ADSB and SBAS are identified as key technologies for the guidance and navigation for the terminal area energy management phase and the landing phase. The functional analysis for re-entry trajectory optimization, terminal area energy management and final approach & landing phases are based on the experiences of NASA's space shuttle missions.

Key Words: TAEM, Re-Entry, GNSS and SBAS

NEPAL'S FIRST HIGH SCHOOL CUBESAT WORKSHOP: TWO MONTHS OF LEARNING, DESIGNING, AND MANUFACTURING

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Abstract

Over the years, CubeSats have undergone exponential growth in usage and application. Even high school students are launching satellites up in space. CubeSats have been a revolutionizing tool in researching new space technologies as well as teaching space systems to new generations. CubeSat incorporates all the necessary functionalities for a satellite and is yet small enough; with the smallest one fitting in the palm of a hand. While multiple countries have already launched the high school-made CubeSats, the concept has shown traction in Nepal as well. The team at Space Systems Laboratory Kathmandu University High School (SSL-KUHS) is working on developing satellites having completed their crash course on CubeSats. In this paper, we will be talking about the satellite crash course, the process, the contents, what the students learned, and how it prepped the team for building an actual CubeSat. In general, to build a CubeSat one needs a set of basic skills; soldering, electronics, programming, Computer-Aided Design, and PCB Layout Designing. Initially, the students at SSL were brushed-up on those basic skills. The training program consisted of four hours of class every alternate day totaling three days a week and twelve hours per week. It was conducted starting from November 2021 to December 2021. A team of six instructors trained, and taught students the skills necessary for designing and building a CubeSat. At the end of the training program, students in teams were able to design and fabricate a prototype of a 0.5U CubeSat.

Keywords: Space System, Education, Training, SSL-KUHS, Prototype,

WEB MAP APPLICATION FOR PRELIMINARY FLOOD DAMAGE ASSESSMENT USING GOOGLE EARTH ENGINE -A CASE STUDY OF FLOOD IN MELAMCHI RIVER, MELAMCHI AND INDRAWATI MUNICIPALITY, NEPAL

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Abstract

This project focuses on creating a web platform for rapid assessment of the floods that have already occurred and will occur in the future in the Melamchi river, covering Indrawati and Melamchi Municipality. In this project, modeling of the recent flood that occurred in June 2021 at Melamchi river was done by using four-band ratios, Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Water Ratio Index (WRI), and Modified Normalized Difference Water Index (MNDWI) using Google Earth Engine (GEE). For the accuracy assessment of the different band ratios, digitization of the most probable flooded zone using Planetscope imagery was done and misclassified flood of each band ratio was calculated. In addition, the undetected flood in the most probable flooded zone was compared among different band ratios for accuracy assessment. Among those band ratios, NDVI detected 82.26 % of the most probable flooded region. In support of it, post-flood land cover classes of different band ratios were also calculated and NDVI gave the most appropriate output. ESRI land cover 2020-2021 was used for the flood assessment of the June 2021 flood and the post-flood land cover was prepared using a random forest classifier and Sentinel 2 which will be used for future flood assessment. NDVI was the most appropriate band ratio to monitor the flood, it was used to develop the Google Earth Engine web-based application. The google earth engine web application was developed using JavaScript API. The web app contains a split panel that is used to compare the same band at different times as well as different bands at the same time. Flood assessment and map panel shows the assessment result of flood with estimated flood region using NDVI threshold, impact on the land cover, and impact on the population.

Keywords: Google earth engine, Disaster assessment, Band ratio, Web application

GLOF ANALYSIS

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Abstract

Glacial Lake Outburst Flood (GLOF) can pose grave danger to lives, properties, and hydropower plants located near the lake. Recent GLOF events in Hunza, Pakistan has crippled its trade with China since the flash floods swept away Pakistan-China bridge called Hassanabad Bridge. Aftermath of this events shows possibility of drinking water shortage in near future. Since 1998 Pakistan has lost citizens and around $3.8 billion in damages due to GLOF. Glaciers are melting and bursting at an alarming rate and the threat is equal in Nepal. Classifying glacier and glacial lakes from satellite data can help monitor lake health and assess possible threats. Parameters such as glacial lake area, retreat rates and temperature can indicate signs for possible GLOF. Five recent GLOF events in Nepal are studied using data from remote sensing and state-of-art machine learning algorithm to understand patterns on aforementioned parameters. The result of the study can help identify glaciers that could potentially lead to outburst.

Keywords: GLOF, Classifying, Remote sensing, Machine learning

LAND USE LAND COVER CHANGE AND PREDICTION IN SURKHET VALLEY, NEPAL

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Abstract

Increasing population leads to rapid urbanization in cities, which can be observed in urban areas of Nepal as well, due to which demands skyrocket for physical infrastructures exerting high pressure on nature. This process alters the land use and land cover (LULC) pattern of the area. In this research satellite images of Surkhet Valley from 1989 to 2019 were analyzed to observe changes in the LULC pattern. The work is followed by the future simulation of urban growth. An object-based image classification method was used to prepare LULC maps of each year whereas Cellular Automata (CA)-Markov change prediction was applied for future simulations of built-up areas. In 1989, of the 103.15 km^2 area of Surkhet Valley, 47.99% area was covered by forest and 40.72% by agricultural lands. At the same time coverage of built-up area was only 1.13%. In 2019, the coverage of cultivation areas in the valley plunged to 27.37% of the total area whereas on the other side the built-up area coverage rose to 15.41%. The suitability for built-up area expansion was predicted around existing towns and roads which may cover up the entire valley bottom. This tendency was less in forest areas and steep slopes. The predicted and existing LULC of 2019 showed an agreement of 80.65% implying the CA-Markov model can be used to predict built-up area growth for future years. The prediction for the year 2049 showed coverage of built-up area would double that of 2019 covering 30.42% of the total area of the valley. Cultivated lands would plummet to 14.20% of 103.15 km^2 at that time. Thus, from the prepared LULC maps and urban growth prediction model, it can be concluded that the built-up area had been and will continue to increase in Surkhet Valley at the expense of cultivated lands.

Keywords: Cellular Automata, Landsat Images, Urban growth, Urbanization,

CIRCULAR VELOCITY CURVE OF THE MILKY WAY USING CLASSICAL CEPHEIDS FROM GAIA AND OGLE

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Abstract

Classical Cepheids are excellent tracers to estimate the rotation velocity of the galaxies because they provide better distance accuracy with less uncertainty. But, due to the less budget of radial velocity in spectroscopic surveys, still, we could not compile a large catalog of them with 6D phase-space. With stringent radial velocity from GALAH DR3 and proper motion from Gaia EDR3, we estimate the rotation velocity of the Milky Way for 29 Classical Cepheids taken from the catalog of Mroz et al. (2019) with precise distance. We present a 3D velocity method to measure rotation velocity up to $20_{-0.51}$ kpc where we draw 6D phase-space coordinates with high precision even we have fewer samples. We obtain rotation $^{-2303}$ velocity of 243.38 kms^{-1} ± 0.00 kms^{-1} and concentration parameter of $2.18^{+1.90}$ and also the virial mass about $(2.6016^{+2.8119} \times 10^{14})$ M_0.

Keywords: Dark Matter, Proper motion, Cepheids, Gaia Data: DR2 DR3

USING INNOVATIVE TECHNIQUE IN RADIO ASTRONOMY TO UNDERSTAND COMPACT SOURCE POPULATIONS AT LOW RADIO FREQUENCIES

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Abstract

The dominant sources at low radio frequencies are the extended radio galaxies often spanning up to megaparsecs in linear sizes (arcminutes in angular scales). Active galactic nuclei (AGNs) are powered by supermassive black holes, and are the progenitors of these large galaxies, but only subtend angular scales <arcsecond. Studying these sub-arcsecond scale AGNs can provide important insights into feedback processes, which influence galaxy evolution, an important goal of modern astrophysics. However, identifying these objects in large numbers at low frequencies is extremely challenging due to prohibitively expensive computational requirements for very long baseline interferometry (VLBI). Our team has recently developed the technique of interplanetary scintillation (IPS) with the Murchison Widefield Array (MWA) to very efficiently identify large numbers of compact AGNs. The MWA is a low radio frequency interferometer with the longest baseline of 6 km and angular resolution ~arcminute. It has 128 tiles, each tile with 16 diploes, and is capable of producing short interval snapshot images of large part of the sky (approx. 30x30 sq. degrees at 162 MHz). Our technique uses the phenomenon of IPS which is similar to twinkling of stars at night, but in radio frequencies induced by the solar wind. Using advanced techniques in radio imaging, we very efficiently identify ~300 compact objects from >3000 objects using a 10 minute long observation. We have recently completed a survey covering ~8000 sq. deg. of the sky. In this talk, we will outline the novel technique and the new insight from our research that the low frequency compact radio source population is primarily composed of peaked spectrum, and compact steep-spectrum objects while the beamed blazars, dominant at high frequencies, are a minority. We further discuss the implications of this technique to space science, and to future major international project, the Square Kilometre Array (SKA).

Keywords: Radio astronomy, Active galactic nuclei, Low frequency source population

EPICYCLIC THEORY IN 3D MODEL

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Abstract

According to the ancient astronomy text "Suryasiddhanta", the motion of the planet is governed by the special kind of wind called "Pravaha Vayu"; wind that flows perennially without cessation and is explained using epicyclic theory. In epicyclic theory, the mean Sun is assumed to be moving on the circumference of a different circle centered around Earth and the true Sun moves along another smaller circle called epicycle, whose center is on the bigger circle. The objective of this study is to understand the implication of "pravaha vayu" on the solar system. In this work, we constructed the 3D model of the epicyclic theory to study the effect of pravaha vayu on Earth's rotation and revolution around the Sun with respect to the fixed stars. One of our major findings showed that, "Pravaha Vayu" has impact on increase and decrease in the length of the solar day throughout the year.

Keywords: Epicyclic theory, Pravaha Vayu, 3D model, Solar day

SBAS BASED AIRCRAFT PROCEDURE ANALYSIS IN NEPAL

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Abstract

Global Navigation Satellite Systems (GNSS) is a key to the Performance-Based Navigation (PBN) that has been adopted worldwide in aircraft navigation services. As a contracting state of the International Civil Aviation Organization (ICAO), Nepal is committed to the PBN plan to enhance the efficiency of Nepalese airspace and air navigation services. There are dedicated short-term, mid-term, and long-term plans to improve the technologies in aircraft procedures design, navigation systems, and surveillance systems, mostly based on the use of GNSS. The GNSS working group at NASO thrives to facilitate the GNSS capacity-building program for aviation and is collaborating with a group of undergraduate and graduate students from various engineering universities to generate competent manpower. The current project explores the existing limitations in the CNS/ATM technologies in Nepal that can be overcome by the use of GNSS. In a mountainous country such as Nepal where the installation of ground-based navigation aids is not feasible, the benefits of GNSS-based flight procedures and surveillance are immense. In particular, for the approach and landing phases, the vertically guided procedures using the GNSS Space-Based Augmentation Services (SBAS) is a proven procedure that can substantially modernize Nepalese airspace. Therefore, the project has characterized the SBAS performances in Nepal and has proposed the implementation of SBAS based flight procedures. The project is a first of a kind in Nepal as the existing literature does not provide any evidence of GNSS performance analysis for PBN implementation. The technical assessments of the Nepalese aviation sector by international companies have regularly stressed a need of GNSS centric CNS and relevant skilled GNSS manpower in the CNS/ATM sector. The project at NASO has contributed to such needs.

Keywords: PBN, GNSS, CNS/ATM and SBAS

A STUDY OF TWO INTENSE GEOMAGNETIC STORMS DRIVEN BY CORONAL HOLE AND CORONAL MASS EJECTION

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Abstract

The solar wind is a stream of energetic charged particles principally electrons and protons, that flow outward from the sun through the solar system at a speed of about 400km/sec and a temperature of one million degrees Celsius. When the solar wind speed is fast and earth directed it causes a geomagnetic storm. A geomagnetic storm is a disturbance in Earth's magnetosphere driven by variations in the solar wind. In this paper, we present a detailed study of two intense geomagnetic storms, one driven by the coronal hole (October 5, 2015) and the other by coronal mass ejection (September 4, 2017). We analyzed and compared solar wind parameters: speed, temperature, pressure, density, DST, etc for both events. These variations cause dense working surfaces to develop and propagate down the wind. It is shown that how the initial parameters of the fluctuations are related to the characteristics of the working surface far from sun.

Keywords: Solar wind, Geomagnetic storms, CMEs, Coronal hole

ANALYZING CHITWAN STORM OF 20TH MAY 2022 USING GNSS RADIO OCCULTATION AND VARIOUS REANALYSIS DATA PRODUCTS

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Abstract

In the current changing climate scenario different part of Nepal is facing severe weather events like flash floods, hail, heat waves, tornado, etc. Some of them have disastrous impacts on society, infrastructure, and the economy. However, monitoring and predicting those events have been challenging tasks due to limited meteorological observation infrastructure in the country. In this study we tried to analyze the storm in Chitwan on May 20, 2022, using various reanalysis and remote sensing data sets. ERA5 and MERRA-2 reanalysis data are used to understand the synoptic-scale phenomenon over the region. Due to the nonexistence of sounding data in the region, we have used the Global Navigation Satellite System-Radio Occultation (GNSS-RO) to understand changes in vertical profile during the event. Due to the GNSS-RO's unprecedented high vertical resolution, global coverage, and long-term stability, this technique has a great potential to complement meteorological observation systems and improve extreme weather monitoring and forecasting. The profiles from the COSMIC-2 GNSS-RO mission are used to analyze profiles from ERA5 and MERRA-2 during the event. We tried to analyze the pressure gradient, and temperature gradient near-surface and in the vertical layers to understand the wind propagation and the reasons leading to the storm in Chitwan.

Keywords: Extreme Weather, GNSS, Radio Occultation, Atmospheric Sounding, COSMIC-2

REVIEW PAPER ON SESMIC RESPONSE ANALSYIS OF UNDERGROUND STRUCTURES.

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Abstract

To achieve safety against natural disasters like Earthquake, it is necessary to construct the underground caverns considering geotechnical problems like site effects. Seismic ground response analysis is carried out to estimate the stratified soil response (in term of acceleration, PGA profile, stress and strain histories, and response spectrum) subjected to a considered bed rock motion. The commonly applied analysis methods are: Linear, Equivalent linear and Non-linear. Owen and Scholl (1981) correlated seismically-induced tunnel damage with surface peak ground acceleration using data from 127 case histories and concluded that slight damage occurred in rock tunnels for Peak Ground Accelerations (PGA) below 0.4 g. Callisto and Ricci (2019) carried out a back analysis of the damage suffered by the San Benedetto tunnel during the 2016 Norcia earthquake in Italy and find out that simplified methods, where the seismic loading is introduced in an equivalent static manner, were found to provide reasonable predictions, while more accurate responses were provided by dynamic analysis of the case study. Ground response analysis is required to carry out for predicting ground surface motion and to evaluate properties of soil during earthquake. It has been a great challenge to design underground structures in highly seismic active zone with a loose soil like Kathmandu. Most of the underground structures in these places are designed with Q-system classification system which do not consider seismic effects. This study aims to develop specific guideline considering seismic forces for underground structures in these places.

Keywords: Underground structures, Site effects, Peak Ground Accelerations (PGA), Seismic effects, Guidelines

METEOROLOGICAL PARAMETERS BASED MODELS FOR EVALUATING GLOBAL SOLAR RADIATION AT HIGH HILL TAPLEJUNG

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Abstract

The knowledge of the global solar radiation (GSR) is of particular significance in the reliable evaluation of the solar energy potential in a given locality. However, ground measurement of global solar radiation (GSR) is not available in most locations in Nepal. In order to estimate GSR on the horizontal surface on an hourly mean daily basis, several empirical models with various input parameters have been developed in the literature. In this study, we select the best possible models based on available parameters to estimate the solar radiation using regression techniques for the very remote and highland Taplejung (Lat.27.35860N, Long.87.67000E, and Alt.1732m.a.s.l.) in eastern Nepal, where there is no sufficient amount of clean energy. The testing models are validated by comparing the measured and estimated values of solar radiation based on ten statistical tools, including mean bias error (MBE), root mean square error (RMSE), mean percentage error (MPE), coefficient of determination (R^2), and t-stat. For better performance, the model's higher value of R^2 and lower values of other statistical tools are considered. Finally, it is concluded that the combined sunshine-based model M-12 based on sunshine duration, a difference between maximum and minimum temperature, and relative humidity was better than other models. Its empirical constants are a = 0.528, b = 0.417, c = 0.053 and d = -0.003. These empirical constants can be utilized at similar geographical sites in Nepal for the year to come. Likewise, the annual average global solar radiation at the study site was 4.22 kWh/m^2/day.

Keywords: Global solar radiation, Meteorological stations, Regression techniques, Statistical tools, Sunshine-based models, Empirical constants.

POSTER PRESENTATION

MODEL ROCKETRY: DESIGNS, BUILD, LUNCH

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Abstract

Model rocket fall under the category of high-powered small rocket. Usually, rocket has a single or two stage separation. These high-powered model rocket can be used for the educational purpose. The main purpose to build the model rocket is to make such rockets which is used to deploy small satellites on L-orbit of earth. These rockets are also called solid rockets because there is no liquid fuel and oxidizer. This project will help students to gain better understanding about rocket & amp; rocketry or space enthusiast, type of separation technique which works on space (satellite-deploy or rocket recovery), an electronic launch system that is more safe and presized and students and other peoples will get a chance to see and learn the mixture of rocket fuel (KNO3 and sugar in ratio 65:35) where, KNO3 contain should be 65% and sugar ccontain should be 35% of total fuel. This explosive mixture is put into a chamber. After the electronic ignition, high pressurize gas is exaust through converjent-diverjent nozzle which produce high thrust (Newton's third law).

