



RESEARCH INSIGHTS

Volume 1, 2023



Kathmandu University
Research, Development and Innovation

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Kathmandu University
Research, Development and Innovation

MESSAGE FROM THE VICE CHANCELLOR

It is with great pleasure that I extend my warmest greetings to all readers of this special publication by the Research, Development, and Innovation Directorate (RDI) of Kathmandu University. Kathmandu University has dedicated substantial endeavors to enhance research and development initiatives in alignment with the goals outlined in the Kathmandu University Strategic Plan 2022-2027. This commitment has catalyzed a multitude of applied scientific research, industry-centric research endeavors, consultancy projects, and advanced academic research within the university premises. This publication stands as evidence of our steadfast dedication towards developing KU as an innovative research focused institution, highlighting the significant research initiatives that originate from the corridors of our university.

The publication serves as a comprehensive overview of Kathmandu University's diverse research projects, showcasing our commitment to self-sufficiency despite financial constraints. Internally funded projects play a vital role in advancing our research agenda by channeling scarce funds into research initiatives. Unlike donor-funded projects, the outcomes of internally funded projects often stay within the university. This publication acts as a conduit for disseminating knowledge generated by our internally funded projects, ensuring that our research efforts enrich both academic discourse and reach those with the power to effect positive change.

I extend my heartfelt thanks to the Research, Development, and Innovation Directorate for their tireless efforts in bringing this publication to fruition. To the researchers and contributors, your dedication to the pursuit of knowledge is truly commendable, and I am certain that your work will leave an indelible mark on the academic and societal realms.

Prof. Dr. Bhola Thapa

Vice Chancellor, Kathmandu University

MESSAGE FROM THE REGISTRAR

I extend sincere appreciation to the Research Development and Innovation (RDI) Directorate for their dedicated efforts in producing this insightful magazine. Kathmandu University (KU) is deeply committed to achieve excellence in research and related activities. The university is engaged in undertaking two types of scholarly inquiry at present, externally and internally funded projects. External projects, generously supported by donors and strategically crafted for policy-level impact, play a pivotal role in engaging a diverse audience, including the policy-makers, industry and academia. This underscores the university's dedication to not only advancing academic knowledge but also making a tangible impact on policy and society at large.

This magazine highlights internally funded projects, showcasing the consistent advancements achieved through the unwavering dedication of our researchers. Their commitment propels the ongoing improvement of research initiatives at Kathmandu University, fostering an ecosystem for continuous innovation and excellence. Through this magazine, the RDI effectively brings forth the knowledge and information gathered from internally funded projects, to a broader audience, bridging the gap between internal research excellence and external visibility. This reflects the dedication of Kathmandu University in pioneering research that encompasses diverse areas and disciplines, contributing meaningfully in sustaining the legacy of academic research in Kathmandu University.

Prof. Achyut Wagle, PhD

Registrar, Kathmandu University



FOREWORD FROM THE DIRECTOR

It is a pleasure for the Research, Development and Innovation (RDI) Directorate to publish the inaugural edition of 'Research Insights', highlighting the research conducted at Kathmandu University (KU) through internal funding.

KU aims to become a research-and-teaching university and thus prioritizes research and related activities. Accordingly, research activities have increased tremendously across schools recently. Initially, research works were mainly driven by projects funded by external donors, including ministries, the UGC, the NAST and other national organizations, and international organizations such as the United Nations and associated organizations, the European Union, and diplomatic missions and development agencies. To reciprocate the generous contributions of the external parties to increase research activities at the university, KU has also started funding research through internal resources.

The knowledge produced through externally funded research works often gets noticed and plays a role in policy-making. This is because presentation, dissemination and report submission to the donors, and by extension to higher authorities, are the obligatory parts of research projects. However, it is observed that the contents and conclusions from internally funded research works usually go unnoticed. In an attempt to allow the research works of internally funded projects to reach the larger community, the RDI has started publishing this magazine.

I thank the editorial and technical teams, faculties, staff and the KU administration for all their support towards seeing the first volume of this magazine in print. RDI is committed to publish new volumes of this magazine every year.

Thanking you,

Prof. Dr. Bibhuti Ranjan Jha

Director

Research, Development and Innovation
Kathmandu University



Interaction Program Between PhD scholars and VC, 2023



Final presentation of internally funded project 2021

2019 - 2020

COMPARISON OF REACTION TIME IN THE STROOP TEST AMONG THE YOUNG NEPALESE POPULATION

✉ **Ms. Swastika Hada**

Assistant Professor, Department of Pharmacy, School of Science, Kathmandu University

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Project Summary

This study assessed the cognitive ability of healthy, educated young adults, which could be used as reference values for future studies in Nepali populations. This quantitative, cross-sectional study with stratified convenience sampling (n=102) (third-year undergraduate students from the Department of Pharmacy, Kathmandu University) was performed using a validated computerized data collection tool for the Stroop test in English and Nepali. A paired T-test was performed between congruent and incongruent reaction times and between the sexes. The Nepali version of the test was validated by the Bland-Altman plot. From our study, we found that the difference in reaction time was significant while performing congruent and incongruent tests in both English and Nepali languages. However, no significant difference was observed when each set (congruent and incongruent) in both languages was compared between the sexes ($p \geq 0.01$). Furthermore, it was identified that color recognition required more attention when the detractor information was the word naming the color. Such ability was not dependable on gender in the same educational background.