Keywords: Educational purpose, Fuel, Stage separation, Electronic launch

DISCOVERING MAIN BELT ASTEROID FROM HOME

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Abstract

Our earth has faced many mass extinction(s) and has encountered many collisions with different heavenly bodies; the most common ones being asteroids. Asteroids originate from the asteroid belt- a region in the solar system between the orbits of mars and Jupiter. In order to protect our planet from asteroid impacts, scientists and researchers have developed a way of tracing these heavenly bodies. Previous researchers have focused on discovering and finding asteroids that pass/will pass our planet but have been lacking in cataloging and discovering new asteroids in the main belt, as well as trans-Neptunian objects that orbit around the sun. Many amateur astronomers and citizen scientists from all over the world, including researchers from Nepal, have been tracing these asteroids from their homes. The findings have made a positive impact in the scientific community, as they are bodies in the solar system closer to our planet which has the capacity to undergo collision, and the more you find and trace them, the more safe is our earth. The objective of this research is to discover main belt asteroid from home and to trace hazardous and non-hazardous Near Earth Objects (NEO's) that can influence our planet in many ways. This paper presents ways used to discover 2020 PG15, a recently discovered main belt asteroid orbiting between Mars and Jupiter. The images from NASA's Pan-STARRS telescope was taken and analyzed to discover asteroids. Our research has resulted in successful discovery of a main belt asteroid 2020PG15 which was discovered in August 2020 from Nepal and was confirmed and named by International Astronomical Union.

Keywords: Near Earth Object, Asteroid Search, Pan-STARRS, Citizen Science, Nepal

CIS NASO PROGRAM: SPACE EXPERIMENTATION, ITS IMPACT AND THE CHALLENGES IN NEPAL

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Abstract

Cubes in Space (CiS) NASO workshop was a 5-week long educational program aimed to teach space experiment design to Nepalese high school students. In the workshop, we designed an experiment to study the effect of ionizing radiation on the structure of Oobleck (corn starch molecules). As Oobleck is a non-Newtonian fluid, we expected that its damping effect can be used as a shield for astronauts and machinery from space threats. This paper will deal with our learnings as high school students from the Cubes in Space NASO program, organized for the first time in Nepal, and our experience as a team designing space experiments under the guidance of NASO and NASA scientists. The paper will also discuss the challenges faced by our team while learning to design the experiment to be fitted in a small cube (of approx. 4x4x4 cm^3) using virtual platforms such as ZOOM and GoogleMeet and other restrictions brought up by the COVID-19 pandemic.

Keywords: Cubes in Space, STEAM, Sounding Rocket, Space Experiment Design, Ionizing Radiation

ASTROBIOLOGY AS TOOL TO INTRODUCE SPACE SCIENCES AND STEM EDUCATION AT SCHOOLS

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Abstract

Astrobiology is one of the most fascinating subjects of all time; it explores and helps us find answers to the most intriguing questions pertaining to life and the universe. People have always wondered how Earth works as a planet, and how it has changed over time, and what really makes it an active planet, utterly different and diverse from other rocky planets. Astrobiology on the primary and secondary level: I'm teaching astrobiology to grade 2nd, 6th, and 7th at Lahore Grammar School EME since 2017. The last session (2018-2019) was more focused on the practical side of astrobiology rather than theoretical. For example, students were asked to build/design their own rover and a mission to Mars. A workshop was held in which students attempted to construct telescopes and learned how to use a telescope. Students also looked for tardigrades under a microscope in order to understand extreme environments and extremophiles. Astrobiology in a classroom: A wide range of topics was covered in every session along with the activities, from how life started on earth to how we look for life in the universe. The main objective of these lessons was to teach students a variety of science subjects that cut across the interdisciplinary nature of astrobiology, including physics, biology, chemistry, geosciences, and astronomy. Astrobiology is the most effective avenue for introducing young students to a wide range of science subjects. By focusing on topics such as how life started in such an extreme environment to what is the possibility of life in the universe, astrobiology has a natural tendency to inspire students to choose a career in these fields. They will get a chance to contribute in this field but act participate actively in future space exploration missions and research.

Keywords: Astrobiology, Space education, Science, STEM

AGN-LIKE MODEL TO DESCRIBE THE POSSIBLE SOURCE OF ORIGIN FOR THE REPEATING FAST RADIO BURSTS

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Abstract

Fast Radio Bursts (FRBs), a recently observed phenomenon that gives a millisecond-microsecond radio pulse has been a center of discoveries in the field of Astrophysics; however, the origin of this source is yet to be localized. Sub-classified as repeating and non-repeating FRBs, this research focuses on identifying the source for the repeating FRBs, especially for FRB 121102. Energetics, Lifespan, Periodicity, and Intermittency factors are considered for different sources which include the Pulsar-like model, Asteroid-Neutron star collision model, Magnetars-like model, Soft-Gamma Repeater-like model, and Active Galactic Nuclei (AGN)-like model. Analytical calculations are shown and possible drawbacks are discussed for all of those models, and AGN-like models are found to be an evident source of the FRB 121102 given its behavior when subjected to parameters of extreme dipolar moment, crompton scattering, and plasma frequency.

Keywords: Localization, FRB 121102, Intermittency, Dipoles, Energetics

LAND MANAGEMENT, FORESTRY AND AGRICULTURE

INVITED SPEAKER

MYCORRHIZAL FUNGI AFFECTED BY MIXED COVER CROPS

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Abstract

Mycorrhizal fungi provide a way for plants to obtain nutrients that would otherwise be out of reach to plants, which is crucial to the agriculture and ecosystems. Cover crops are planted to manage the soil nutrients and to prevent erosion in agricultural lands. We established four cover crop plots and a control plot at Carter Farm located in Weatherford, Texas, USA to determine the effects of cover crop mix on mycorrhizal fungal colonization. Plot A contains native plants, plot B has Willman lovegrass and B-Dahl bluestem, plot C giant Bermuda grass, plot D winter wheat and legumes, and plot E is the control with no cover crops. Three random soil samples were collected from each plot to extract spores and roots. Extracted spores and roots were quantified under microscope at 200X magnification. We observed highly significantly *($p \leq 0.05$)* different spore density across the plots with the highest spore density of 46.28±9.79 spores per gram of dry soil in plots planted with winter wheat and lowest spore density of 23.26±8.06 spores per gram of dry soil in the plot planted with Giant Bermuda grass. Interestingly, we found the lowest colonization level (54.67±6.65%) of hyphal colonization on the plot planted with native plant mix compared to all other plots. Willman love grass and bluestem mix plot was colonized with 75.50±4.64%, Giant Bermuda grass plot colonized with 74.00±2.76%, Winter wheat legume mix plot was colonized with 78.67±3.08% and Control plot without cover crops with 79.67±6.53% of hyphal colonization. We also observed a significantly different colonization of arbuscular coils among the treatment plots; however, vesicular and arbuscular colonizations were not significantly different across the treatment plots. Further studies to explore crop yield at the plots with respect to soil nutrients and AM fungi will help to understand the roles of mycorrhizal fungi.

INDIA-ASIA COLLISION, HIMALAYAN UPLIFT, AND CLIMATE CHANGE

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Abstract

Following the fragmented of Gondwana, the Indian plate began moving northward and collided with the Eurasian plate during the Early Cenozoic, culminating in the Himalayan-Tibetan Orogeny. Several microcontinents broke out from Gondwana and merged with the Indian plate, causing magmatism along the continental edge. These volcanic rocks exhibit continental intraplate features and were formed during the rifting of the Indian subcontinent from Gondwana. The initial collision between these two plates (Indian and Asian plates) occurred in the YTSZ's center region, then extended outwards diachronically towards both the eastern and western Himalayas. The climatic change in this region was caused by this collision and uprising of Himalaya. The Himalayan foreland basin records the key information of variation in climate after the India-Asia collision. The Indian Summer Monsoon (ISM) was active in the central Himalaya as early as 10.7 million years ago, remained stable until 9.5 million years ago, and subsequently reduced by 7.5 million years ago, 0.5 million years later than in the western Himalaya. The emergence of the proto-Tibetan Plateau may have also contributed to the intensity of ASM around 10 Ma. Furthermore, geochronological investigations show that until around 10 Ma, the Tethyan and Greater Himalaya were a major source of sediments, with later detritus coming from the Lesser Himalaya. The occurrence of large amounts of Cretaceous and newer debris in the eastern Himalaya, on the other hand, highlights the uneven pattern of Himalayan exhumation. A decline in ASM is shown by the state and production of paleosols in Lower Siwalik in the central Himalaya.

Keywords: Himalayan Foreland Basin, India-Asia Collision, Neogene Environment, Paleoclimate

ETHNOPHARMACOLOGY INVESTIGATION AND DOMESTICATION OF HIGH VALUE MEDICINAL PLANTS IN THE HIMALAYAN REGION OF THE ANNAPURNA CONSERVATION AREA, NEPAL

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Abstract

The flora of the Himalaya in Nepal is one of the richest in the world. The Medicinal and Aromatic plants (MAPs) represent around 25% of the country's vascular flora and are an important component of traditional medicinal systems. The aim of the present study is to document ethno-pharmacological knowledge, validate the claims through phytochemical and pharmacological laboratory analysis and then develop recommendations for the MAPs as guided by this investigation. An objective of the study is to provide training to local community members on the domestication and cultivation of high value MAPs while facilitating closer collaborations with herbal medicinal industries interested in commercialization. Both research activities and communities' involvement and awareness activities will be carried out in the field. The research findings will guide the management of valuable MAPs in the Himalayan region of Nepal. The findings will be of benefit to local rural peoples in understanding the value of MAPs in their region while providing income generating opportunities through the sustainable and economical utilization of those plant species in collaboration with herbal medicinal corporations. It is expected that the results can be extrapolated to benefit other Asian countries in the Himalayan region.

ORAL PRESENTATION

EFFICACY OF BIOPESTICIDES IN THE MANAGEMENT OF POTATO TUBER MOTH, *PHTHORIMAEA OPERCULELLA* (ZELLER), UNDER POTATO STORAGE IN BHAKTAPUR, NEPAL

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Abstract

The potato tuber moth is an oligophagous pest that feeds on Solanaceous crops. The presence of potato tuber moth in storage areas for potato tuber seeds is a major concern in the farming community including Bhaktapur. The negative effects of chemical use on sustainable agriculture, as well as its impact on the ecosystem and non-target species, are now widely acknowledged. As a result, now is the time to look for alternatives that are reliable, long-term, environmentally sustainable, and cost-effective.The present study aims to evaluate the efficacy of various biopesticides in the management of potato tuber moths under storage condition.The research was conducted in Changunarayan Municipality Ward No. 8, Bhaktapur, Nepal from February to June, 2021. The experiment was laid out in a 5×3 two-factor Completely Randomized Design (CRD) with three replications. Three varieties viz., Khumal Seto-1, Janak Dev and MS - 42.3 whereas five bio-pesticides viz., *Bacillus thuringiensis*, *Acorus calamus*, *Azadirachta indica*, *Artemisia vulgaris* and a control were used and altogether there were 15 treatment combinations. Observations were made for the intensity of infestation, tuber damage index, emergence of PTM adults, physiological loss in weight, decay loss and tuber damage score. Analysis of variance for all parameters was analyzed by using R studio. *Acorus calamus* had reduced larval mining by 88 % and eventually had reduced decay loss by 93 % as compared to control. The study revealed that Janak Dev showed tolerance and *Acorus calamus* provided the best protection against the damages caused by potato tuber moths.

Keywords: *Solanum tuberosum*, *Bacillus thuringiensis*, *Acorus calamus*, Potato tuber moth, Damage

RAPID PREDICTION OF NEPAL MID HILL AND TERAI BIOMASS MOISTURE CONTENT USING NEAR INFRARED SPECTROSCOPY

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Abstract

Biomass, a carbon neutral fuel, can be combusted directly for different thermal application vary from domestic woodstoves to industrial combustion technologies, mainly for power generation and co-firing with fossil fuels. However, biomass has number of hurdle for its smooth application, including moisture content (MC), low-energy density and complex structure. Therefore, accurate and consistent measurement of biomass properties is of great challenge. This paper presents non-destructive rapid prediction of Nepal biomass moisture content using Near Infrared Spectroscopy (NIRS) as an alternative method for other destructive traditional thermal analysis. NIRS is a rapid, low cost per test, environment friendly (requires no chemicals to purchase or dispose of), non-destructive and versatile analytical method. Biomass samples-fast growing tree and agricultural residues were collected from different locations of Nepal representing mid-hill and terai region of Nepal. Samples were dried in open sun, manually chopped, stored in air tight aluminum bag and shipped to NIRS research center for agricultural product and food at KMITL, Thailand for experiment and data analysis. Partial least squares regression model, using MATLAB-R2020b inbuilt code, were created based on spectral data obtained from NIRS (non-destructive) and biomass moisture content from thermogravimetric analyzer (destructive). The spectral data were pre-treated through different pre-processing techniques i.e.First and second derivative, vector normalization, multiplicative scatter correction (MSC). The performance of model was compared based on coefficient of determination (R^2_c), Root mean square error of calibration (RMSEC) and ratio of prediction to deviation (RPD). The best model is selected with spectral data pre-treated from vector normalization and R^2_c, RMSEC and RPD values of 0.74, 0.58 wt % and 1.28 respectively. Model for prediction of MC could be useful for rough screening purpose. To upgrade a robust model, number of representative samples must be increased and must confirm a validation with the unknown biomass samples.

Keywords: Biomass, Moisture content, Near Infrared Spectroscopy, Partial Least Square Regression

PROFITABILITY, MARKETING, AND RESOURCE USE EFFICIENCY OF GINGER PRODUCTION: EVIDENCE FROM RUKUM WEST, NEPAL

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Abstract

The study was designed to investigate the profitability, marketing, and resource use efficiency of ginger production in Rukum west. The sample size of 62 ginger-growing farmers out of 187 farmers was determined using slovin's formula. In addition, 20 traders from two major market hubs Simrutu and Jhulneta were interviewed. The pre-tested semi-structured interview schedule was administered to interview a randomly selected sample size. Data were analyzed using descriptive and statistical tools, including the Cobb-Douglas production function. Result showed that the average area under ginger cultivation was 0.14 ha . The benefit-cost ratio (2.02) indicates that ginger production enterprise was profitable. The productivity of ginger in the study area was estimated to be 11.39 Mt/ha, while per kg cost of production was found to be (NRs 35.67 = USD 0.30). Most of the gross income (78.85%) was found to be contributed by fresh ginger. Similarly, gross margin, market margin, and producer's share were found to be 21.16, 33.33, and 62.97%, respectively, for 1 kg of ginger. The indexing technique identified high-cost with low-quality seed and price instability as the major problems associated with the production and marketing of ginger, respectively. Cobb-Douglas production function estimated the value of return to scale at 0.889, implying that ginger production exhibited decreasing returns to scale. A study on resource allocative efficiency revealed that farm yard manure and total labor were underutilized resources while seed rhizome was overutilized resource. Thus, for optimal allocation of resources, expenditure on farm yard manure and total labor need to be increased by 87.374% and 39.908%, respectively**.** The study concluded that an effort should be made to bridge the gap between optimal resource utilization and current practices. For this, it is prime important to interconnect the combined efforts of ginger growers, provincial government, or any developing partners.

Keywords: Benefit-cost ratio, Cobb-Douglas production function, Resource allocative efficiency.

ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM BAMBOO RHIZOSPHERE AND THEIR ROLE IN PLANT GROWTH PROMOTION

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Abstract

Plant growth promoting rhizobacteria (PGPR) are group of root associated bacteria which intimately interact with the plant roots and consequently enhance growth by extemporizing nutrient retrieval or phytohormone production. We isolated and screened indigenous phosphate solubilizing and auxin producing PGPR from bamboo rhizospheric soil, and assessed their growth promoting activity in seedlings of Bambusa nutans subsp. cupulata. Altogether 66 soil samples were collected depth wise (5, 10 and 15 cm) from four species of bamboo (Bambusa nutans subsp. cupulata, B. balcooa, B. tulda and B. nepalensis) from Dhanusha, Mahottari and Sarlahi districts, Nepal. 120 isolates of PGPR were obtained by serial dilution in Pikovskaya's (PVK) agar and Luria Bertani (LB) agar. 92 out of 120 isolates of PGPR with the ability to solubilize phosphate were selected based on the halo colony ratio in PVK medium and auxin production in LB agar. Among them six isolates having high ability to solubilize phosphate and high amount of IAA production capacity were further screened. Biochemical analysis revealed that these isolates belonged to the genus Pseudomonas. Phosphate solubilizing index (PSI) and IAA production by six isolates ranged from 4.19±0.8 to 7.65±1.3 and 72.93± 0.2 to 82.48±0.9 µg/ml respectively. Seed germination experiment using surface sterilized seeds of B. nutans subsp. cupulata revealed that six isolates significantly increased shoot length (13.26±0.56cm), shoot fresh weight (16.26±1.02mg), shoot dry weight (10.56±0.09mg), root length (4.9±0.5cm), root fresh weight (7.56±1.05mg), root dry weight (3.21±0.01mg), and chlorophyll 'a' (2.16±0.01mg/g) and chlorophyll 'b' (1.19±0.06mg/g). Statistical analysis revealed a positive correlation between the inoculated isolates and plant growth traits. This study suggests that PGPR isolated from bamboo rhizosphere could be a potential source for bio-fertilizer as they have demonstrated outstanding contribution for effective plant growth.

Keywords: Auxin, Bamboo, Biofertilizer, Nepal, Phosphate solubilizing index, Rhizosphere, Siwalik,

SYNTHESIS AND CHARACTERIZATION OF ACTIVATED CARBON DERIVED FROM TRIPHALA SEEDS STONE FOR ENERGY DEVICES

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Abstract

Nanoporous carbon materials exhibit high surface area due to well-defined pore structure. Because of which the activated carbon prepared from biomass could be suitable low-cost electrode materials for high performance electrochemical supercapacitors. Here we prepare the novel nano-porous activated carbon from Triphala in a definite ratio of Harro, Barro and Amala seeds stone. The prepared activated carbon is characterized by Iodine and Methylene blue adsorption properties. Here Zinc Chloride is used as an activating agent for the precursor. The effect of carbonization time and carbonization temperature was studied. The experimental result indicates that at a mixing ratio 1:1 carbonized for 4h at 400^0C for the Triphala seeds stone shows high value of iodine number and methylene blue number as 1015.43mgg^{-1} and 375.77mgg^{-1} respectively. The surface area and the pore volume of the sample were found as 1073.64m^{2}g^{-1} and 0.8841cm^{3}g^{-1} respectively. The high value of iodine number and methylene blue number indicate that the prepared sample have well-defined micro and mesopore structure with high surface area and pore volume. This shows that prepared nanoporous carbon material led to their excellent electrochemical supercapacitance performance.

Key words: Biomass, Electrochemical performance, Supercapacitor, Nano-porous, Chemical activation

STUDY OF COMPOSTING OF KITCHEN WASTE BY USE OF DIFFERENT MICROBIAL CULTURE ALONG WITH BIOCHAR AND ITS NUTRIENT ANALYSIS

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Abstract

Kitchen waste has long been responsible for a significant amount of pollution. As a result, there has been a compelling need to improve the vegetable waste treatment system. The goal of this study was to evaluate different additive combinations with kitchen waste in order to optimize treatment efficiency and determine the optimal time required for each treatment to produce good quality compost. Kitchen waste was decomposed in this study utilizing a variety of microbial cultures, including EM.1, Biofertilizer, Prarhamva Decomposer, and Biochar. Each treatments including 5 kg of kitchen waste including browns. Biochar (800g) + Biofertilizer provided the fastest breakdown, while the prarhamva decomposer took 16 days to decompose kitchen waste. In the 20th day, biochar + biofertilizer was decomposed, Biochar in the 21st day, Biofertilizer in the 25th day, and EM.1 and control in the 35th day, respectively. The nitrogen, phosphorous, potassium, organic carbon, PH, and moisture content were all analyzed. This test helps is the management and use of kitchen waste as compost.

Keywords: Composting, Kitchen waste, Kitchen waste management, Biofertilizer, Biochar, Microbial treatments, Nutrient analysis

EFFECTS OF INTEGRATED PLANT NUTRIENT MANAGEMENT SYSTEM ON BUSH FRENCH BEAN PRODUCTION AND SOIL PROPERTIES (A POT TRIAL)

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Abstract

Integrated Plant Nutrient Management System (IPNMS) focuses on the optimum utilization of locally available nutrient resources along with the proper use of synthetic inorganic fertilizer, maintaining optimum crop growth and production and also focusing on soil health, soil fertility and productivity and environment. Besides production, inorganic fertilizer has other negative impacts in term of soil productivity, soil health and environment. And using manure, crop residue, field waste helps to increase the soil productivity, good soil structure, soil physical properties and biologicEal properties, and lead. It even reduces the cost of the fertilizer, but these organic sources can provide considerably low amount of nutrients especially macronutrients. IPNMS includes both types of sources, and suggests for integration and tries to combine the benefit of both. French bean (*Phaseolus vulgaris*) is commonly found leguminous crop and it is popular in Nepal too. French can be eaten on green stage and also dry seed as *dal*. And it is usually grown on the warm season, and can be grown almost throughout a year, in hilly region. Bushy variety- *Contender* is used for the study which can be harvested on 50-55 days. IPNMS practice has been found effective and it is one of the most applicable cultivation practice and this study is to find out which of the manure and fertilizer combination is effective, Cow Manure (also known as Farm Yard Manure), Poultry manure, Compost and Vermi-compost along with Rhizobium and PSB are used. There are 8 treatments with 3 replications for each, carried out on Grow Bag.

Keywords: IPNMS, Bush French Bean, Bio-fertilizer, Pot-trial, Soil Properties.

PREPONED NATURAL BUDBURST TIMING ENABLES SUCCESSFUL GRAPEVINE CULTIVATION IN NEPAL

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Abstract

Grapevine (*Vitis vinifera*) has been widely cultivated all around the world which typically prefers Mediterranean type of climate. But overtime the it's cultivation has been extended to warmers regions of tropics and subtropics due to advances in breeding, dynamic vine management practices and use of several plant growth regulars. In Nepal, it is believed that grapevine cultivation has been started since seven decades ago. Still, the area under grape cultivation is limited to couple of hectare (~20 ha in 2015) with negligible production volume. The bottleneck of the grapevine cultivation in Nepal is considered the harvesting time coincided with the seasonal monsoon associated diseases. Other reported factors are narrow range of germplasms, lack of knowledge regarding grapevine phenology, suboptimal chilling, inadequate vineyard management, and negligible research priorities. Series of field experiments with the application of doses and timing of hydrogen cyanamide (H_2CN_2) and pruning dates had been done since 2019 to prepone the natural budburst time aiming to harvest the crop earlier than seasonal monsoon. Considering the results of experiments in Warm Temperate Horticulture Farm, Kirtipur and Kewalpur Vineyard, Dhading, 50% budburst were preponed from 10-30 days than natural timing and the harvesting was 7-25 days earlier than natural harvest with minimum acceptable quality depending on grapevine cultivars. H_2CN_2 application also improved the percent budburst and uniformity in budburst, and thus improved the yield. It is concluded that the right time and dose of H_2CN_2 application is one of the key management practices for the successful grapevine cultivation in Nepal.

Keywords: Grape, Viticulture, Hydrogen Cyanamide, Berry

SPATIOTEMPORAL PATTERNS OF PREDATOR-PREY INTERACTIONS IN BARDIYA DISTRICT, NEPAL

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Abstract

Prey-predator interaction is governed by their respective spatiotemporal activity patterns and coping mechanisms to optimize their own fitness. Human-dominated landscape can cause changes in these patterns impending further population declines and range shifts. We investigated the spatiotemporal patterns of co-existence of prey and predators alongside human disturbance using camera traps in Bardiya National Park and its adjacent areas. 104 cameras were established in the centre of 2*2 km grids for 2857 camera trap days after dividing the study area into less disturbed inside national park (NP) and highly disturbed outside national park (ONP). Activity patterns and temporal overlap of tiger (predator) and its seven wild prey ungulates (prey) were estimated by utilizing kernel density estimation techniques. Spatial overlap was estimated by Pianka's index. Highest activity level was exhibited by tiger and four-horned antelope in NP and ONP respectively. The highest temporal and spatial overlap of tiger was with chital in NP and with wild boar and chital in ONP respectively. Spatial overlap between tiger-prey pairs was low (i.e. lower than 56%), whereas temporal overlap was widely distributed (35%-83%). Results from Watson's two-sample test showed significant difference in the activity level of tiger and all prey ($p<0.001$) in NP contrary to that of ONP where except for swamp deer and barking deer all prey showed no significant difference. Our results indicate that spatial differentiation is more important for predator-prey co-existence. Shift in activity of prey species towards nocturnality and human-disturbed areas was observed which can cause consequent shift in predator activity causing conservation complications. We suggest inclusion of temporal aspects in conservation management planning.

Keywords: Activity pattern, Bardiya National Park, Human disturbed landscapes, Outside national park, Temporal overlap

RICE LANDRACES AND IMPROVED VARIETIES IN PRACTICE OF CULTIVATION IN PHEDIKHOLA RULAR MUNICIPALITY, SYANGJA DISTRICT, NEPAL.

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Abstract

Nepal is rich in rice landraces due to its diverse topography and numerous agroecosystems. In terms of cultivation and consumption, rice is one of the most important crops of Nepal. The current study was carried out in Karamdi village, Phedikhola Rular municipality, Syangja, Nepal, to document rice accessions cultivated by local farmers. A total of 46 households were surveyed based on the judgmental sampling. The head of family from each household was interviewed, and three focal group discussion was carried out during the survey. A total of ten rice accessions were reported from the study area and out of them seven varieties named 'Pahale', 'Gola', 'Mansara', 'Gudura', 'Kholejarpani', 'Gurdi', 'Kanjira' are landraces. Among the landraces the most popular variety is 'Pahale' which is grown by 71% of the household. Other landraces such as 'Gudura', 'Mansar', and 'Kanjira' are in the verge of of extinction. Varieties named 'Bikashe-3', 'Radha-7' and 'Kafaltade' are improved varieties. Annual rice production per household was 4.12 quintal. However, this is insufficient for subsistence, so on average 103.8 kg of rice per household is imported each year. The study shows that the rice landrace are still popular in the study area in the context of wide use of improved varieties throughout the country. Hence the farmers and local authorities should be encouraged to conserve the rice landraces with effective measures to improve their productivity, minimize the import and introduce of exotic varieties.

Keywords: Agrobiodivesity, Agroecosystem, Landrace, Rice cultivars, Rice varieties.

FINE ROOT BIOMASS AND THEIR NUTRIENT CONCENTRATIONS IN THE FORESTS LOCATED ALONG ALTITUDINAL GRADIENTS IN THE TROPICAL REGION OF EASTERN NEPAL

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Abstract

Fine roots are the important source of below ground soil organic matter. The objective of this research was to estimate fine root biomass and their nutrients concentrations in the forests located along elevation gradients in tropical region of eastern Nepal. Soils were collected from 0- 15 cm and 15-30 cm from top of each plot at five different forests (Kanepokhari, Rajarani, Murchngi, Adheri and Sakma). Fine root biomass of < 2 mm and 2-5 mm diameter root size were estimated in both soil depths. Fine root biomass was found higher in upper soil depth (0-15cm), ranged between 5.15 to 9.63 t per ha and < 2 mm diameter size ranged between 3.42 and 6.55 t per ha among all the forests studied. Among the studied forests, highest fine root biomass was recorded at Murchungi (700-800 m elevation). Fine root biomass showed increasing trend up to this elevation and decreasing trend beyond this. So far the nutrient concentrations are concerned, nitrogen was higher in <2 mm diameter fine root (ranged from 1.01 to 1.23 %) than 2-5 mm size. Contrary to this, potassium concentration was found higher in fine roots of 2-5 mm diameter in all forests. However, phosphorous concentration was nearly same in both < 2mm and 2-5 mm sized fine roots. Upper depth (0-15 cm) and < 2mm diameter size fine root exhibited a rich source of nutrient management.

Keywords: Below ground, Diameter, Depths, Nitrogen, Phosphorus

ELEVATED CARBON DIOXIDE *VIS-À-VIS* AGRICULTURAL PEST MANAGEMENT: DISSECTIONING THROUGH NEUROBIOLOGICAL MECHANISM

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Abstract

Global warming trigger major changes in the geographical distributions of insects species. One of the key elements of the global warming is the rising atmospheric carbon dioxide ($CO2_)$. Carbon dioxide is a ubiquitous gas abundant in Earth's atmosphere and the concentration of this gas is currently increasing at an unprecedented rate. Several insect species are likely to become more devastated with the global warming. Here, we use one of the serious pests causing substantial damage in more than 200 food plants – *Helicoverpa armiera*. These insect species detect external fluctuations in atmospheric CO_2 for finding a suitable host plant both in relation to feeding and egg laying via a specialized organ called labial pit organ in the mouth part. The female moth releases the pheromones to attract the male for mating. The female sex pheromone is detected by the other structure, the antennae. This study addresses whether an elevated CO_2 has a significant effect on the pheromone detecting structure in this species at the neuron level. How and where such interaction takes place despite detecting these two stimuli at two separate structures. We performed an electroantennogram (EAG) to measure the responses elicited by the mixture of the pheromone and carbon dioxide. We used three concentrations of CO_2, 0.1%, 1%, and 10% mixed with pheromone blend. The high concentrations of CO_2 (10%) suppressed the response of the pheromone sensing sensory neurons. The lower concentrations of CO_2 did not have a significant suppression effect. The increase in global warming will benefit the agricultural production by eliminating the destructive effect of these moths and also sequestrations of the more carbon atoms in the growth of the plants.

Keywords: Global warming, Carbon dioxide, Pheromone, Moths, Electroantennogram

DISTRIBUTION AND ABUNDANCE OF INVASIVE ALIEN PLANT SPECIES IN A TROPICAL FOREST OF SOUTH-EASTERN NEPAL

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Abstract

Invasive Alien Plant species (IAPs) is a major concern in tropical and subtropical forest, yet their distribution and abundance are poorly understood at local level like forest patch where management interventions are implemented. It is crucial to understand the factors that governs the distribution and abundance of IAPs to manage them efficiently and cost-effectively. However, forest-level information and species-specific information on the distribution and abundance of IAPs are little known. In this study, we analyzed spatial distribution and abundance of IAPs in a tropical remnant forest at Jalthal of Jhapa district situated in south-eastern Nepal which has uniquely rich biodiversity, yet rapidly degrading due to spread of IAPs and other anthropogenic activities. Following the systematic random sampling method, the forest was divided into 261 grids, each of size 500 m × 500 m, to generate sample points and their locations. Altogether, 228 plots were sampled establishing a nested circular sampling plot of radius 1m, 3m, and 10m concentrically at each sampling location where environmental variables, disturbance factors, and species level data were assessed. Altogether eight IAPs were recorded within the sampling plots out of which *Mikania micrantha* and *Chromolaena odorata* were the most abundant and frequent species. Among several variables assessed, tree canopy was found to be the most significant environmental variable influencing the abundance of these two species as indicated by a decline in their abundance with increase in the tree canopy. The result suggests that the shade provided by the tree canopies would be an effective barrier to limit the establishment and growth of IAPs in a tropical forest. Therefore, increasing the tree canopy through certain forest management activities could be an effective strategy to control IAPs within the forest.

Keywords: *Chromolaena odorata*, Jalthal Forest, *Mikania micrantha*, Tree Canopy

POPULATION STRUCTURE AND REGENERATION STATUS OF *PINUS-QUERCUS* MIXED FOREST IN BHARDEW VILLAGE, LALITPUR DISTRICT NEPAL

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Abstract

The temperate forest (1817-2627masl) of Bhardew village, Lalitpur was quantitatively analyzed to find the population structure and regeneration status of tree species. The study was carried out by laying down twenty-eight concentric circular plots of 8.92-meter radius randomly during 2021-2022. Altogether 28 tree species belonging to 23 genera and 18 families were recorded. However, five species (*Miliusa velutina*, *Cinnamomum camphora*, *Rhaphiolepis dubia*, *Maesa chisia*, and *Saurauia napaulensis*) were only recorded in seedlings or saplings form but not in adult form. The forest was found to be dominated by the species of *Pinus sps.* and *Quercus sps.* with the IVI values ranging from 49.91 to 35.24. The average Simpson's diversity index was 2.88, Shannon Weiner's index was 0.85, species evenness was 0.57 and species richness was 1.07 in the study area. Individuals were divided into three groups based on their girth classes viz. seedlings, saplings and adults. The natural regeneration status was determined based on population size of each species. The overall regeneration status of the forest was fair having seedlings 6484 individuals/ha, saplings 533 individuals/ha and adults 1198 individuals/ha. The majority of tree species showed fair regeneration (32.14%) followed by none regeneration (25%), new regeneration (17.85%), poor regeneration (14.28%) and good regeneration (10.71%). The density diameter curve of the forest showed uneven distribution indicating that forest harbors an unhealthy population with missing of various diameter classes. The present analysis revealed that the population structure may get altered in future and the species with none to poor regeneration should be prioritized for the conservation.

Key words: Temperate forest; Diversity index; Species richness; Girth class

ORCHID CONSERVATION IN NEPAL: A NEED FOR SHARED UNDERSTANDING OF ILLEGAL TRADE NETWORKS AND DOMESTIC LEGISLATION

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Abstract

Nepal hosts over 500 orchid species, more than 100 of which are reportedly harvested for Ayurveda, Amchi, and Chinese medicinal trade. Wild orchid harvest and trade have been, at different times, both legal and illegal in Nepal. However, many orchid species are sensitive to over-harvest due to their biology yet are economically important to many rural communities, including to socio-economically disadvantaged indigenous groups and women. This threatens not only orchid conservation, but also harms ecosystem services and rural livelihoods, and overlooks potential for more sustainable management. This research explored the existing challenges to conserving Nepal's most traded medicinal orchids. It highlighted what is known about the country's legal and illegal trade, based on analysis of seizure records, the CITES Trade Database, and a detailed review of national and sub-national legislation governing orchid resources. Despite being legally protected, orchids were being traded illegally, mis-reported in the CITES Trade Database and the implementation of legal projections was subject to wide confusion. The study highlighted that the strong focus on CITES Convention and national-level CITES legislation is important, but it often overlooks a complex network of sub-national implementing legislation that influences meaningful on-the-ground decisions affecting wildlife. As such, this study suggests the need for detailed, shared understanding of both illegal trade networks and of domestic legislation–in order to tackle illegal trade, and meaningfully support more sustainable use of plant resources.