Keywords: Cognitive ability, T-test, Reaction time, Bland-altman plot.

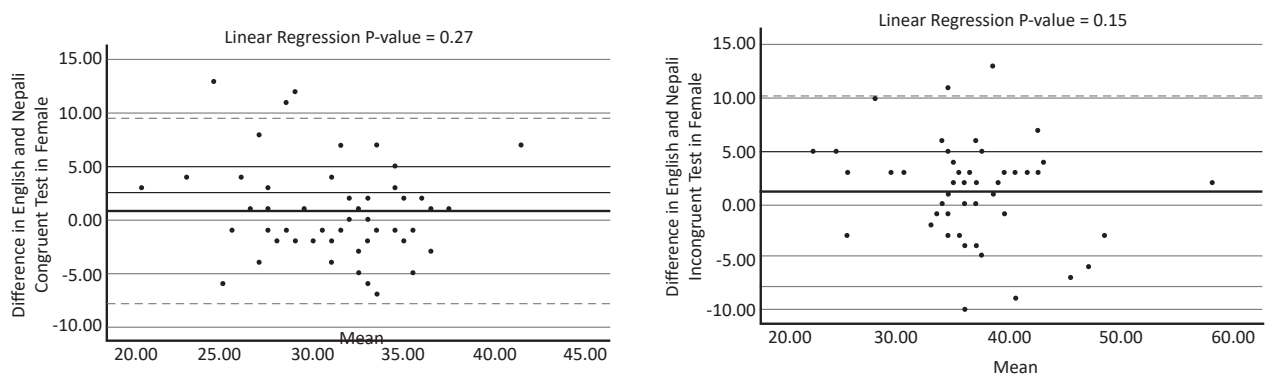


Figure 1. Bland–Altman plot showing the difference in English in the Nepali test in females

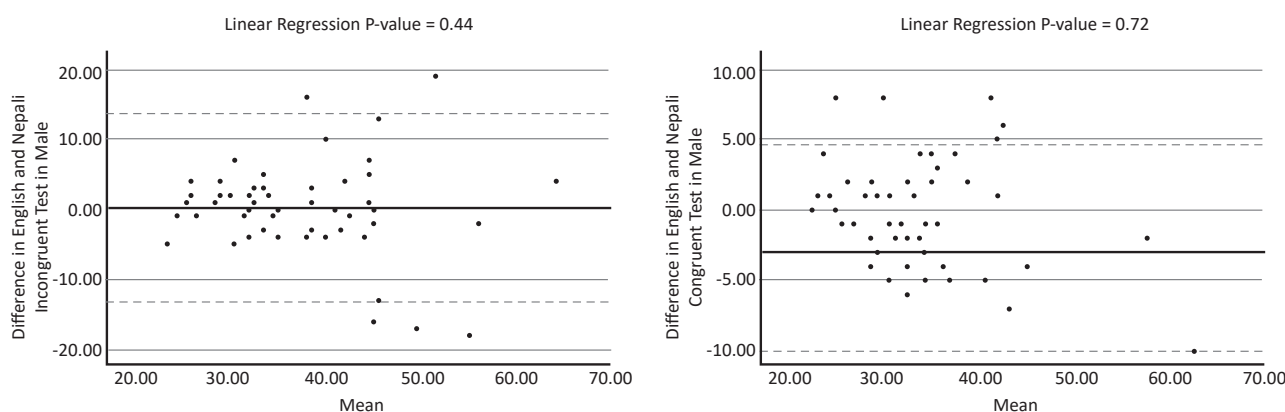


Figure 2. Bland–Altman plot showing the difference in English in the Nepali test in males



FACTORS AFFECTING THE ADOPTION OF ELECTRONIC PAYMENT SYSTEMS (EPS): A STUDY OF NEPALESE CUSTOMERS

✉ Srawan Kumar KC^{*1}, Sunanda Ale Sharma²

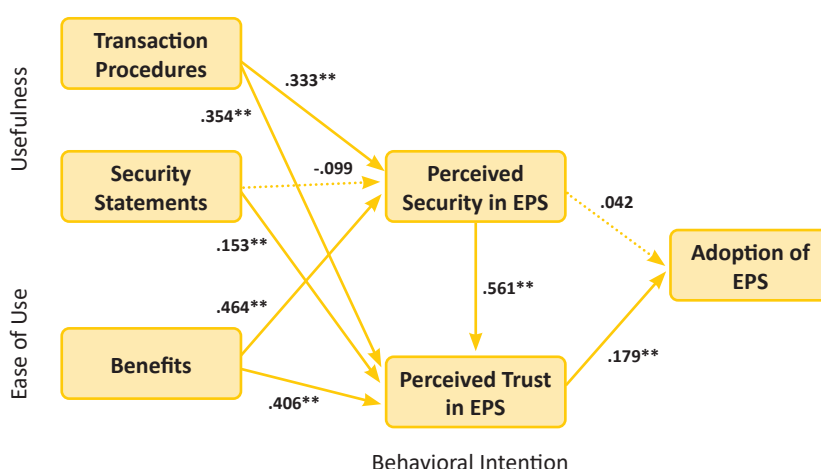
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**Principal Investigator:* srawankc@kusom.edu.np

Project Summary

This study aimed to investigate the factors influencing the adoption of electronic payment systems (EPS) in Nepal. It sought to achieve this by evaluating an extended version of the Technology Acceptance Model (TAM). Furthermore, a conceptual model based on the Extended TAM framework was introduced, elucidating the factors contributing to perceived security and trust, along with their impact on EPS adoption. The study's sample encompassed 309 individual customers with prior experience in utilizing electronic payment methods. Statistical analysis was performed using SPSS software. Demographic characteristics and the degree of familiarity with electronic payment systems were examined through descriptive analysis. Furthermore, the reliability of each measurement instrument was assessed by calculating Cronbach's alpha coefficients. To investigate the associations between independent variables and the adoption of electronic payment systems, correlation matrix analysis was employed. Additionally, the study tested its hypotheses through hierarchical regression analysis.