Keywords: CITES, Medicinal orchids, Plant trade, Legal ambiguity, Governance challenge

ROOT COLONIZATION, SPORE DENSITIES OF ARBUSCULAR MYCORRHIZA IN *TERMINALIA ALATA* HEYNE EX ROTH IN TROPICAL FOREST OF EASTERN NEPAL

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Abstract

Terminalia alata, a member of Combretaceae family is a valuable timber tree species found often in alluvial soil. Earlier information is mainly confined to its timber value and medicinal importance. *Terminalia alata* is considered as an important tree species in Ramdhuni forest as this species only is used to burn to make Dhuni (wood fire), a historic and spiritual event which has been maintained continuously since long back. The present study is designed to understand the arbuscular mycorrhiza (AM) association in *Terminalia alata*, such a valuable tree species. Samplings were carried out in the rainy season (June – August, 2021). Spores were isolated using wet sieving and decanting method, while extraction of AM fungal root colonization was done using the magnified intersection method. AM fungal spores were counted under stereomicroscope. Based on the magnitude of infestation *Terminalia alata* could be recognized as an active colonizer of AM fungi. The root segment was found to contain different AM fungal structures i.e. hyphae, hyphal coils and vesicles. This study serves as a tool to understand the belowground functioning, a state of art of mycorrhizal association and interaction with the host species which would be useful for the management of forest resources using a natural symbiont.

Keywords: Combretaceae, Hyphal coils, Ramdhuni, Rhizosphere, Vesicles

LOOKING INTO BIOECONOMY OPPORTUNITIES FROM AGRICULTURE, MUNICIPAL, LIVESTOCK, AND HUMAN WASTE AT THE SUB-NATIONAL LEVEL IN NEPAL

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Abstract

Biomass is abundantly available in Nepal. However, it is mostly underutilized due to the lack of proper valorization mechanisms. We assessed the theoretical biowaste potential mainly from agriculture, municipal, and livestock sectors at the sub-national level for the first time in Nepal based on the secondary literature. We have also discussed the existing biowaste management and consumption practices and the possible waste-based bioeconomy focusing on fuel, feed, and fertilizers (FFF). It has been estimated that the country has a biowaste potential of 62,477 kilotons (kt) per year; 24,305 from agriculture, 1,255 from municipal, and 43,917 from livestock, poultry, and human sectors. Province 1 found the highest, and Province 2 estimated the lowest in terms of biowaste potential. The variation in quantity is mainly due to land area, land-use practices, and geography. There is a considerable under utilization; a total of 69% agriculture crop residue, 51% municipal organic waste, and 31% livestock, poultry, and human wastes are estimated to be available for other valorization purposes. The conversion of such waste to high-value products like densified biomass fuel (pellets and briquettes), densified total mixed ration (DTMR) feed blocks, biogas, biofertilizer, and biochar can be beneficial for both the economy and environment. Such sub-national level biowaste information revealed by the study is expected to be helpful for the government to formulate policies and entrepreneurs for business plans and open the door for further research.

Keywords: Biowaste, Waste potential, Bioeconomy, Nepal

EVALUATION OF RICE GENOTYPES FOR RESISTANCE TO YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER) THROUGH SCIRPOLURE

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Abstract

Yellow stem borer, *Scirpophaga incertulas* (Walker) is one of the important insect pests causing serious damage to rice growers of Tikapur, Kailali. This pest is monophagous in nature and feeds specifically on rice. This study was done to evaluate the host preference of yellow stem borer of rice to the various genotypes of rice in Tikapur Condition. The research design employed was Randomized Complete Block Design (RCBD) with seven treatments and three replications and research was carried out in farmer's field of Tikapur in kharif season of 2021. Rice varieties selected were Sabitri, Sarju 52, US 312, Radha 4, Sawa Mansuli, Silky Mansuli and Hardinath-3, which are popularly cultivated in Tikapur. Scirpolure (pheromone trap) was installed to monitor the preference of yellow stem borer especially for panicle initiation stage for above mentioned rice varieties. Three weeks data was recorded by counting the number of adult moths captured in the trap in each week. From the experiment, highest mean number of male moths were trapped in hybrid variety i.e. US 312. Furthermore, statistical analysis revealed that the yellow stem borer adult moths were highly attracted to the US 312 and this variety was followed by Sawa Mansuli. Sawa Mansuli was again followed by Sabitri, Radha 4 and Hardinath-3. Most importantly, Sarju 52 and Silky Mansuli were resistant to yellow stem borer attack compared to US 312, Sawa Mansuli and Sabitri. This research showed that the adoption of popular rice variety Sarju 52 and Silky Mansuli could safeguard the farmers from the notorious pest i.e. yellow stem borer of rice.

Keywords: Yellow stem borer, Rice, Variety, US 312, Scirpolure

LAND USE LAND COVER CHANGE DETECTION AND DEFORESTATION IN PHIDIM

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Abstract

The Living Planet Index (LPI) report 2020 shows an average 68% decline in global vertebrate species populations and the report has attributed the deforestation and habitat degradation as the primary cause of this decline (WWF, 2020). In 2011, the Government of Nepal (GON) had selected 10 districts to be developed as the modern city (Himalayan News Service, 2015). Among them Panchthar (Phidim) is one of the districts to be developed as modern city based on which there is rapid destruction of forests for road construction. This study focuses on to study the land-use/land cover change, and determine deforestation rate since project commencement. The study utilized the remotely sensed Landsat imagery for this analysis and pixel based maximum likelihood classification algorithm was used to classify images into LULC classes. The final output of the analysis was LULC map of 2010 and 2021 in which post-classification comparison techniques had been employed to detect LULC changes and deforestation rate in the study area. There had been found that over the period of 10 years the deforestation rate constituted was 2.58%. This annual rate of forest change/deforestation is way higher than average of Nepal's annual rate of deforestation: 0.68% (Reddy, 2018). This study found that the most critical factor causing deforestation is conversion to bare land, followed by agriculture and urban development. Further analysis unveiled that under the name of MTDP clearing of forests into barren land has doubled and this transition is gradually been encroached by agricultural practices. This information is believed to be a valuable commodity for local land-use planners, urban planning committees, and green advocates.

Key words: Land-use Landcover change, Deforestation, Phidim (Panchthar), Modern townDevelopment project, Remote sensing and GIS

POSTER PRESENTATION

BOTANICAL EXTRACT AS A BIOCONTROL AGENT AGAINST FUNGUS *ALTERNARARI SOLANI CAUSING* EARLY BLIGHT IN POTATO

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Abstract

Early blight, caused by a fungus, *Alternaria solani*, is one of the destructive diseases of potatoes. It can reduce yield from 20% to 50% under severely infected conditions. An experiment using the poison food technique was conducted in *in-vitro* conditions to evaluate the efficacy of six botanical extracts, viz. *Artemisia vulgaris, Datura stramonium, Lantana camara, Justicia adhatoda, Melia azadirach and Parthenium sp. and a* fungicide: Mancozeb, on mycelial growth of *Alternaria solani* at the plant pathology laboratory of National Potato Research Program, Khumaltar. Lalitpur. Potato Dextrose Agar (PDA) was used as a nutrient medium. Plant extracts were prepared using Soxhlet extraction procedure employing acetone as a solvent. The final stock solution of extracts were maintained at a 2:1 (w/v) ratio. Two different concentrations, i.e. 0.5% and 1% of botanical extracts and 1000 and 2000 ppm of Mancozeb, were used. Plant extracts and chemical fungicide were mixed well in the molten PDA media and poured into Petri plates (90 mm diameter). The PDA plates containing poisoned bait were inoculated with a 4mm diameter agar plug of actively growing mycelia of *A. solani* at the center of Petri plate. The radial growth of mycelium was recorded at five days of inoculation, and percentage inhibition growth was calculated by comparing it with control plates. Mancozeb had a maximum inhibitory effect of 74% and 77% at 1000 ppm and 2000 ppm. Among botanical extracts, *A. vulgaris* had a significantly higher inhibitory effect of 12% and 36% at 0.5% and 1% concentrations. The percentage inhibition growth of *A.vulgaris* was followed by *M. azadirach*. However, *J. adhatoda* had not shown any anti-fungal potential. Inhibitory effects of *A. vulgaris* and *M. azadirach* suggests their application as alternatives to fungicides for controlling *A. solani*.

Keywords: Agar plug, Actively growing mycelia, Percentage inhibition growth, Soxhlet extraction, Stock solution

ISOLATION AND IDENTIFICATION OF FUNGAL PATHOGENS OF MUSHROOMS

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Abstract

Fungi causes diseases and acts as competitor molds, thereby incurring a significant loss in yield and productivity of mushrooms. The studies on fungal diseases affecting mushrooms are very limited in Nepal. So, the current study was carried out to isolate and identify the fungal pathogens of mushrooms in Nepal, by morphological and molecular methods. The research was carried out at Nepal Academy of Science and Technology, Khumaltar for a period of 1 year from December 2020 to 2021. A total of 41 samples (mushrooms, substrates, casing soil, and spawns) were collected from 13 mushroom farms and 5 spawn laboratories of 5 districts of Nepal: Kathmandu, Lalitpur, Bhaktapur, Chitwan, and Morang. Then, the samples collected were inoculated on PDA and incubated at 25ºC for 7 days. Pure fungal isolates thus obtained were identified by observing colony morphology and microscopic characteristics. Further the identity of selective isolates was confirmed at molecular level by Sanger sequencing of the ITS region. Forty-three different fungal isolates belonging to 9 different genera were obtained. Thirteen different species of fungi were identified: *Trichoderma pleurotum, T. atroviride, T. reesei, Aspergillus flavus, A. niger, Penicillium brevicompactum, Chaetomium globosum, C. funicola, Alternaria alternata, Clonostachys rosea, Sordaria fimicola, Rhizopus oryzae* and *Mortierella elongata.* Among the fungal isolates, *Trichoderma* sp. was the most prevalent (27, 62.8%). Both morphological and molecular methods are suggested for the accurate identification of fungal pathogens of mushrooms.

Keywords: Mushrooms, Fungal diseases, ITS region, *Trichoderma*

CHARASTERISTRISTICS OF SOIL IN DIFFERENT LAND USE TYPES IN BUFFER ZONE AREAS OF SHIVPURI -NAGARGUN NATIONAL PARK, CENTRAL NEPAL

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Abstract

The aim of this study is to analyze physicochemical characteristics of soil in buffer zone of Shivpuri-Nagarjun National Park, Kathmandu, Nepal. The soil samples were collected from two different land use types considering different depths and season. Different Physiochemical parameters were analyzed. Soil Bulk density (BD) determined by using the core method, soil organic carbon measured dichromate oxidation method, macro-Kjeldhal method is applied for total nitrogen, available phosphorous and available potassium including all others determined by using standard methods. The highest value of BD (1.33 g/cm3) was found in 20-30 cm depth in abandoned land in post monsoon and the lowest (1.15 g/cm3) in 0-10 cm in agriculture land in monsoon. The soil pH, moisture and EC ranged from 5.6 – 6.4, 18.1 - 42.02 and 21.2 – 67.9 µ S/cm3 , respectively. The highest (2.55 and lowest (1.67 %), value of SOC were found in monsoon in abandonment and agriculture land respectively. The highest (0.25 %) and lowest (0.10 %) value of total nitrogen were found in post monsoon in (0-10) cm depth. The available phosphorus 58.52 kg/ha and 32.4 kg/ha from agriculture land were obtained from the depth of 0-10 and 20-30 cm respectively. The maximum 720 kg/ha and minimum 194.93 kg/ha available potassium was found in agriculture land in (0-10) cm depth in post monsoon. The results revealed that land use types and its depth and seasons as well lead to change the soil characteristics.

Keywords: Soil, Physio-chemical characters, Land use type, Soil depth, Season

INNOVATION AND KNOWLEDGE MANAGEMENT

THEMATIC SPEAKER

INNOVATION AND KNOWLEDGE MANAGEMENT: CHAOTIC TRANSPORT OPTIMIZATION FOR SUSTAINABLE DEVELOPMENT

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Abstract

Every success of specific sustainable development goals are heavily dependent on innovative ideas and scientific knowledge management. Optimizing a complex transportation dynamics in everyday life, rush-hour traffic, special event periods, and emergency scenarios is a computationally challenging issue, and it is mathematically an unsolved open NP-hard problem. A universally acceptable analytic or heuristic solution and an implementation software is hardly available although a world class of scientists from different research domain such as mathematical scientists, engineers, computer scientists and IT specialists, economists, management scientists and practitioners have been deeply devoted for scientific based solutions. In this talk, we briefly hint the operational model approaches that are most relevant in addressing the issues of complex traffic chaos. The strategies may be beneficial for transferring maximum number of people from densely affected places to the safer destinations or minimizing the time needed by using suitable and available vehicles. One may wish to look at multi-objective approach as a combination of them. Since the data are either unavailable before the event occurs or they are already uncertain in case of unpredictable scenarios, the problems are extremely difficult if the network topology or thereby the data to be involved are enormous. A focus will be given to the mathematical models with lane reversals that are widely adopted for reducing traffic congestion, models that benefit by reducing merging and crossing conflicts, and partial reversals that support location planning and logistic supports for humanitarian relief. As optimal transportation plans relax the life, save the property and significantly reduce the cost to be occurred in the society, these models and solution strategies play vital impact for the sustainable development goals if implemented scientifically.

INVITED SPEAKER

STATISTICAL ANALYSIS OF GENDER GAP IN EDUCATION AND EMPLOYMENT – EXAMPLES FROM

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Abstract

Women are 50% of the population. If this section lags behind in education and opportunity, then half of the world will be deprived of opportunities. This lag also affects science and technology which has adverse impact on society at every level. Efforts should be made to reduce this gap. "Achieve gender equality and empower all women and girls" is also one of the seventeen United Nations Sustainable Development Goals. So, data based studies related to the gender gap in science and technology needs to be conducted, as what gets measured also should be done. With 66% of people being employed in agriculture sector, the economy of Nepal is agricultural based. This workforce is mainly dominated by women. With men migrating abroad for lucrative and well paid jobs, the contribution of women in the workforce has increased from 36% in 1981 to 45% 1991. This number has further soared to 50% in 2017. But the percentage of women with ownership of land is only 20%. Here, gender gap in education and employment sector in Nepal and in various science streams in two universities in particular is analyzed. University graduates are considered to be highly skilled and are employed in highly paid white collared jobs. This paper is a study of dynamics of change in gender gap with respect to subject of education and employment. It will be helpful in providing guidelines to policy makers and planners. The results are based on secondary data which was collected by the government [1]. These results can be generalized to other countries of South Asia and Africa.

Key Words: Logistic regression, Odds ratio, Odds in favor, Categorical data

INNOVATION & KNOWLEDGE MANAGEMENT

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Abstract

Innovation & knowledge management and are two key activities for any organization & to develop the country. Considering our country Nepal, currently we are very behind in innovation because of lack knowledge management. Presently, all graduates are going to pursue their higher education to another country and many peoples are going for foreign employment because of improper plan of government. Nepalese people import around 90% of goods from other country, which tends economics crisis or always depends on other product. Only 10% of goods are exported to other countries. Innovation is very important factor for economic development. Knowledge management has been regarded as one vital management approach in new era of knowledge-based economy. The need for organizations to innovate comes from increasing competition and customer demands and new market areas. Knowledge management has important implications for innovation; therefore, it is imperative that we understand the role of Knowledge management in innovation. Its important to grow all individual economy in country which will make country prosperous through innovation & knowledge management.

ORAL PRESENTATION

DEVELOPMENT OF NOVEL COMPACT RADIOLOGICAL DATING INSTRUMENTATION BASED ON COLLINEAR RESONANCE IONISATION SPECTROSCOPY (CRIS)

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Abstract

Traditional radiological dating techniques such as carbon dating using isotope ratio accelerator mass spectrometry (AMS) are expensive, experimentally complex and access to instrumentation is often associated with excessive lead times. The use of CRIS as an alternative method affords unparalleled interference suppression when compared to other laser based spectroscopy techniques or AMS. The CRIS technique was developed at CERN in the ISOLDE facility for the analysis of exotic radionuclei. When scanning the frequency of the excitation laser across a known transition the hyperfine spectrum may be acquired. Acquisition of hyperfine spectra enable nuclear spins and precise values of nuclear magnetic dipole and electric quadrupole moments to be determined. By sitting on-resonance without scanning it is possible to further enhance the high selectivity and sensitivity that CRIS affords for the determination of precise isotope ratios for radiological dating. The sample inlet is configured to incorporate a flash gas chromatography nitrogen/carbon elemental analyser for carbon dating; the resulting CO_2 gas is bled into the ion source with initial carbon mass selection & detection of the major isotopes being performed using a multi-collector magnetic sector. The high sensitivity & non-resonant suppression characteristics required for the determination of the ultra-trace ^{14}C isotopic abundance employs the CRIS experimental setup. The instrument at the University of Manchester is initially being configured for isotope ratio analysis of krypton, strontium and carbon but can easily be tuned for other elements and offers a state-of-the-art alternative technique for various forensic, environmental, archaeometry and food security applications.