The study's findings revealed a predominant usage of electronic payment systems among individuals aged 21-30. Among the available payment modes, digital wallets such as Khalti and eSewa were the most frequently utilized. In general, the results indicated significant and positive relationships between the adoption of electronic payment systems and factors like transaction procedure, benefits, and perceived trust. However, it was observed that security related statements did not exhibit a significant positive relationship with perceived security, but they did display a positive correlation with perceived trust. Furthermore, there was no significant positive association between perceived security and the adoption of electronic payment systems. This research highlights that customers do not currently perceive security statements (SS), which affects their perception of security in adopting EPS. Therefore, institutions looking to implement or enhance electronic payment systems should prioritize improvement of security systems and statements electronic payment systems.



Keywords: Electronic payment system, Usefulness, Ease of use, Security and trust, Adoption.

2019 - 2020

KNOWLEDGE, ATTITUDE AND PRACTICE OF DISPENSERS OF COMMUNITY PHARMACY TOWARDS EMERGENCY CONTRACEPTIVE PILLS (ECPS) IN KATHMANDU VALLEY OF NEPAL

 **Ms. Sweta Shrestha**

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Project Summary

Unintended pregnancies, the primary cause of abortion, can result into severe negative effects such as infertility and maternal death. Adequate knowledge of emergency contraceptive pills (ECPs) and a positive attitude among the dispensers in community pharmacy is a prerequisite for timely access to ECP thus ultimately abating the incidence of unintended pregnancies. This study intended to explore the knowledge, attitude and practice of dispensers of community pharmacy toward ECPs in Kathmandu valley. A cross-sectional study was conducted in community pharmacies located in three districts of Kathmandu valley. A convenient sampling method was employed to interview dispensers in 227 community pharmacies using a validated questionnaire. The questionnaire assessed the knowledge, attitude and dispensing practice of the dispensers. The data were subjected to descriptive and inferential analysis using SPSS 18 (SPSS Inc., Chicago, IL, USA).

Respondents' knowledge was statistically significant with dispensing practice and had a positive relation [AOR= 11.86, 95% CI (5.821-24.190)]. Approximately three-fourth (74.9%) of respondents had a good practice and about 65.6% had a good knowledge on dispensing ECP. Majority (93.4%) had a positive attitude towards ECP yet slightly more than half the respondents (54.2%) had conservative belief about the Over the Counter (OTC) availability of ECP. Similarly, respondents' practice towards ECP was higher among the age group 40-49 years with experience above 10 years and pharmacies located inside the city and in the Kathmandu district. Adjusted for other variables, only the pharmacies located at Kathmandu district was significantly associated with practice. The dispensers lacked specific information on ECP and posed a conservative perception of its' OTC availability, despite good overall knowledge and positive attitude. Hence, training on proper counseling strategies should be afoot to refine service delivery.

Keywords: Abortion, Contraceptive pills, Dispensers, Inferential analysis, Counseling.

Table: Demographic characteristics of the respondents and their level of knowledge

Degree/Education	Frequency	Percentage
Bachelor of Pharmacy	57	25.1
CMA	29	12.8
Diploma in Pharmacy	90	39.6
Masters of Pharmacy	13	5.7
Others	38	16.7

Gender	Frequency	Percentage
Male	131	57.7
Female	96	42.3

Age	Frequency	Percentage
<20	29	12.8
20-29	107	47.1
30-39	51	22.5
40-49	23	10.1
≥ 50	17	7.5

Median Age: 20-29 Years

Religion	Frequency	Percentage
Hindu	190	83.7
Buddhist	32	14.1
Muslim	3	1.3
Christian	2	.9
Hindu	190	83.7



ALGAE BASED TREATMENT OF LANDFILL LEACHATE(LL)– PRETREATED BY COAGULATION-FLOCCULATION

✉ Anish Ghimire^{*1}, Shiwasish Singh Swar²

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Project Summary

Sisdole Landfill Site (SLS) was established in 2005 A.D for a design period of 2-3 years, but unfortunately, 800 tonnes of municipal waste are still being disposed there and LL management is an urgent issue in SLS as untreated leachate is flowing directly to the nearby Kolpu River causing environmental and health concerns. This study aimed to assess the potential of algae-based treatment of landfill leachate pretreated by coagulation flocculation (CF) to treat LL for the removal of conventional pollutants such as biological oxygen demand (BOD), chemical oxygen demand (COD), ammonia, nitrate, and phosphate. Response Surface Methodology (RSM) was used to optimize the operating variables (Dose and pH) during the pretreatment of leachate by the CF process using poly aluminum chloride (PAC), Ferric chloride ($\text{FeCl}_3 \cdot 7\text{H}_2\text{O}$), and Alum ($\text{Al}_2(\text{SO}_4)_3 \cdot 6\text{H}_2\text{O}$) as coagulants. For biological treatment, the pretreated LL was subjected to algal treatment using the mixed culture microalgae strain isolated from the wastewater collection pond. The combined physicochemical and biological treatment of LL from SLS achieved high percentage removal, 62.9-72.4 %,74.9-75.5%, 87.6-93.4%, >99% and 73.63-86.73% removal for COD, BOD5, ammonium-nitrogen, phosphate and conductivity, respectively. Thus, this research proves the feasibility of a combined biological and physiochemical algae-based treatment of LL and also offers a potential alternative to current treatment practices for LL. However, additional studies are needed to assess the ability of combined treatment over a longer period, while also taking into account the changing characteristics of LL.

Keywords: Microalgae, Landfill leachate, Coagulation-flocculation, Solid waste management.

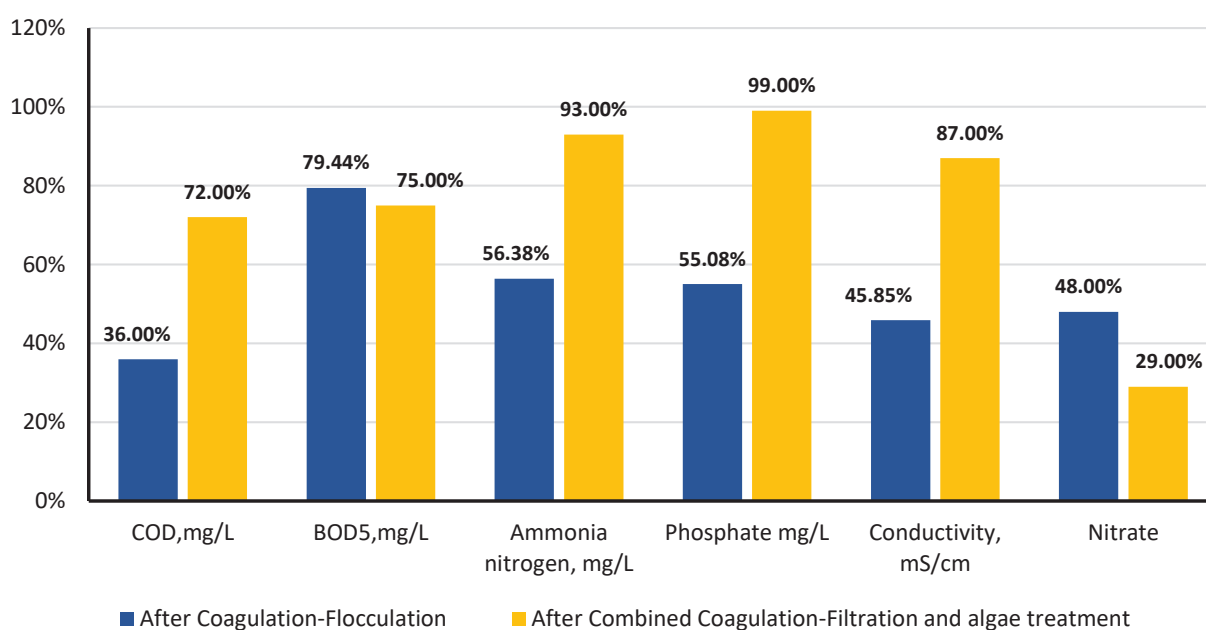


Figure: Percentage Removal of Contaminants

2020 - 2021

A CRITICAL ANALYSIS OF ENFORCEMENT OF JUDGMENT OF PUBLIC INTEREST LITIGATION (PIL) ON ENVIRONMENT ISSUES IN NEPAL (FY 2073-2076 B.S.)

 **Vijaya Prasad Jayshwal***

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Project Summary

This research has analyzed the trends of enforcement of public interest litigation on the environmental issues. Green litigation is highly appreciated in Nepal, and most of the activists are well aware of the judicial trend on green litigation. The right to clean and healthy environment (Article 30) is fundamental rights guaranteed under the Constitution and Article 51 (g) under the Policies of State. The Schedule 5-9 of the Constitution prescribes the power of federal, state and local government on environmental issues. The Environment Protection Act, 2019 and Rules, 1977 are two major legislations for protection and preservation of an environment in Nepal. In the three years, 21 cases on PIL are registered in the SC and in 2076, the highest number of PIL are registered.

Under this background this research has aimed to identify the key measures initiated by respective responsible agencies to enforce PIL on environmental issues in the last three years (2073- 76) and analyze the judicial trend on green litigation in the last three years (2073-76) in cases of PIL in Nepal. The purposive sampling, in-depth, structured interview and KII method has been used for selecting the PIL on environmental issues. The enforcement of PIL on environmental issues are very weak in Nepal as compared to the number of issues favored by the judiciary in litigation. The judicial trend seems very positive and also remarkable on the various aspects of environmental issues. This requires a comprehensive plan among all major stakeholder for the enforcement and considering the judgment alive and also enforceable in character. Thus, the government agencies must work together in sectorial issues with the sector specific private institution for the protection and promotion of environmental concerns.

Keywords: Environment issues, Judicial trend, Government, Constitution.