Keywords: CRIS, Carbon dating, Hyperfine spectroscopy, Mass spectrometry, Archaeometry

SYSTEMATIC REVIEW ON FACTORS ASSOCIATED WITH FEMALES AGE AT MARRIAGE

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Abstract

Number of different factors found to be associated with female's age at marriage, varying due to many reasons. This paper is an attempt to identify the determinants associated with female age at first marriage through systematic review of published journal articles. In this study three search engines Scopus, EMBASE and PubMed were used to identify relevant articles combining of key search terms. PRISMA flow diagram is used for the reporting standard including 344 papers, and then using rigorous inclusion and exclusion criteria only 19 papers were included finally. The risk of early marriage, married before the age of 18, are still prevailed in many countries, those who believed in strict cultural and traditional values. The aggregated females mean age at marriage was observed to be 18.6 ± 2.6 years ranging from 14.8 to 24.4, associating with more than twenty-two significant factors. Some of the important determinants associated with females age at marriage were female's education, employment of females before marriage, place of residence, religion, type of marriage and social status, etc. Identification of such important factors associated with outcome is expected to be immensely helpful for policy point of view in the concerned area. No education or low level of education, consanguinity marriage, poor socio-economic condition and place of rural residence were found to be interrelated to females age at early marriage. It was also observed that female spending more years in school significantly increases delay entry into marriage and, subsequently, decreases duration of exposure to the risks of early motherhood.

Keywords: Determinant, Early marriage, Education, PRISMA

HUMAN DEVELOPMENT INDEX AND ENHANCEMENT WITH SELECTION PROCEDURE OF ITS COMPONENTS

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Abstract

This paper aims to identify the method for assessment of rational components and statistical technique to measure the performance in key dimensions of human development. The study uses desk review particularly the literature that focused quantitative techniques used for the computation of human development. Different ideas, models, concepts and knowledge of human development are drawn from various literature. Models and concepts of human development that have evolved over time have been reviewed along with their strengths and weaknesses. Many recent studies suggest that the Human Development Index (HDI) is not complete and there is a need to modify and develop updated measuring tool for human development. In connection with this issue the study focuses to identify and develop rational components and appropriate model that can overcome the deficiency of the existing models. The study recommends the use of Principal Component Analysis (PCA) and methods of regression based upon primary and secondary data for developing estimators for the measurement of the level of human development.

Keywords: Estimator, Human development index, Multiple regression analysis, Principal component analysis, Weighting

ON CERTAIN TYPE OF VECTOR VALUED DIFFERENCE SEQUENCE SPACE $C_0(M, (X, \|.\|), , , A)$ DEFINED BY ORLICZ FUNCTION

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Abstract

In this article we introduce and study a new class $c_0(M, (X, \|.\|),, \langle)$ of normed space $(X, \|.\|)$ valued difference sequences with the help of Orlicz function M .This is a generalization of the familiar sequence space c_0 . Our primarily interest is to explore some linear structures and investigate the conditions relating to the containment relation of the class $c_0(M, (X, \|.\|), , \langle)$ in terms of different and $\langle$. Finally we give some applications of sequence spaces in different fields of science and technology.

Keywords: Orlicz Function, Orlicz Space, Sequence Space, Difference Sequence Space

DICHOTOMIZATION OF QUANTITATIVE VARIABLES IN POVERTY ANALYSIS

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Abstract

It has been proposed four schemes of dichotomization for the four household level quantitative variables – area of land holding, geographic accessibility to the nearest market center, number of children under 15 and number of literate members of working-age – with justification in the selection of threshold value for each variable to dichotomize into disadvantaged and advantaged group of households using the Nepal Living Standard Survey 2010/11 data. Then association of each dichotomized variable with household level poverty status (poor/non-poor) has examined using Chi-square test and the association was found to be highly significant in each case. Finally, the proposed schemes of dichotomization have tested empirically for their ability to differentiate the poor people into two categories - 'more vulnerable' and 'less vulnerable' - by first estimating the three measures of poverty – head count index, poverty gap index and squared poverty gap index - of each group of population and comparing the estimated measures between the disadvantaged and advantaged group of populations. To a large extent the proposed schemes of dichotomization have found to differentiate the poor people into two groups; for example, the head count index of the disadvantaged group of the number of children under 15 is 3.1 times higher than that of the advantaged group. The results of this paper are expected to be useful to the policy makers and development planners of Nepal for focusing their poverty reduction program towards the more vulnerable group of population as well as academician.

Keywords: Headcount index, Poverty gap index, Square poverty gap index, Vulnerable

A SYSTEMATIC REVIEW OF FACTORS ASSOCIATED WITH UNDER-FIVE CHILD MORTALITY

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Abstract

Preventing the life of new born and reducing entrenched disparity of childhood mortality across different level is one of the important public health problems especially in the underdeveloped and developing countries in the world. Sustainable Development Goals (SDGs) -3.2 aims to terminate all preventable under-five child mortality and shrinking it to 25 per 1000 live births or lower than this by 2030. Several determinants have been shown to be linked with childhood mortality. This study is an attempt to explore significant determinants related with under-five mortality by systematic review of literature. EMBASE, PubMed, and Scopus database and Google scholar search engine was used for the systematic search of literatures. To point out the relevant studies, special key words and Boolean operators were used. Original research articles, and peer reviewed papers published in English language till August 10, 2021 were included in the analysis and synthesis of the results. As per the PRISMA guidelines, out of 257 studies identified from different sources, only 19 articles were ascertained for this study. Eligible articles were appraised in detail, and relevant information were extracted and then integrated into the systematic review. Mother's education, place of residence, type of birth (singleton/ multiple), birth order, size of child at birth, age of mother at child birth, household income, family size along with other socio-economic, maternal, child, health facility utilization, and community level variables were observed as significant covariates of under-five mortality. Women education, and easy access to quality health care facilities should be in the apex priority to lessen the childhood mortality.

Keywords: Childhood mortality, Determinants, SDGs, Women education

KdV TYPE EQUATIONS AND VANISHING VISCOSITY

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Abstract

In this presentation, we mainly discussed and talked about the KdV type equation. The general KdV equation is given by u t +a u x +2buu x +cu xxx -du xx =0, u(x,0)=u 0 (x) where a,b.c,d are parameters. The objective of this presentation is to explore the role of viscosity in the solution of the equation and its regularity. We here use Pseudospectral method and reduce the value of the viscosity coefficient to zero so as to study the inviscid cases and the change in the nature of solution from viscous to inviscid case. Also we discuss the various cases depending upon the values of a, b, c and d. Finally we found that the solution becomes regular for the viscous case whereas in the case of inviscid, there is formation of shock.

Keywords: KdV equation, Viscosity, Nonlinearity

ENVIRONMENTAL IMPACT ANALYSIS OF USED PERSONAL PROTECTIVE EQUIPMENT IN NEPAL BASED ON LIFE CYCLE ASSESSMENT

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Abstract

The excessive use of Personal Protective Equipment (PPE) in Covid-19 and their single-use nature has pressurized the already vulnerable waste management system of Nepal. This study analyze the environmental and health impacts of used personal protective equipment (gown, PPE suit, face-shield, 3ply mask, surgical mask, sanitizer, safety goggles and gloves) in Nepal in Covid-19 period (March 2020 to January 2022AD) and inform on four waste management option viz. incineration, sanitary landfill, landfill with utilization of energy and leachate treatment and recycling. The data were collected firsthand and analyzed using Life Cycle Assessment methodology. For secondary data eco-invent databases inbuilt within the SimaPro software were used. Life cycle impact analysis was done by International Reference Lifecycle Data System (ILCD) 2011 also within SimaPro. Results revealed the environmental impact in 16 categories i.e. Climate change, Ozone depletion, Human Toxicity cancer effects, Human Toxicity non- cancerous effect, Particulate Matter, Ionizing Radiation Human Health, Ionizing Radiation interim, Photochemical ozone formation, Acidification Potential, Freshwater eutrophication, Terrestrial eutrophication, Marine eutrophication, Freshwater eco-toxicity, Land use, Water resource depletion, Mineral, fossil and renewable resource depletion. The impact of 1 ton of each PPE item were compared and found that safety goggles without reuse, PPE suit, gown and 3 ply mask had higher impacts on most of the categories followed by surgical mask, face-shield and sanitizer. Among the waste management scenarios sanitary landfill site performed worst on most impact categories.

Keywords: Covid-19, PPE, LCA, Environmental Impacts, Waste Management

POSTER PRESENTATION

RECYCLING OF PLASTIC WASTES TO PREPARE BIO-BRIQUETTES BY COMPOUNDING WITH BIOCHAR FROM *LANTANA CAMARA*

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Abstract

The management of plastics has become a huge challenge for the country. These plastic wastes produced has been a major issue for the whole world. However, it can be made useful to the mankind by the process of recycling. The objective to carry out this research work was to convert the plastic wastes into the energy by the process of briquetting in combination with biomass like *Lantana camara,* an alien species to Asia. The conversion of waste to energy through the process of briquetting has the potential for providing energy, while simultaneously reducing wastes and their environmental risks. The incorporation of plastics in the briquetting process leads to the more efficient briquettes since the plastics have high energy content. For the briquette making process, firstly plastics wastes were collected, washing and drying was done in order to remove the impurities and moisture respectively. Then it was crushed into flakes with the help of shredder. The *Lantana camara* biomass was collected, dried and char was made simultaneously. Secondly, mixing of biomass char and plastic flakes was done and finally briquettes were produced. Lastly, the properties of produced briquettes were studied. High temperature and high pressure are required for the process of briquetting. The recycling of plastic wastes into fuel shows great promise and could be considered as part of waste management options especially in the developing countries.

Keywords: Biomass, Recycling of plastics, Briquette, Waste to energy

URBAN DEVELOPMENT AND FOOD GREEN CITY

THEMATIC SPEAKER

FOOD GREEN CITY FOR SUSTAINABLE URBAN DEVELOPMENT

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Abstract

The world is urbanizing very fast with more than 56 percent of the population living in cities and towns. Recent researches of have shown that urban areas contribute more than 70 percent of total CO_2 emission on earth. Building construction, transportation, solid waste management, manufacturing industries are the main sources of carbon emission in cities. In Nepal also, urbanization is taking place at a much faster rate with more than two third of the population already living in municipal areas. Though urban centres are considered as engines of economic growth, urbanization has its toll on environment, public health, food security and wellbeing of people. The Sustainable Development Goal (SDG) of United Nations envisages safe, resilient, sustainable and inclusive cities and human settlements (Goal no. 11). In order to achieve this goal, the urban development has to be regulated to protect natural and built environment, promote social equity and ensure economic efficiency. In Nepal, cities grow in forest and fertile agriculture land, displacing farmers and destroying the green cover. Food security has become a major issue in city management and critical political and strategic factor sovereignty of nations. The concept of Food Green City is based on minimizing the food deficit and maximizing greenery in the city by utilizing streets, walkways, riversides, leftover public spaces and building terraces,whereby the residents can grow freshly grown food and utilize their farming skills in urban setting. There are other indirect benefits of the urban agriculture such as management of solid waste, waste water and personal recreation. At the city level it contributes to ecological balance, reduction of carbon emission, carbon sequestration and control of rise in temperature. In Nepal, where most of the urban dwellers come from farming background, the concept of food green cities is best suited not only for food production and recreation but also for environmental conservation.

Keywords: Urbanization, Food production, Environmental protection, Sustainability

INVITED SPEAKER

FOOD GREEN CITIES AND ECOCITIES FOR SUSTAINABLE URBAN DEVELOPMENT

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Abstract

The twenty-first century is the age of cities. We are constructing urban ecosystems that are in conflict with natural ecosystems, resulting in environmental disasters. Does this imply that we should halt our urbanization efforts? This may not be practicable, and urbanization will continue unabated. As a result, we must make a paradigm shift in how we plan and operate our cities. Humans should be able to flourish on this planet in a social and ecologically balanced setting, as well as with economic prosperity, but not at the price of the environment. For long-term growth, the triple bottom line of sustainability is crucial. We need to build cities that provide people with a high-quality living environment while simultaneously being efficient and resource-conserving. In Nepal, the tendency of urbanization is developing, and it has accelerated dramatically in recent years. There have been a number of municipalities added since 2011, when there were 58 municipalities and 17 percent urban areas, and the current number of municipalities is 293 with more than 66 percent of areas considered to be urban (census 2021), making it one of the fastest-urbanizing countries in Southeast Asia. The majority of the new municipalities are still rural in nature, and must be designed in accordance with the government's green, inclusive, and efficient development strategies, as outlined in the National Urban Development Strategy. The primary focus of this study is on the applicability of planning techniques such as food green city and ecocity in present urban environments. It claims that in a country like Nepal, the concepts of food green city and ecocity are extremely important and play a significant part in structuring metropolitan areas in a significant way for overall growth.

Keywords: Food green city, Ecocity, Sustainable urban development

ORAL PRESENTATION

COMPARATIVE STUDY ON DIFFERENT VARIETIES OF CORIANDER CULTIVATION ON FIELD AND HYDROPONICS SYSTEM

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Abstract

Hydroponics is the system of cultivating the crops/plants on sand, coco-peat, etc. with water but without use of soil and nutrient required is provided through water. Nutrients, available oxygen are provided at the root area. It is one of the most emerging and fascinating cultivation system adopted widely, especially on areas with less arable soil/land. Coriander is commonly grown and consumed spices crop, has great demand throughout the world. And four varieties are used for this experimentation and their characters are assessed, monitored and compared on both hydroponics and soil cultivation trial. Bolting effect are also studied by planting seeds of all varieties on different time with interval of 10 days, i.e. 1st day, 10th day and 20th day. These Coriander plants are meant to be grown till marketable maturity and different in their characteristics are studied and are analyzed. Essential oil will also be produced from these plants and will be compared.

Keywords: Coriander, Varietal trial, Hydroponics, Pot-trial, Essential Oils, Bolting.

ETHNOMYCOLOGICAL KNOWLEDGE OF SOME WILD MUSHROOMS OF KAPILVASTU DISTRICT, NEPAL

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Abstract

The forest biodiversity has supported the livelihood of many indigenous tribal people who live in inaccessible remote area. Wild edible mushroom are one of the most important non-timber forest products (NTFPs). Mycodiversity play important roles in ecosystem replenishment and perform a wide variety of ecological roles. The current paper documents the knowledge about use of wild fungal mycobiota by the indigenous community of Kapilvastu district in Nepal. The study was conducted from July to September 2021 in Barakulpur and Dubiya of Buddhabhumi municipality, Kapilvastu. To fulfill this aim the Participatory Rural Appraisal (PRA) technique was used. The collected fungi include 50 mushroom species belonging to 30 genera, nine orders, 21 families and two classes. Based on the traditional knowledge obtained from local people 22 species were edible, 15 used as medicine, two species poisonous, nine species non-edible and two species have cultural/religious value. This exploration creates an enthusiasm towards intensive exploration on these mycobiota have a vital role in enrichment of the socio-economic life of the rural marginal people.

Keywords: Indigenous people, Macrofungi, Therapeutic use.

HYDROPONIC AS MODERN TECHNIQUE FOR CULTIVATION OF DIFFERENT VEGETABLES GROWTH: A STUDY FROM NAST

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Abstract

Hydroponic is the method of farming without soil where flowers, herbs, and vegetables are planted in inert growing media and supplied with nutrient-rich solutions, oxygen, and water. Nowadays, villages are developing into cities rapidly. Agricultural imports are increasing at an alarming rate post-COVID-19. In Nepal, fruits and vegetables worth 11 billion were imported in the past nine months. To ameliorate such a situation and develop urban sustainability, hydroponics technology must come into use. Under food green city program, a study was carried out from January 14th to May 30th, 2022, related to green leafy vegetable production in the NAST and a yield was recorded. Meanwhile, pH, nitrogen content, concentration of hydroponic solution, and conductivity were monitored on a daily basis according to the plant type. The results showed that the vegetables have a rapid growth rate without any obstacles in the hydroponic system. In the near future, it will become impossible to feed the entire population using an open-field system of agricultural production only. Improved space and water conserving methods of food production under soil-less culture have shown some promising results all over the world. Performance of different crops like peppermint, bok choy, lettuce, spearmint, onion, and leafy greens and water conservation by this technique has been observed. Hydroponic innovations have proven that direct exposure to NPK-enriched water can be a more effective and versatile method of growth. Several benefits of this technique include less growing time of crops than conventional growing; minimal disease and pest incidence; and weeding, spraying, watering, and leaching can be eliminated. It is important to develop low-cost techniques that are easy to operate and maintain, require less labor, and have a lower overall setup and operational cost.

Keywords: Hydroponics system, Leaching, NPK (Nitrogen, Phosphorous, Potassium), Vegetable production, Urban sustainability

DOCUMENTATION OF WILD ORNAMENTAL FLOWERING PLANTS OF TRIBHUWAN HIGHWAY (HETAUDA TO TISTUNG) IN MAKAWANPUR

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Abstract

Ornamental Plants have important role in environmental planning of both city and rural areas. The demand of such ornamental plants is increasing alarmly. This study is focused in exploring the wild ornamental flowering plants so as to enrich the ornamental values of the plants. The study highlights the exploration of wild ornamental flowering plants documented on the road side of Tribhuwan Highway from Hetauda to Tistung in Makawanpur district. From the study all together 52 species of wild flowering plants belonging to 29 families and 47 genera were recorded. The documented plants have high ornamental potentialities because of their attractive and showy flowers. The study was carried out during the year 2020-2021. Several field trips were carried to collect the targeted plants from all the possible sites covering all the seasons. This work will be helpful for the students, researchers and people who keep interest in the gardening of indoor plants and outdoor landscape practices. These valuable natural resources need to be conserved and used in sustainable way for the future generation. Further studies could be carried for the documentation of more wild ornamental flowering plants and even non flowering wild ornamental plants of the study site and other sites of Makawanpur District.

Keywords: Exploration, Field trips, Gardening, Indoor plants, Landscape

VOLUNTEERED GIS IN IDENTIFYING POTENTIALITY OF ROOF TOP FARMING IN NAYABASTI BANEPA, NEPAL

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Abstract

Global report on human settlements stated that over 70 percent of the world population will be living in cities by 2050. Further, the UN-SDGs have indicated the importance of agriculture and sustainable cities in SDG target 11.3. To achieve this target, in the spirit of the SDGs, it is necessary to integrate urban agriculture into urban planning to manage growing cities. Besides, urban agriculture appears as an effective means to address global warming by reducing the effects of UHIs. Globally, rooftop farming, ¾one of the perspectives in urban farming—, is considered as an approach to obtain urban greenery and food security simultaneously. Yet, owing to various building design architecture, construction technology, building materials and structures, all urban forms across cities may not render similar potential to rooftop farming, Such evidence becomes pertinent for cities in order to promote rooftop farming. This paper aims in identifying the potential area at rooftop farming in Nayabasti Banepa and its methodological implication. The data acquisition was conducted by UAV and VGIS including WebODM software for image processing. A multi criteria analysis including Roof Shape, Tin Roof, Buildings Materials, Water tanks. Solar Panels, collected by VGIS technique was used to extract suitable rooftop areas. Total number of houses in study area is 1055. The result shows 10.23 % (505.2 m^2) are already adopting rooftop farming. Housing structure shows that 1.7 % are temporary, 54 % are concrete houses which include 16.68 % (Single flat roofs) and 37.25 % (double roofs), 16.1 % (with solar panels) and 47.86. % (with water tank). The preliminary analysis suggest that 54.02 % houses (approximately 48500 m^2) are potential roof top farming areas identified by excluding Tin roof, water tank and solar panel areas. Nonetheless, the methodological framework to accommodate socioeconomic aspects of house owners and their willingness to adapt rooftop farming needed to be developed.

Keywords: Rooftop farming, UAV (Unmanned Aerial Vehicle), VGIS (Volunteered GIS), Urban Heat Islands (UHIs).

BUILT-UP AREA EXTRACTION AND CHANGE ASSESSMENT USING BUILT-UP INDICES: A CASE STUDY OF KATHMANDU METROPOLITAN CITY

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Abstract

Urbanization has significantly increased all over the world. Remotely sensed multi-temporal satellite images has allowed favorable mapping of built-up areas and their changes over time. Normalized Difference Built-up Index (NDBI) is useful for mapping urban built up areas. Although it was developed using Landsat Thematic Mapper (TM) data, it is also applicable for Landsat 8. New built-up index (NBUI) was developed for extraction of urban built-up area in a more efficient way by using Enhanced Built-up and Bareness Index (EBBI), Soil Adjusted Vegetation Index (SAVI) and Modified Normalized Difference Water Index (MNDWI). NDBI and NBUI were used to map built-up area for 2003 and 2021 time period. The expansion of built-up area was seen to be substantial in Kathmandu Metropolitan City (KMC). This study demonstrated that the area of built-up area extracted using NDBI were 26.45 km^2 and 43.67 km^2 for 2003 and 2021, respectively. Similarly, use of NBUI showed the area to be 27.69 km^2 and 45.43 $km^{2,}$ respectively. This analysis showed that there was more than 50% increase in built-up area from 2003 to 2021 in KMC. Both, NDBI and NBUI were found to be effective and simple to implement and they gave notably accurate extraction of built-up areas. Use of built-up indices can be applicable in land use planning and management of urban areas as it can make the mapping more efficient and inexpensive.

Keywords: Built-up area, Built up index, Landsat, Urbanization

POSTER PRESENTATION

DIVERSITY OF INVASIVE ALIEN PLANTS (IAPS) AND THEIR IMPACTS ON URBAN FLORA OF POKHARA VALLEY

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Abstract

Urban ecosystem often serves as befitting suitable microhabitat for IAPs and the increased incidence of invasion around the world poses a major threat to native biodiversity in urban settings too. So, this study aims to find out diversity of IAPs and their impact on urban ecosystem of Pokhara valley. For this work, urban ecosystem was divided into four different land categories based on characteristics and uses. All together 80 sample plots; 20 in each land category were randomly laid across the study area for the vegetation survey. Different variables like coverage, frequency, density were measured in the field, and ecological parameters such as Margalef's index of richness(R'), Shannon-Weiner's diversity index (H'), and Pielou's Evenness Index (e') were calculated, additionally factor governing IAPs and its impacts were analyzed using linear regression. This study reported 19 species of IAPs belonging to 10 families, updating the checklist of invasive alien flora found in Pokhara valley. Likewise, urban wetland category had the highest IAPs diversity (with H'= 2.31, R'= 2.84, e'= 0.55) while urban forest category had the least diversity. Additionally, the species richness of naturalized plant species was found to govern the invasion of IAPs with strong correlation and significant relationship ($r = 0.567$, $p < 0.001$). Moreover, species richness of native plants was found to be negatively affected by coverage of IAPS ($r = -0.130$, $p < 0.05$). Considering the results, this study recommends the utilization of combined control methods for widespread IAPs and containment and eradication of IAPs, which are in the early stage of invasion.

Keywords: Ecological parameters, Urban ecosystem, Diversity indices, Impact assessment

DETECTION OF NDM-1 AND VIM-2 GENE AMONG METALLO-BETA-LACTAMASE PRODUCING CLINICAL ISOLATES OF *Escherichia coli* AND *Klebsiella pneumoniae*

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Abstract

Antibiotic resistant bacteria are emerging problems in the treatment of infectious diseases. This might be due to production of β-lactamases enzymes in most of the Gram Negative bacteria. *Escherichia coli* and *Klebsiella pneumoniae* harboring New Delhi Metallo-beta-lactamase-1 and Verona Integron Encoded Metallo-beta-Lactamase-2 has spread throughout the world. Therefore this study was carried out to determine the prevalence of antibiotic resistance in *E. coli* and *K. pneumoniae* emphasizing the metallo-β-lactamase and the related genes. The hospital-based cross-sectional study was conducted in a tertiary care hospital at Kathmandu, Nepal from November 2019- February 2022. A total of 64 *E. coli* and 33 *K. pneumoniae* were identified and subjected to antimicrobial susceptibility tests by modified Kirby Bauer Disc Diffusion Method. The MBL, ESBL, AmpC and KPC were screened and confirmed by combined disc method. The prevalence of MBL, ESBL, AmpC and KPC were found to be 6.18%, 28.86%, 6.18% and 2.06% respectively. Among six MBL positive isolates, five (1 *E. coli* and 4 *K. pneumoniae*) isolates harbored NDM-1 gene. None of the isolates were found harboring the VIM-2 gene. All of the β-lactamase producers were Multi-Drug Resistant (MDR). All MBL producers were resistant to most of the antibiotics used and sensitive only to Polymyxin B and Colistin. Thus, early detection of drug resistance such as MBL, ESBL, AmpC and KPC is important for reduction of MDR pathogens in hospital as well as community setting. In addition, awareness programs, proper treatment and prevention measures should be implemented without delay to restrict their uncontrolled spread and infection.

Keywords: Antimicrobial resistance, MDR, MBL, $bla_{\text{NDM-1}}$, $bla_{\text{VIM-2}}$

PERFORMANCE EVALUATION OF FAECAL SLUDGE TREATMENT PLANT AT LUBHU, LALITPUR

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Abstract

Proper management of the Faecal Sludge is growing issues particularly in developing countries including Nepal. Unsafe disposal of FS into the open environment has adverse impact on public health and environment. Faecal Sludge Treatment Plant, Lubhu was introduced to treat FS as pilot implementation (6 m3/week). While there are very limited FSTP in Nepal, sustainable O&M of system is another challenge. Thus, the study aims to understand the performance of Lubhu FSTP with respect to the existing O&M procedures and practices, measuring the effectiveness based up on final effluent quality and resource recovery along with people's knowledge, perception and acceptability. Major constituents such as BOD, COD, TS, TSS, Nitrate, TKN, TP, K, E. coli. and Helminths eggs of untreated FS from inlet, treated effluents from PGF and treated dried sludge from PDB was analyzed in the laboratory to measure effectiveness. Field observation, key informant interview, questionnaire survey was carried out. The study explained that proper training to caretaker on O&M procedure have important input on good performance of the FSTP. Lab analysis shows that COD (94 %) and BOD (92.18 %) removal efficiency is high. However, effluents concentration did not meet the generic standards mainly due to very high influents concentrations. It has highest removal efficiency of TSS (97.7%). It was found to be very efficient on removing Helminths eggs but large number of E. coli. (900 CFU/ml) present in effluents. Most of the people (77.51 %, n=93) don't know that there is FSTP in their locality which represents that there is less promotion. However, most of the people (77.4 %, n=93) want to accept FSTP at their locality which encouraging to replicate and scale up. The step by step guide for proper O&M should be prepared and perform regular monitoring to enhance the performance.

Keywords: Faecal sludge treatment, Operation and maintenance, People's knowledge and acceptability, Performance evaluation, Removal efficiency

PROXIMATE ANALYSIS, ANTIMICROBIAL ACTIVITY, PHYTOCHEMICAL SCREENING AND ANTIOXIDANT PROPERTY OF COMMON WILD EDIBAL FRUITS FOUND IN NEPAL

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Abstract

This study was carried out under the project, "Development of Food Green Cities for Urban Sustainability". Under this study the proximate analysis, phytochemical screening, antioxidant property, and antibacterial activity of methanol extracts of common wild edible fruits found in western Nepal, namely *Phoenix acaulis*, *Diospyros melanoxylon*, *Terminalia chebula*, *Madhuca longifolia*, *Rubus ellipticus*, *Prunus cerasoides* and *Coriaria nepalensis* were investigated in the laboratory of NAST. The highest amount of fat content was found in *Prunus cerasoides* which was 5 ± 0.26% and lowest fat content was observed in both *Diospyros melanoxylon* and *Terminalia chebula* which was 2.00 ± 0.21% and 2.00 ± 0.32 respectively. Similarly, the ash content value of *Rubus ellipticus* was 3.98 ± 0.05% which was highest value whereas 1.90 ± 0.07% was the lowest ash content value of *Terminalia chebula*. Similarly, the highest moisture content was found in *Prunus cerasoides* which was 9.30 ± 0.74% and lowest moisture content was observed in *Phoenix acaulis* which was 7.72 ± 0.51%. The study of Phytochemical screening, antioxidant property, and antibacterial activity against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonsa* are ongoing.

Keywords: Antimicrobial activity, Antioxidant, Phytochemical, Proximate analysis

EFFECT OF PLANT LEAF EXTRACT AND DIFFERENT FERTILIZERS ON PERFORMANCE OF CUCUMBER (*CUCUMIS SATIVUS* L.) UNDER POLYHOUSE CONDITION IN NAWALPARASI, NEPAL

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Abstract

A field experiment was carried out with an objective to study the effect of plant leaf extract and different fertilizers on overall performance of cucumber under Polyhouse condition in Bardaghat municipality, Nawalparasi, Nepal from February 2022 to May 2022. The experiment was laid out in two factorial Randomized Complete Block Design with four replications. Treatments used were two leaf extracts application (foliar application of leaf extract and without application of leaf extract) and six different fertilizers (no fertilizer (control), 100% N through RDF (140:60:100 kg/ha of NPK), 50 % N through RDF+ 50% N through FYM, 75 % N through RDF+ 25% N through FYM, 50% N through RDF+ 50% N through Krishi Poshak and 75% N through RDF + 25% N through Krishi Poshak) in the variety Raja F1 hybrid. Foliar application of leaf extract showed significantly minimum days required for 50% flowering, minimum sex ratio (2.77) and it recorded maximum average fruit diameter (5.84 cm), maximum number of marketable fruits (36.45) and maximum average total yield (55.64 Mt/ha) as compared to without application of leaf extract. Regarding fertilizers, plants treated with 50 % N through RDF+ 50% N through FYM resulted significantly minimum days required for 50% flowering and minimum sex ratio (2.51). Similarly, Average fruit length (24.10 cm), average fruit diameter (5.93 cm), number of marketable fruits (39.75) and average total yield (63.65 Mt/ha) were also maximum in 50 % N through RDF+ 50% N through FYM which are statistically similar with 75 % N through RDF+ 25% N through FYM, whereas statistically superior than other treatments. The results concluded that integrated application of organic manures and inorganic fertilizers in balanced dose with foliar application of plant leaf extract is best for growth and yield of cucumber.

Keywords: Cucumber, Leaf extract, Fertilizers, Yield

CLIMATE CHANGE AND DISASTER MANAGEMENT

THEMATIC SPEAKER

CLIMATE CHANGE AND DISASTER MANAGEMENT

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Abstract

Climate change is a global problem now and moving towards a crisis too. It is mainly due to an increase in severe weather systems and thereafter disasters more frequently than in the past. Climate change is also impacting Nepal mainly through severe weather systems and thereafter increasing disasters. The maximum and minimum air temperatures of Nepal are increasing at the rate of 0.056 ^{o}C per year and 0.002 ^{o}C per year respectively based on the study carried out by the Department of Hydrology and Meteorology with the data from 1971 to 2014. Again increase in air temperature is higher in higher altitudes than in the lower altitudes. Such an increase in air temperature directly affects more melting of snow and ice and less snowfall in the mountains. Also, it increases the area of existing glacial lakes posing a higher risk of outburst floods in the near future. An increase in severe weather systems such as heavy precipitation; rainfall and snowfall, and drought events increase the disaster in recent years. For proper management of climate change and disaster, we must need good data sets which can help us to tackle the problem effectively. There are 252 meteorological (precipitation, climatology, synoptic, and agro-meteorology stations) in Nepal at present but out of that only 14 stations are lying higher than 3,000 m altitude. Also, snow monitoring stations are negligible in the mountain regions. Similarly, the existing number of hydrological stations is also needed to increase and glacier and glacial lakes monitoring stations are very urgent to establish from east to west in Nepal. The status of different stations in Nepal shows a strong need for meteorological, hydrological, snow, glacier, and glacial lake monitoring stations in Nepal to tackle climate change and disaster management properly.

Keywords: Climate change, Disaster, Snow, Glacier and glacial lake

INVITED SPEAKER

NAVIMANDAL - EXPLORING THE INTAKE STRUCTURES OF HITI SYSTEM

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Abstract

Endowed by fertile soil and the benefit of Indo-Tibet trade route Nepal Mandal the Kathmandu Valley was urbanized already in medieval period. For the ecological reasons they settled on the higher ground leaving the fertile flood plain for agriculture. In the elevated ground they invented unique water management system called Hiti System. This paper tried to peep through the technicality and the approaches taken by then people to quench the thirst of the population while conserving soil and land, particularly Navimandal- the intake structure. The system utilizes ground water, storm water and the surface water by continuously flowing the Hitis as bringing the water fall to their neighbourhood. These Hitis collect water from nearby aquifer while they are charged by the ponds which are again fed by De Dhah (Rajkulo- the surface canals) and the rainwater. The used water is further collected in downstream ponds for irrigation and other agricultural purposes. Apart from Rajkulo, ponds and downstream drain from the Hiti complex, there are several important components brought together to bring water from the aquifer to Hitimangah (the stone spout) in the Hiti Gah the Hiti complex. They are Navimandal the intake structure, Hitidun the conveyance conduit and Athah, the trough placed inbetween to change direction, level or bifurcation of Hitidun. Navimandal is the intake built to bring in water from aquifers. Unlike infiltration galleries to bring water into the system in water supply and irrigation systems, these are very small but sensetive systems. There are simple to complex Navimandals installed as per need, knowledge and importance. As there are social/cultural restrictions to open these structures very little information is available on these structures. This paper will deal with several such Navimandals that are reported and available to the author so far.

Keywords: Water management, Aquifer, Irrigation system

ORAL PRESENTATION

COMMUNITY LED DISCOVERY AND CONSERVATION OF FRESH WATER DOLPHINS IN NEPAL

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Abstract

The riverine dolphin (*Platanista gangetica*), once thought to be disappeared from Nepalese River, can now be seen in tributaries of the Karnali River. Thanks to the local effort led by Dolphin Conservation Centre (DCC), one can enjoy the leaping and playing dolphins in the confluence of the Karnali and the Mohona river and other small tributaries like the Patharaiya and the Kandra river. In fact, in 2005, DCC [1]challenged the opinion of scientific communities that this riverine mammal was no longer found in Nepal. With the local methodology, in 2006, DCC counted their number and within the short territories, 130 dolphins were recorded. DCC also initiated community led dolphin conservation and initiated catapult collection campaign to prevent killing of birds and target the leaping dolphins. With this discovery, the area was brought to immediate limelight and nowadays, the dolphin has become one of the symbols of Far West Province. But the debate of its number still continues. Survey conducted in 2014 showed only 28 dolphin where as another survey conducted in 2016 by Department of National Park and Wildlife Conservation (DNPWC), the International Union for Conservation of Nature and the National Trust for Nature Conservation recorded 52 dolphins. Dolphin Conservation Action Plan (2021-2025) prepared by DNPWC aims to secure dolphin population against emerging threats and recover in the current and historical freshwater ecosystem. But much needs to be done to put these plans in action.