Year	Month	No.	Total
2073	Shrawan	2	5
	Ashoj	1	
	Poush	1	
	Falgun	1	
2074	Ashad	1	1
2075	Mangshir	3	7
	Magh	2	
	Falgun	1	
	Chaitra	1	
2076	Jestha	1	8
	Ashad	3	
	Ashoj	1	
	Mangshir	2	
	Falgun	1	
Total		21	21



CRITICAL INQUIRES ON KATHMANDU UNIVERSITY SILVER JUBILEE INITIATIVES VISION 2030

 **Punya Prasad Koirala**

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Project Summary

Kathmandu University (KU) has released six different campaigns to achieve Silver Jubilee Initiatives Vision 2030. They are Quality Initiative, Impact Initiative, Equity Initiative, Global Engagement Initiative, Identity Initiative and Innovation Initiative (KU Insider 5.1 Feb-July 2017). These initiatives are the major issues of educational leaders in KU during their public speeches. The speakers of the convocation also reveal similar educational goals, objectives and mission. The educational leaders can strengthen, develop and preserve educational policies, mission and vision of the country.

The study analyzed KU Silver Jubilee Initiatives Vision 2030 in the specialized situational speeches like convocation addresses and other public documents addresses by the university officials after November 2016. This is a deductive content analysis. Six Initiatives Quality, Impact, Identity, Innovation, Global Engagement and Equity initiatives are taken as the subject of study. The leaders of the university present their educational vision in the convocation speeches. The vice chancellor of Kathmandu University emphasizes silver jubilee initiatives that are broad frameworks based from which the university can draw present and future directions. The speeches are dedicated to fulfill the mission and vision of the university.

The study samples included convocation addresses of Vice-Chancellor. The first three Initiatives (quality initiatives, innovation initiatives, identity initiatives) are based on internalization and other three Initiatives (equity initiatives, impact initiatives and global engagement initiatives) are related to externalization. The speeches emphasize these issues with the key indicators with the global trends of these initiatives.

Keywords: Critical inquires, Content analysis, Silver jubilee initiative.

Table: A brief overview of the findings

Kathmandu University Silver Jubilee Initiatives Vision 2030					
Equity	Quality	Impact	Global Engagement	Identity	Innovation
Equal opportunities	Students' feedback	Get impact in society	The collaboration with local and global partners	Branding	Innovative approaches
Disadvantaged communities	Multidisciplinary	Academic engagement	Foreign qualified faculty	Ranking of university	Research starter grants
Choice-based credit system	Interdisciplinary	Modernizing teaching methods	Collaborations with global universities	World class universities	Transferring of responsibility
Funding sources	Multidisciplinary	Transformation to the communities	Figure out the most reputed global ranking		
	Adequate space for expansion	Initiating new ventures			

2020 - 2021

EFFECT OF PLASMA TREATMENT ON SEED GERMINATION AND SEEDLING GROWTH

✉ **Dr. Gobinda Prasad Panta**

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Project Summary

Cold plasma treatment is an effective, cost-effective, and environmentally friendly way to increase seed performance and crop production. Cold plasma processing methods possess many advantages in agriculture, owing to their operation at low-temperatures and short processing times, without inducing damage to crops, foods, seeds, humans, and the environment. Plasma discharges produce reactive neutral species, charged species (electrons, ions), electric fields, and ultraviolet radiation. These factors cause the change in density of reactive oxygen species (ROS), reactive nitrogen species (RNS), pH, oxidation-reduction potential, electrical conductivity, and so on, and affect seed germination, plant growth, and the quality of agricultural products. The current study suggests the creation of a novel technology based on single dielectric barrier discharge (DBD) reactor of low temperature plasma treatment of seeds.

An atmospheric pressure DBD system has been designed for the treatment of seed of cash crops. The treated seeds were then passed through the germination process. We studied the change in the germination time, germination rate, root/shoot length, leaf area, chlorophyll content, crop yield of the treated seeds at different conditions. An optimum condition of plasma treatment on the best result of the germination rate and seedling growth was determined by investigating different plasma conditions. The treatment time varied during the experiment. Mustard and Radish seeds were taken for the investigation.



Figure 1 Control and treated seeds of Mustard seeds by DBD for 2

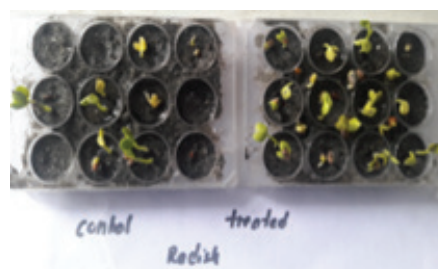


Figure 2 Control and treated seeds of Radish by DBD for 2 minutes using line frequency at 15 kV.

Germination Percentage was found to increase in case of plasma treated seeds in both Radish and Mustard. A significant change in the seedling length was observed in the case of plasma treated Radish and Mustard seeds. An increase in the seedling length and germination percentage in the case of plasma treated seed indicates an increase in the vigor index of the plant. i.e., overall development of plants. Root length and shoot length were found to increase in plasma treated Radish and Mustard seeds. Fresh weight was also found to increase in case of plasma treated seedlings. There was a significant increase in the total chlorophyll content in case of plasma treated seedlings of Radish. In short, the application of non-thermal plasma can be utilized for improving the seed germination rate thereby increasing the yield of the crop.

Keywords: Cold plasma, Atmospheric pressure system, Germination percentage, Chlorophyll content.