Keywords: Fresh water dolphin, Community conservation and census

PROBABILITY DISTRIBUTION MODEL FOR FREQUENCY ANALYSIS OF EXTREME INSTANTANEOUS RUNOFF EVENTS AT LOTHAR

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Abstract

Frequency analysis of extreme runoff events is critical for water resource planners at the catchment level. Lothar station (470), located at 27°35'40.00"N and 84°43'0.00"E, is selected for the study. Several research studies used different statistical distributions to estimate the likelihood and intensity of floods. Yet choosing the best appropriate distributions has always been a difficult task. The study's primary objective is to recommend the best probability distribution for assessing maximum instantaneous discharge at Lothar. Available discharge data for 1964 to 2015 at Loather station is taken from the Department of Hydrology and Metrology (DHM). Statistical approaches for assumed probability distribution function use the EasyFit model. The proposed distributions for the study are Gumbel Max, Dagnum, Generalized Extreme Value (GEV), Normal, and Log Pearson 3. Significance tests, Anderson Darling, Kolmogorov Smirnov, and Chi-Squared are applied to assess the goodness of fit for selected distributions. Integrating all three-statistic parameters, an alternative but simple model selection criterion Least Sum of Statistic Model Selection Criterion (LSSMSC), is used. For each distribution, the LSSMSC value is computed. Distribution with the least LSSMC value is the best fit distribution. The study's results, based on computed LSSMSC value, exhibited that Dagum distribution ranked superior. Therefore, it is the best fit distribution among the other applied distributions for the study area. For flood frequency analysis, using the appropriate probability distribution determines the likelihood of a certain flood event precisely, which acts as the major factor for designing, planning and managing water-related projects.

Keywords: Gumbel Max, Dganum, Generalized Extreme Value, Lothar, Significance Tests, EasyFit, Statistic Model Selection Criterion

FLOOD HAZARD MAPPING IN INDRAWATI RIVER BASIN USING FREQUENCY RATIO MODEL AND ANALYTICAL HIERARCHY PROCESS

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Abstract

Floods are devastating natural hazards responsible for direct mortality, deterioration of crops, and damage of infrastructure and property. So, their study is crucial for watershed management and mitigation of flood hazards. The main objective of this study was to create a scientifically valid flood hazard map of the Indrawati River Basin (IRB) using frequency ratio (FR) method as well as analytic hierarchy process (AHP) and to compare their performance. Topographical wetness index, elevation, slope, precipitation, land use/land cover, normalized difference vegetation index, distance from river, distance from road, drainage density, and soil type were chosen as flood-triggering factors based on literature review, data availability, and catchment characteristics. All these factors were resampled into 30 m × 30 m pixel size. Hundred flood points were identified in IRB based on evaluation of satellite imagery, of which 75 flood points (75%) were randomly selected to be used as training dataset while remaining 25 flood points (25%) were used as testing dataset for validating the outcome. Based on results from the FR and AHP method, the IRB has been classified into five different flood susceptible zones; very low, low, moderate, high and very high. 28.21%, 36.46%, 26.16%, 7.62% and 1.55% of total area as per FR method and 13.36%, 26.29%, 30.06%, 22.62%, and 7.68% of total area as per AHP method lie respectively, in very low, low, moderate, high and very high flood susceptible zone. The area under curve (AUC) value for prediction rate was estimated as 0.824 and that of success rate was 0.803 for FR method, whereas AUC value for success rate was 0.792 for AHP method. Results of this study will be crucial for concerned parties to design early warning systems and flood risk reduction measures for flood preparedness.

Keywords: Indrawati River Basin, Frequency Ratio, Analytic Hierarchy Process, Flood Hazard

SPATIAL AND TEMPORAL VARIABILITY OF WINTER RAINFALL OVER NEPAL FOR THE RECENT FOUR DECADES

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Abstract

The study was conducted using 107 stations rainfall time-series data from 1977 to 2018. The reliability of the time series data was checked using robust statistical tools. During the study period, excess/deficit winter events were investigated based on winter rainfall anomalies. The contribution of winter rainfall to annual varies from 0.68% in a year 2006 to 7.04 % in year 1989. The five large excess winter seasons of years 1989, 1978, 1996, 2007, 2003 and the eight winter's large deficient years 2006, 2009, 1999, 2018, 2017, 2008, 2016, and 2001 were identified. The winter season of year 2006 was the worst drier -88.33% below the average anomalies during the last four decades. In regional prospective, there were diverse winter rainfall dynamics over the western, central, and eastern regions. There were two conjugate 2008-9 and three conjugate winter drier years 2016 to 2018 in recent decades. Intrinsic rainfall patterns identified on high Complex Mountain ranges in the central and eastern regions. However, the western region of Nepal recorded more rainfall during the winter in comparison with the central and eastern regions in contrast low annual rainfall.

Keywords: Anomalies, Composite, Eextreme events, Precipitation

SEASONAL VARIATION OF WATER QUALITY INDEX OF SPRING IN MID-HILL OF NEPAL

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Abstract

Globally population growth, rapid urbanization, and developmental activities have inflicted significant pressures on drinking water supplies leading to severe water scarcity. Spring is the major source of water in the mountain region. However, limited studies carried out on water quality of spring in Nepal. The objective of the study was to access the water quality index (WQI) of spring in pre-monsoon (April, and May) and monsoon (June) seasons in Tanahun district of Nepal. Discharge of water from three springs was measured at 10 am and 4 pm by bucket method. Water samples from three springs were collected for laboratory analysis of various water quality parameters. The discharge of all the springs increased during the monsoon season than pre-monsoon. Water quality parameters i.e. turbidity, pH, ammonia, nitrate, total hardness calcium hardness, and alkalinity are approximately under the range of standard limits by World Health Organization (WHO) and National Drinking Water Quality Standard of Nepal (NDWQS). However, electrical conductivity (EC), total dissolved solids (TDS), and Fecal coliform (*E. coli*) exceed the permissible value of drinking water by WHO and NDWQS. The presence of fecal coliform made the water unsuitable for drinking purposes without treatment. WQI was good in spring II (15.76) followed by spring III (38.65) and spring I (61.08). Spring II has the lowest WQI among three springs due to the application of conservation measures like plastering the spring. Overall, variation on WQI in three springs depends on management of springs.

Keywords: Spring, Water quality, Discharge, Monsoon season, WHO, Mid-hill

DETERMINING SOIL CARBON EMISSION WITH IT'S INFLUENCING FACTORS OF THE MIXED FOREST IN SHIVAPURI NAGARJUN NATIONAL PARK

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Abstract

Forest plays an important role in global carbon sink, and provides both carbon and non-carbon benefits that needs to be trapped wisely. A major process of the soil carbon emission i.e. soil CO_2 flux strongly influences carbon uptake in forest and contributed continuously in the atmospheric carbon dioxide. In this study, rates of carbon dioxide (CO_2) emission was measured by closed dynamic chamber method using infrared gas analyzer (IRGA) at the interval of one month for a year. Factor such as soil temperature, soil moisture, air temperature, bulk density, soil organic carbon, litter fall rate and pH influencing carbon emission of the mixed forest in Shivapuri Nagarjun National Park (SNNP) was determined. The result showed that the soil temperature significantly affected soil CO_2 flux and accounted for 40% contribution with the temperature and the sensitivity (Q10) value of the soil CO_2 flux was 2.35. But, the soil water content contribution was unclear to define the soil CO_2 flux effect. The air temperature contributed to the soil CO_2 flux variations was 33%. The seasonal variation of soil CO_2 flux followed the variations of temperature, soil water content, bulk density, SOC and litter fall. Average soil CO_2 flux, SOC and tree carbon stock of the forest was 362.07 mg CO_2 m^{-2} h^{-1}, 19.84 % and 210.54 t/ha, respectively. Thus, we concluded that the soil temperature is major environmental drivers of soil respiration variation of the forest among the soil parameters in SNNP and the amount of soil CO_2 flux of the forest could be included while estimating the carbon budget of the forest.

Keywords: Mixed forest, Temperature, Soil CO_2 flux, Soil water content

ECOLOGICAL STRATEGIES AND PATTERNS OF RECOVERY OF LANDSLIDE DAMAGED ECOSYSTEM

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Abstract

Landslide is one of the physical agents of natural disturbance which causes disruption of community structure and nutrients cycling and consequently the loss of biodiversity and nutrients. However, the retrogressed ecosystem begins the recovery by applying different ecological strategies that contribute to the damaged ecosystem's resilience to recover rapidly. The temporal recovery pattern is reconstructed from five landslide damaged sites representing a chrono sequence of 1 to 58 - years old age and a comparison with undisturbed mature Sal Forest. Fast decomposing and nutrient-rich herbaceous plants accelerated nutrient regeneration in soil. Recovery of soil nutrients was rapid in the early stages (1 to 15 years old) due to the high turnover rate of litter, fine roots and their nutrients. Soil microbial biomass and N-mineralization recovered rapidly in the early stages which supports higher net production of developing vegetation. High rate of decomposition, mineralization and high nutrient uptake in the early stages exhibit the fast nutrient recovery. Soil microbial biomass C and N increase rapidly 3 folds in 15-year-old site compared to 1 - year old site. Recovery in plant species tends to follow the tolerance model of succession. The biodiversity index recovered rapidly up to the 40-year-old site. Higher translocation and immobilization of nutrients exhibit efficient use of nutrients and close nutrients cycling in the older sites representing a nutrient conservation mechanism. The best fit power function models exhibit the recovery pattern where soil organic C, total soil N, soil microbial biomass C and N recovered faster between 1 and 15-year age intervals while plant biomass recovered rapidly after 15 years. The pattern of recovery exhibits that various components of landslide sites recovered together in an interdependent manner with the passage of time which translates the damaged ecosystem into a self-organizing stable ecosystem.

Keywords: Decomposition, Immobilization, Microbial biomass. Mineralization, Plant biomass

DETERMINATION OF FLOOD ROUTING PARAMETERS USING MUSKINGUM, LEVEL POOL AND MODIFIED PUL'S ROUTING IN KARNALI RIVER BASIN, NEPAL

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Abstract

The study focused on the application of Flood Routing Models for Flood Mitigation in downstream settlements of Karnali River basin in Nepal. Highest thirty years instantaneous discharge and water level were collected from Department of hydrology and meteorology, Government of Nepal for flood routing analysis of the study area. Two flood routing models Muskingum model, Level pool and Modified Pul's model are compared. The Kirpich method is used to estimate time of concentration in each subbasin of Karnali rivers. Different time interval is assumed from upstream and downstream of flood response with the real-time flash-flood forecast of the settlements. Highest ten relevant historical flood events are selected for calibration and validation purposes in both routing models. Linear interpolation is used for one day highest flood events to the short time break. The K and X values are also used in the linear equation for highest flood events in given area for the optimization. This study will be useful for others similar characteristics river basins of Nepal for designing the flood control and water managements project.

Keywords: Flood Routing, Muskingum routing, Level pool routing and Modified Pul's routing, Flood response and Real-time-flood forecast.

POSTER PRESENTATION

EVALUATION OF DISTRIBUTED AND SEMI-DISTRIBUTED HYDROLOGICAL MODEL IN TRANS-BOUNDARY HIMALAYA RIVER BASIN, NEPAL

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Abstract

Hydrological model has been developing to simulate rainfall-runoff relationship and different hydrological process in basin to sub-basin scales. Continuous hydrological information requires designing water resource structure but in under developing countries continuous hydrological data records is lacking because of loss of gauge station due to regular monitoring and maintaining. Spatially Process of Hydrology (SPHY) Model is fully distributed hydrological model simulate large scale, basin, sub basin to regional scales hydrology. Hydrological Engineering Corps Hydrological Modeling System (HEC HMS) model is semi distribute model simulate the complete watershed build to basin and sub-basin from terrain data. SPHY and HEC HMS hydrological model simulated in Tamakoshi River Basin evaluated by statistical tools are Nash Sutcliffe Efficiency (NSE), Coefficient of Determination (R^2) and Percent of bias at Busti and Rasnalu gauging stations in Tamakoshi river basin. SPHY model calibrated at Rasnalu evaluate NSE-74 and validated evaluated NSE-69, similarly calibrated at Busti NSE-73 and validated NSE-67. HEC HMS calibrated at Busti gauge station with NSE-78 and Validated at Rasnalu gauge station with NSE-76 on 2004-2008. HEC HMS performance good results than SPHY in transboundary Himalayan River Basin at similar topography.

Keywords: SPHY model, HEC HMS Model, Statistical tools, Trans-boundary Himalaya, Tamakoshi River Basin.

SOIL CARBON EFFLUX AND STORAGE STATUS IN THE FORESTS OF THREE DIFFERENT ELEVATION IN PHULCHOKI HILL, CENTRAL NEPAL

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Abstract

Forest soil acts as an important sink of atmospheric carbon. Soil respiration represents a major mechanism of carbon exchange between the Earth and atmospheric carbon pools. The soil organic carbon (SOC) decomposition process is also the source of carbon dioxide released into the atmosphere and may contribute to the warming climate. The study was carried out from November 2021 to May 2022 to analyze soil respiration rate and soil organic carbon in three forest types distributed in different elevation zones (1500-1800, 1800-2400 and >2400 m a.s.l.) of Phulchoki hill, Lalitpur, Nepal. Carbon dioxide (CO_2) efflux was measured by 'closed chamber method' using an infra-red gas analyzer (IRGA) and soil temperature and soil water content were measured at 5 cm soil depth in each month. Soil organic carbon (SOC) of three different soil depths (10 cm interval) was determined by titrimetric method.The results revealed that the average (n=10) soil respiration rate was found higher in 'Evergreen Oak forest' (257.17 mg $CO_2m^{-2}h^{-1}$) at higher elevation (> 2400 m a. s. l) than in the 'Oak-Laurel forest' (166.81 mg $CO_2m^{-2}h^{-1}$, 1800-2400 m a.s.l.) and the Mixed broadleaved forest(170.5 mg $CO_2m^{-2}h^{-1}$, 1500-1800 m a.s.l.) respectively. The soil respiration showed temperature sensitivity with respect to the months and with the seasons. A significant ($p < 0.05$) positive relationship of soil respiration with the soil temperature, and a non-significant ($p > 0.05$) correlation with the soil water content were observed. The soil organic carbon (SOC) content of 114.89, 96.14 and 67.96 tha^{-1} in Oak-Laurel forest, evergreen Oak forest, and mixed broadleaved forest were measured, respectively. The SOC declined significantly with the soil depth. The study concluded that vegetation and forest type more influence soil respiration and SOC along with soil temperature and moisture.

Keywords: Soil carbon-dioxide emission, Soil temperature, Soil moisture, Closed chamber method

INDUSTRY ACADEMIC
ACADEMIC

THEMATIC SPEAKER

INDUSTRY ACADEMIC PARTNERSHIP FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT & ECONOMIC PROSPERITY

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Abstract

Prior to first industrial revolution, people lived on a subsistence level. They were struggling simply to meet the basic needs of their families. People used human energy & hand tools for food production within a small area and consumed locally. The rapid increase of population demanded large quantity of food and merchandize. The first industrial revolution began since 1780s developed the mechanical device for large volume food and merchandize production. A series of industrial advancement in technology brought out the 2nd, 3rd and 4th stage of industrial revolution which developed the electrical driven machine, computer operated system and the web based physical system, respectively. Every stage of advancement improved the product volume, productivity, and quality of product. Society shifted from hand to machine and home production to factory and mass production. In the recent years, a high competition exists among the producers and efforts are made to reduce the production cost through the use of latest efficient technology (less wastage, high productivity, better quality). The latest efficient technology could be achieved through research and development from universities which could be utilized by the industries in their production unit for sustainable industrial development. Most of the Nepalese industries import the technology and machine operators from abroad. High amount of royalties is paying to the technology supplier every year. The technology transfer is common in Nepalese industries. Moreover, the maintenance of the equipment at site is almost impossible, which stops the production unit for several days. We could not even absorb the technology. It indicates that the successful collaboration between industry and academic is most for the sustainable industrial development in the country. Government must allocate the significant amount of research fund to develop the indigenous technology, which saves huge amount of foreign currencies and also generates employment.

Keywords: Industrial revolution, Industrial advancement, Successful collaboration, Technology transfer

INVITED SPEAKER

COMPARATIVE STUDIES ON AYURVEDIC *BHASMAS* PREPARED BY TRADITIONAL AND MODERN METHODS

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Abstract

Bhasmas are traditional Ayurvedic medicines prepared by ancient technology following the thermal disintegration of metals and minerals to extremely small particles. They are mainly metallic, mineral based and organo-metallic compounds made up of different metals such as calcium, iron, copper, gold, silver and zinc etc. The refined form has a significant therapeutic effects on living organisms including humans. In this work, *Tamra (TB), Yashad (YB),* and *Lauha (LB) Bhasma we*re synthesized in following ancient method mentioned in textbook 'Rasa Tarangini' *using* modern tools. The various steps of synthesis included purification, heating and roasting, levigation and incineration. These synthesized *Bhasmas* were characterized for their organoleptic character, physiochemical analyses and classical tests also using modern analytical techniques viz. X-ray diffraction (XRD), Fourier Transform Infrared (FTIR) spectroscopy and Energy Dispersive X-ray (EDX) analysis, and Scanning Electron Microscopy (SEM). The results obtained showed CuS as the major crystalline phase present in *TB*, ZnO in *YB* and ferric oxide (Fe_2O_3) in *LB*. The synthesized *Bhasmas* are proven to be more antimicrobial in comparison to commercial *Bhasmas* and show effectiveness against all the bacterial strains studied including major foodborne pathogens like *Escherichia coli*, *Staphylococcus aureus, Bacillus subtilis, Klebsiella pneumonia, Enterococcus faecilis, methilicillin resistance Staphylococcus aureus,* staphylococcus epidermis, *saccharomyces cerevisae, klebsiella pneumoniae,proteus vulgaris* etc.

Keywords: Tamra Bhasma (TB), Yashad Bhasma (YB), Lauha Bhasma (LB), Nanoparticles, Scanning Electron Microscopy (SEM).

ORAL PRESENTATION

HEAVY MERCURY EXPOSURE AMONG METAL PLATING WORKER IN NEPAL

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Abstract

Mercury is one of the top ten chemicals or groups of chemicals of major public health concern. Gold plating process involves mixing of mercury and gold to make paste, applying paste on the statues and heating it to evaporate the mercury leaving gold coating on statue. All these are happening without using any protective gears resulting very high level of mercury exposure among workers and huge environmental burden of mercury.The study aimed to highlight and solicit the required efficient technological innovation from all concerned towards prevention of occupational exposure.Bio monitoring of mercury among 20 metal plating female workers hair samples from Patan area of Lalitpur at BRI USA lab using DM 80 method revealed very high level of mercury exposure. The average level of exposure is 3.62 ppm which is higher than the exposure in Africa, USA and Europe and exposure among workers ranging from 0.35 to 28.46 ppm. 75% (15 of 20) workers` samples exceeds reference dose of mercury exposure of 1 ppm.100 % (5of 5) waste water samples tested for total mercury using AAS method found to be highly contaminated. Mercury in waste water samples ranges 0.627 mg/L to 1478 mg/L which is 62.7 to 1147800 times more than the Government of Nepal Generic Standard of Waste Water effluent for water ways or in land (0.01mg/L) discharge.Therefore, an urgent need to develop required robust and efficient mercury recovery technology to prevent ongoing high mercury exposure among the workers as well as protect this traditional and unique practice in Nepal. Swift ratification of Minamata Convention on Mercury and shifting to the mercury free gold plating process could be a sustainable solution to be adopted.

Keyword: Mercury, Gold, Gold Plating, Workers and Exposure

MAGNESIUM-CATALYSED ACETYLATION OF ALCOHOLS

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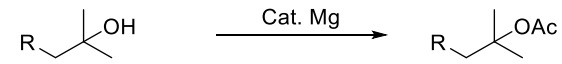
Abstract

Acylation is an organic reaction in which acyl functional group is introduced into a chemical compound. In case of alcohols, the hydroxyl group undergoes acetylation to produce corresponding acetates, and it is also called *O*-acetylation reaction. The acetylation reaction has numerous applications in the preparation of cosmetics, medicine, and uses in other transformations such as peptide formation, glycosylation, etc.This reaction is commonly performed in the construction of polyfunctional natural products. Although the acetylation of primary and secondary alcohols is more facile, however, acetylation of hindered tertiary alcohols is uncommon and often quite resistant. Recently, we have reported acetylation of phenols with acetic anhydride using magnesium powder as a catalyst to produce corresponding phenylacetates in excellent yield[2].Herein, we employed the magnesium catalysis protocol for the acetylation of primary, secondary and tertiary alcohols; and gratifyingly, the acetylation of alcohols was realizedincluding acetylation of tertiary alcohols. For examples,the reactions of 4-hydroxy-4-methyl-2-pentanone or *tert*-amyl alcohol with acetic anhydride were performed in the presence of 2.5 mol% Mg catalyst at 100 °C, under solvent free conditions.Corresponding acetate *viz.* 2-methyl-4-oxopentan-2-yl acetate and *tert*-pentyl acetate were obtained in very good yields.



R = CH_3CO, CH_3

Keywords: Acetate, Acetic anhydride, Catalysis, Esterification, Esters, Magnesium powder.

METHOD OPTIMIZATION FOR EXTRACTION OF ESSENTIAL OIL FROM *EUCALYPTUS GLOBULUS*

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Abstract

Eucalyptus globulus is grown in Nepal for timber and Eucalyptus oil. The Essential Oil (EO) obtained from *E. globulus* is widely used in therapeutic, perfumery, flavoring, antimicrobial, and bio-pesticides. In this study, three main extraction techniques which include Steam Distillation (SD), Simultaneous Distillation Extraction (SDE), and Supercritical Fluid Extraction (SCFE) were applied for the extraction of essential oil from *E. globulus*. For SDE three solvents namely Hexane, Diethyl ether, and Dichloromethane were used, while, SCFE was carried out in two different pressure conditions. The yield was 1.01%, 1.80%, 0.81%, 1.86%, 3.21%, 2.50% in steam distillation, Hexane, Diethyl ether, Dichloromethane, SCFE1, and SCFE2 respectively. The GC-MS analysis of the EO of *E. globulus* showed the presence of 29 different compounds out of which alpha-pinene, beta-pinene, alpha-phellandrene, limonene, and eucalyptol were the major five constituents. The percentage of these five constituents was found to be 36%, 36.77%, 39.85%, 51.40%, 13.27%, 41.56% in steam distillation, Hexane, Diethyl ether, DCM, SCFE1, and SCFE2 respectively. The fractional distillation was performed by applying pressure to get different fragments of EO enriched with specific compounds. The major constituents in F1 were alpha-pinene (35.98%) and Eucalyptol (42.63%), in F2 alpha-pinene (18.52%) and Eucalyptol (56.92%), in F3 Eucalyptol (69.89%), in F4 Eucalyptol (70.36%) and in F5 Eucalyptol (72.13%). Results showed that SCFE1 was best to get a higher yield with the green process. However, the simultaneous distillation using DCM was best for increasing eucalyptol content in EO. Fractional distillation was useful for separating the fractions enriched with specific compounds.

Keywords: Steam distillation, Simultaneous distillation, Supercritical fluid extraction, Fractional distillation

POSTER PRESENTATION

THE EFFECT OF LOW ATMOSPHERIC PRESSURE AND RADIATION ON POSSIBLE WELDING OF SILVER METALS

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Abstract

Traditional welding and soldering process are very dependable on their surrounding environment; the stated problem is to test an effective way for weld of pure metals/alloys for long-term space missions and ISS. Since the traditional soldering process depends on microgravity conditions and is not so efficient due to the formation of gas bubbles in soldering joints often reduces conductivity and is prone to cracks. If the least reactive metal pieces of the same kind (silver) are exposed in a near-space environment then the average pressure of about 2.50-20 hectopascals will act for about 3-10 hours, depending on the amount of metal taken and centripetal force applied on the experimental balloon providing necessary kink to the materials welding of same pure metal may occur because of jumping of electrons from one metal to another.So, our experimentation depends on very low atmospheric pressure and radiation Solar Energetic Particles and Galactic Cosmic Rays for the weld to occur while independent of microgravity because given sample particles do not have any way to differentiate among themselves when even a small force is applied in a near-space environment. Increment in size by 10% in the samples with chunks under a microscope is expected. The paper's experiment model is to be launched and tested via NASA Wallops Facility; facilitated by Idoodle inc. and the Cubes in Space project under guidance of Nepal Astronomical Society.

Keywords: Microgravity, Electrons, Gas bubbles, Conductivity

INFORMATION, COMMUNICATION AND ARTIFICIAL INTELLIGENCE

THEMATIC SPEAKER

USE OF DIGITAL SIGNATURE IN ELECTRONIC TRANSACTIONS

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Legal Provisions and Implementation Status in Nepal

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Abstract

A digital signature is a mathematical technique for verifying the authenticity and integrity of digital messages and documents. The use of asymmetric key cryptography in digital signature ensures that the contents of a message are not altered in transit and also overcomes the problem of impersonation and tampering in digital communications. The Electronic Transaction Act 2063 of Nepal has the provisions of digital signatures and electronic record validity. It also covers all of the procedures and working principles required for its implementation. The Government of Nepal has established the Office of Controller of Certification (OCC) and the Certifying Authority (CA) for its implementation under the provisions of the Act. A trusted Certifying Authority generates, distributes, and securely stores the public and private keys used in asymmetric cryptography. The CA has begun to provide digital certificates to end users. Some government offices in Nepal have already begun to use digital signatures in electronic transactions. Despite the fact that there are several challenges to implementing digital signatures, it is only a way of making electronic transactions secure and reliable in the current context.

Keywords: Digital Signature, Hash Value, Cryptography, Encryption, Decryption

ORAL PRESENTATION

WOULD YOU OWN A ROBOT? : A DETAILED RESEARCH ON PUBLIC RESPONSE TO THE NOOKS AND CRANNIES OF OWNING A ROBOT.

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Abstract

The utility aspects of robots in our day to day tasks have been diminished over the fear of them taking over humanity, especially thanks to unrealistic movies. But how much should the public care about having or owning a robot? What tasks do we want robots to do? Which workforce do we want a robot to join? What are the privacy concerns of owning a robot? And given the circumstances of an economy sustained by our automated metal friends, will we still want to continue our jobs? In this research, we find answers to all these questions. We surveyed over 300 participants to get their opinions on all these topics and try to get a result out of the emotions our participants held towards robots. The major theme that emerged as the result of this survey were: owning a robot had a positive connotation on general public, people preferred robots to do household activities where they aren't involved emotionally, people want at least 50% of most jobs to be occupied by robots, people want to maintain their privacy and are very uncomfortable to even share their name with them.

Keywords: Robots, Privacy, Data and privacy, IoT devices privacy

MULTICLASS SKIN CANCER CLASSIFICATION USING CONVOLUTION NEURAL NETWORK (CNN)

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Abstract

Deep learning is an AI function that mimics the working of the human brain in processing the data for use in detecting patterns or objects which ultimately helps in making better decisions. Deep learning has been witnessing a tremendous amount of attention over the last few years. Early detection of diseases or any other irregular patterns has been a challenging task in the medical field. Deep learning algorithms help in the automatic and very early detection of such patterns and diseases using artificial neural networks. Several DL architectures have been implemented for classification, segmentation, and detection tasks in medical imaging and computational pathology. DL architectures consist of multiple layers like convolution, pooling, flattening, dense, activation, etc. In this experiment, we have put particular focus on fine-tuning the variants of the EfficientNet model for skin cancer diagnosis. For this, we trained the EfficientNets B0-B4 on HAM10000 datasets. The dataset consists of seven classes of cancer which are Melanocytic nevi, Melanoma, Benign keratosis-like lesions, Basal cell carcinoma, actinic keratoses, vascular lesions, and Dermatofibroma. Different resolutions were used for different variants of the EfficientNet model such as 224 for B0, 240 for B1. These resolutions were used in increasing order for higher variants. The final input size for the B1 variant is 240*240. The proportion of data is such as 95% 2.5% 2.5%, for the Training, Validation, Testing split. The experimental results show superior performance on classification tasks compared to other networks.EfficientNet B1 shows around 90 % test accuracy for dermoscopic skin cancer classification. The high-class classification scores resulted from fine-tuning up to a certain layer of the model. The obtained output outperforms the performance of the existing skin cancer classification system such as VGG16 and U-Net.

Keywords: Fine-tuning, Transfer learning, Pattern recognition, Segmentation

POSTER PRESENTATION

ICT AND ITS USE IN INCREASING EQUITY AND INCLUSION IN SCHOOLS PRACTICE ACROSS NEPAL: FINDINGS FROM INITIAL RESEARCH WITH SCHOOL LEADERS

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Abstract

School leaders are in charge of operating a school and the overall functioning and welfare, including promoting change for equity and inclusion in the schools that they lead. The objective of this research is to understand the activities of school leaders' working to solve local issues of equity and inclusion in their schools. The paper also focuses on the role of ICT for sustainability and scaling of the outcomes from this research. The data for the study was collected through a one-time cross-sectional mixed questionnaire survey with 118 school leaders, semi-structured interviews with 10 school leaders, five policy makers and relevant policy document analysis. Convenient sampling method was used to collect data for this study. The findings suggest that the school leaders were aware of the basic importance of inclusive education but were not trained to achieve it. Most school leaders perceived that it was their formal responsibility to ensure inclusive education but they had never enrolled in any online or blended professional development courses regarding inclusive education. Internet Connectivity and workload of school leaders was the reason for not being networked. Nepal has several plans and policies regarding inclusion and equity in education, however these documents talk less about school leaders and teachers' knowledge that could address these issues and provide direction to overcome the problems in and outside schools. Overall, this study presents initial findings that will act as a starting point in developing an open course to strengthen school leaders' capacity through a different approach which sees them as initiators of solutions. Different stakeholders such as school leaders, community, and government will be benefited from this study.

Keywords: Inclusive Education, Networked Improvement Communities, Equity, ICT, Head Teachers, Scaling

PESTICIDES SPRAYING DRONE - KRISHAKCOPTER 1.0

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Abstract

In the present era, there are too many developments in precision agriculture for increasing crop productivity. Especially in developing countries like Nepal, over 80% of the rural people depend on the agriculture fields. The production rate of crops in agriculture is based on various parameters like temperature, humidity, rain, etc, which are natural factors and not in farmers control. The yield also depends on some factors like pests, disease, fertilizers, etc, which can be controlled by giving proper treatment to crops. The agriculture fields face dramatic losses due to the diseases. These diseases came from pests and insects, which reduced the productivity of the crops. Pesticides and fertilizers are used to kill the insects and pests in order to enhance the crop quality. The WHO (World Health Organization) estimated one million cases of illness, when spraying the pesticides manually in the crop field. So the main aim of this research is to design agriculture drones for spraying pesticides. The use of pesticides in agriculture is very important, and it will be easy if we use intelligent machines such as Drones. This product reduces human efforts in various operations of agriculture like detection of presence of pests, spraying of UREA, spraying of fertilizers, etc. The Unmanned aerial vehicle (UAV) – aircrafts are used to spray pesticides to avoid the health problems of humans, when they spray manually. This research includes the successful development of the pesticides spraying drone KrishakCopter V.1 for the farmers of Nepal.

Keywords: Crops, Agriculture, Unmanned Aerial Vehicle (UAV), KrishakCopter V.1

FEASIBILITY STUDY OF USING UNCREWED AERIAL VEHICLES TO DELIVER COVID-19 VACCINES IN GEOGRAPHICALLY INACCESSIBLE AREAS OF NEPAL

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Abstract

The infectious diseases vaccine program started in Nepal. Transportation facilities using uncrewed aerial vehicles (UAVs) will support the COVID 19 vaccine; therefore, remote areas where accessibility is unavailable and takes enormous time to reach the primary health center. However, it can distribute vaccines at standard times with required temperature-sensitive. Moreover, eliminating human contact reduces logistics costs, time, and chances of virus carriers to the frontline workers while delivering vaccines. This feasibility study provides one of the possible ways of transporting vaccines using UAVs to the remote areas of Nepal; one approach will be using a customized prototype of drones and deploying it. The following will to studying the research articles on this field for proper guidance to conduct a study. The drone with a vaccine carrier takes the vaccine from Simikot Airport to the Local Mission hospital about a 400-meter journey time of about 11-15 minutes. The results show that drones can supply medical kits to health centers to reduce delivery time. It has been practiced that literature review on this related field states UAVs' possible implication in transporting vaccines. It reduces the time to deliver by 11-15 minutes with a vaccine carrier box (10-12 kg) that maintains a low temperature for 3-7 days. Furthermore, it minimizes the potential risk of not providing vaccines due to the unavailability of the road in remote areas. This alternative can support the delivery of vaccines for vulnerable groups deprived of health care. One of the significant ways to deliver the vaccine can be using a drone for remote areas with limited health facilities. In addition, it can support government plans to vaccine people incorporation with emerging technologies.

Keywords: Feasibility, UAVs; Vaccine, COVID 19, Remote places

SCIENTIFIC TOUR, DIPLOMACY, POLICY

ORAL PRESENTATION

GANDAKI PROVINCE ACADEMY OF SCIENCE AND TECHNOLOGY: OPPORTUNITIES AND CHALLENGES

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Abstract

Gandaki Province Academy of Science and Technology (GPAST) is an autonomous institution founded by the government of Gandaki Province under "Gandaki Province Academy of Science and Technology Act-2076" in 2076. The academy brings together multidisciplinary stakeholders to foster research and innovation in the province. GPAST aims to build the skills and knowledge of local youths, researchers, and experts to prepare them to lead the Science Technology Innovation(STI) sector in the province, contributing to the sustainable utilization of resources and holistic development of Gandaki Province. In the year 2078/2079, GPAST has been funding several research projects for the study in different thematic areas of Gandaki province. Similarly, it has organized internship programs, workshops, conferences, and other outreach activities to disseminate knowledge and ideas in the field of science and technology. Moreover, GPAST is actively involved in identifying priority areas for research in the Gandaki province for the progression and development of STIs. Through its activities, the academy continues to strengthen expertise and promotes research on front-line areas of science and technology.

Keywords: GPAST, Provincial academy, Research priorities, Multidisciplinary research

IMPACT OF REMITTANCE ON EDUCATION: A SYSTEMATIC REVIEW

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Abstract

The remittance has been major source of income for many countries including Nepal. Remittance has helped to relax burden of expenditure to the families receiving remittance. Use of remittance on human capital development changes the scenario of vicious circle of remittance to virtuous circle. The education may one of the area where remittance can be used for human capital development, so this paper examines situation of use of remittance on education. There is ambiguity in effect of remittance across the past researcher. So this study aims to identify what the majority of researcher have found. Systematic Review has been conducted following protocol defined .The scoping, planning , identification, screening, checking eligibility criteria has been followed as steps to conduct systematic review. The inclusion and exclusion criteria has been clearly defined. Defining explicit inclusion criteria, 18 records out of 54 identified from databases PubMed and Scopus. Type of data used, country to which data related to, methods used for analysis and major findings of the papers has been extracted and analyzed. Majority of the papers used for study revealed that there is a positive impact of remittance on education.

Keywords: Remittance, Impact, Education, Scoping, Screening, Eligibility criteria

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