PATHWAYS TO TEACHER LEADERSHIP AMONG ENGLISH AS A FOREIGN LANGUAGE TEACHERS IN NEPAL'S PUBLIC SCHOOLS

✉ **Bharat Prasad Neupane**

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Project Summary

The study implies that a proper learning environment in the early phase, culture of reflection and interaction among peers, training and development opportunities from the school, and construction of a networking platform for teachers should be created for professional development and the development of teacher leadership. Three English teacher leaders, two males and one female, from public schools in Nepal, particularly Kathmandu valley, were purposively selected as they have demonstrated considerable leadership skills and their leadership journey from teacher-to-teacher leadership will be of significance. To explore the lived experiences, I conducted an in-depth interview and informal conversation with research participants on multiple phases. We audio-recorded the interviews on mobile with the permission of participants and later the recorded interviews were transcribed and translated into English as the participants code-switched between Nepali and English languages during the interview. All three face-to-face interviews were completed within half an hours' duration.



Figure: Leadership Development Process in Nepal

Then transcribed and translated interview text were analyzed employing activity theory envisioned by Engestrom. The study discovered that to become a successful teacher leader, communication and instructional competence is a must because it provides visibility of prospective teacher leaders among colleagues and the wider community initially. Further, reflection and sharing among colleagues, we found, were instrumental in the development process of teacher leaders. This article reveals that leadership is the manifestation of co-construction of an individual in a complex ecosystem of learning communities and hence the notion of leadership is emergent and fluid.

Keywords: Learning environment, Networking platform, Interviews, Instructional competence, Teacher leaders.

2020 - 2021

PERSONAL EXPOSURE TO PARTICULATE MATTER IN VARIOUS MODES OF TRANSPORT IN KATHMANDU, NEPAL

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Project Summary

Particulate matter pollution concentration in Kathmandu valley exceeded up to 9-fold higher than the World Health Organization 24-hour guidelines. Daily commuting to work in a vehicle increases particulate matter exposure and it is influenced by the mode and time of commuting. This study aimed to investigate the effect of commuting in various modes of transportation on personal exposure to particulate matter with aerodynamic diameter $\leq \mu\text{m}$ (PM_{2.5}). Real time personal exposure to PM_{2.5} was monitored in four different modes of transportation: personal bike, private cars, public cars (taxi) and bicycle. The exposure was monitored for each mode of transport mode in three different road stretches in Kathmandu twice a day for peak hours and off-peak hours. The measurements were repeated for each transport mode for 10 measurement days in all three routes.

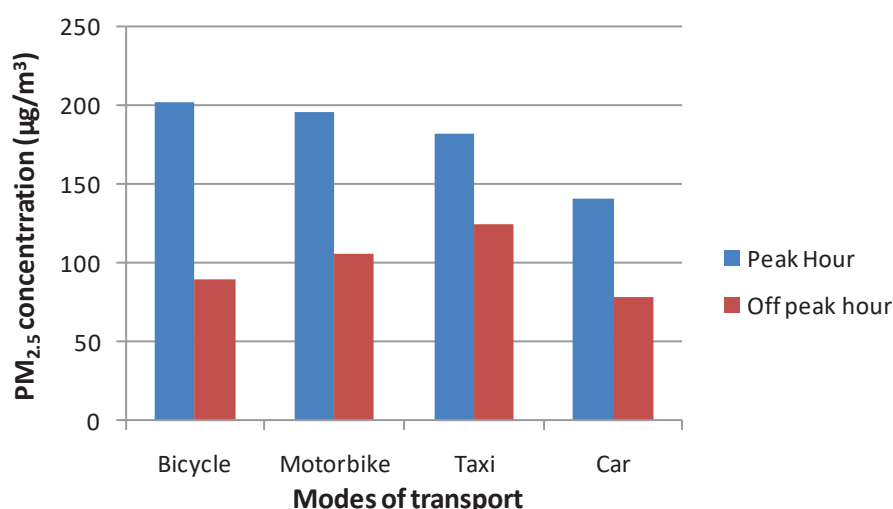


Figure 1: Average PM_{2.5} concentration in different modes of transport for peak and off-peak hour.
Data presented is an average of all three routes for each mode of transport

The result showed that peak hour average concentration of PM_{2.5} for all mode of transport was higher than the average concentration during off peak hour in all three routes. There was a variation in average concentrations in all transport mode, and the commuters travelling through bicycle were exposed to highest average PM_{2.5} (205 µg/m³) in all road stretches during peak hours. However, off peak hours' average concentration was lowest for cyclists (86 µg/m³) as compared to other transport modes. The commuters travelling through bike (193 µg/m³), taxi (155 µg/m³) and car (150 µg/m³) were exposed to respective decreasing peak hour average concentrations of PM_{2.5}.

This study showed the effect of commuting on different modes of transport during peak and off-peak hour on personal exposure to particulate matter. The results of this study hence help commuters to choose appropriate travel arrangements to minimize exposure to ambient air particulates.

Key Words: Particulate matter, Mode of transport, Personal exposure, PM_{2.5}.



PREVALENCE OF ORAL SOLID DOSAGE FORM MODIFICATION IN THE CONSUMERS OF COMMUNITY PHARMACIES

 **Joshna Shrestha**

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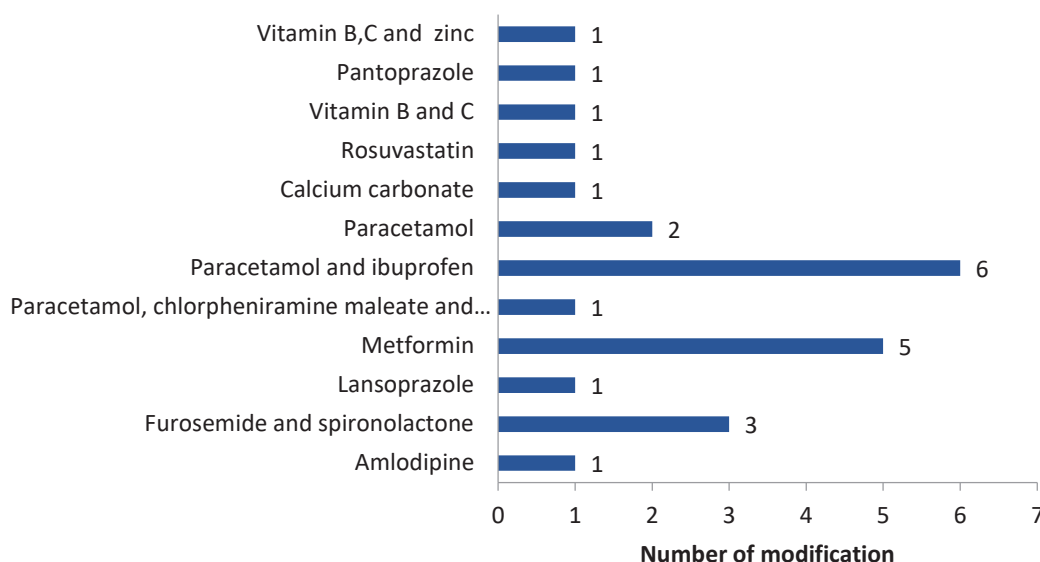
Project Summary

People may modify their oral solid dosage form of medicine to deal with problem faced during medicine administration. The modification of dosage form may adversely affect the quality, safety and efficacy of the medicine. This study aimed to investigate the causes and practices of oral solid dosage form modification among the consumers going to community pharmacies.

A descriptive, cross-sectional study was conducted in five community pharmacies of Kavrepalanchok and Bhaktapur districts of Nepal. The consumers visiting these pharmacies for their oral solid dosage form of medicine were invited to participate in interview using structured questionnaire. Among 419 participants, 13.6% of participants reported having problem of taking intact medicine. Most of them (12.4% of total participants) experienced difficulty swallowing the medicine. The swallowing difficulty is significantly associated with age and sex ($p < 0.05$). Around one third (36.8%) of participant with medicine administration problem modified the dosage form of medicines. One quarter of medicine dosage form modifications (25.0%) were inappropriate. Medicine dosage form modification was found to be associated with age and number of daily medicine intake ($p < 0.05$). Among participants modifying dosage form of medicines, 66.7% were advised to do so mainly by family and friends; 33.3% were modifying on their own and 76.2% were unaware of possible effects of medicine dosage form modification. About 62.3% of total participants were never asked about any problems on taking medicines by doctor/pharmacists.

Difficulty swallowing medicines and medicine dosage form modification were prevalent in the Nepalese population. Medicine dosage form modifications also involved inappropriate modifications due to specialized design of such dosage forms. So, it seems important to provide proper counseling while dispensing such dosage forms.

Keywords: Oral solid dosage, Structured questionnaire, Swallowing difficulty, Medicine administration.



2020 - 2021

SHORT-TERM ELECTRICITY DEMAND FORECASTING FOR KATHMANDU VALLEY, NEPAL

 **Kamal Chapagain, PhD**

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Project Summary

Accurate electricity demand forecasting for a short horizon is very important for day-to-day control, scheduling, operation, planning, and stability of the power system. For the electricity consumption, economic status of the people plays a significant role. Therefore, three different economic development scenarios such as (i) Low growth rate of 4.5% GDP, (ii) Normal growth rate of 7.2% GDP, and (iii) High growth rate of 9.2% are considered while analyzing the demand. Apart from economic development, calendar variables and the weather variables such as days, special days and temperature are the major factors that affect the forecasting accuracy. Since the electricity demand data are continuously increased by smart meters and automation systems, static model's computations are replaced accordingly by dynamic real time robust forecasting models. Therefore, time series, regression, machine learning, and deep learning models are constructed and implemented on historical dataset of Kathmandu city of Nepal. Accuracy improvement is also considered during model design. Several experiments were conducted for determination of training length and the selection of variables which are crucial to avoid the over-fitting problems. The result showed that the deep learning model, long short-term memory (LSTM) perform outstanding in-terms of accuracy with mean absolute percentage error (MAPE) value 1.56%, and root mean square error (RMSE) of 3.16 MW. The regression model was found impressive compared to timeseries model. Regression model coefficients were analyzed to study the impact of the variables to the electricity demand. The electricity demand during Dashain was found to have the lowest demand variation while Ghatasthapana had highest demand variation until evening 7 pm, but after 7 pm during Tihar (Dipawali/Laxmi Puja) showed the highest (peak) demand variation (Fig. 1). The reason behind low demand variation in Dashain might be because of shut-down of all the industries and the peak variation during Tihar/Laxmi Puja is due to Lightening function at the home.

Keywords: Deep learning, Impact analysis, LSTM, Short-term electricity demand, Temperature impact, Weather variables.

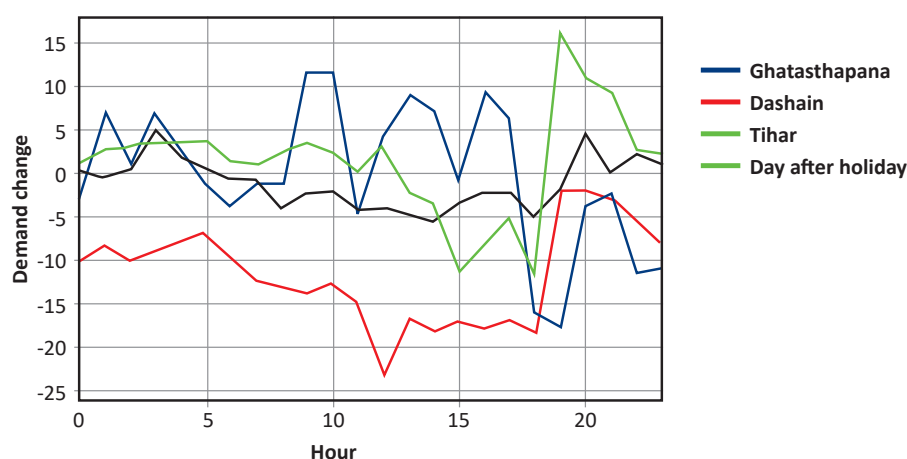


Figure 1. Variation of electricity demand (MW) for every hours of the day



STUDY OF GLASS ENAMEL COATING FOR ENGINEERING APPLICATION

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Project Summary

Enameling is the ancient technique of applying a thin coat of finely ground glass to a metal for designing creative and technical arts. The main goal of this research project was to explore glass enamel coating as a suitable metal coating technique to enhance mechanical properties of the substrate. However, due to COVID-19 pandemic condition, limited mechanical testing and characterizations were performed. Borosilicate glass-based enamel powder was used for all the experimentation. The method for glass enameling includes five basic steps; Step 1 – Preparation of the metal sheet to be enameled, Step 2 – Application of Flux, Step 3 – Firing the Flux coat, Step 4 – Application of Enamel coat, and Step 5 – Firing the Enamel coat.

The project activities started with further literature study and the arrangement of basic tools and facilities for glass enamel coating. To understand the evolution of enamel color after firing, short one-day in-house glass enamel coating training was conducted at Materials lab, Department of Mechanical Engineering on the copper substrate. Two main glass enameling process parameters – firing temperature and holding time -- were initially studied. Two temperature points 800°C and 850°C and firing time of 5 minutes, 10 minutes and 15 minutes were used in this study based on the literature. The surface of the copper metal was studied under stereo-zoom microscope at different point in the process of enamel coating. It was observed that proper sample surface preparation is essential to ensure good adhesion of the glass coating. Clean surface free from oil and rush along with slightly rough surface provided better adhesion of the coating. The enamel coat is glass like feel in touch which provides combine benefits of substrate metal and glass on the surface. The results indicated that for the copper substrate, firing temperature of 800°C and holding time of approximately 5 minutes showed better result of smooth and shiny coating surface. Higher temperature resulted into typical over-burned regions and higher holding time resulted into porous enamel coating surface.



Figure: Enamel Color Palette in Copper Substrate

Keywords: Enamel coating, Borosilicate, Firing, Copper substrate, Adhesion.

2020 - 2021

STUDY OF *PANCHAGAVYA* ON CULTIVATION OF TOMATO AND ECOLOGICAL STABILITY

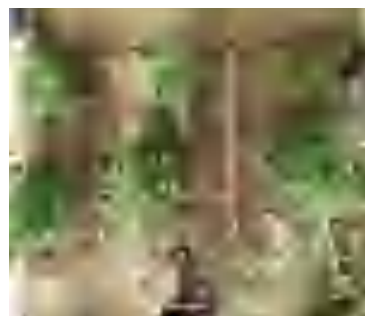
✉ **Sabita Aryal Khanna**

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Project Summary

Vrikshayurveda, the ancient science of plant life, describes *Panchagavya* as a pest repellents, plant disease inhibitors and fertilizer, made by cow products namely milk, dung, clarified butter (ghee), urine, and curd. Scientists are re-discovering the value of the pest repellent and its miraculous effect. The objective of the study was to check the efficiency and efficacy of *Panchagavya* in trail plots experiments for tomato crops after monsoon. *Panchagavya* can be cheaper eco-friendly organic preparation for hill farmers in Nepal. This experiment was carried out during August to March 2020 in an open plastic tunnel which is off season production.



Panchagavya dilutions of 2%, 3%, 4 % treatments showed various positive results in growth parameter such as increase of height, stalk girth, number of leaves, size of leaves, number of branches and flower setting. The best result is shown by 3%. Insect, and pest were not seen in any of the plots during the whole experiment, which proved that the insect and pest were distracted due to its smell. During the whole experiment, occasional fungus was detected in all *Panchagavya* treatment except for 5% *Panchagavya* treatment. This shows the fungus inhibition might be possible with concentrated *Panchagavya*. This experiment has substituted tender coconut water with aloe vera juice since both contain auxin and gibberelin and are good to induce growth on plants. A new formulation of *Panchagavya* was found to be best suitable for hill farming in Nepal. The replacement has shown acceptable performance in the growth of the plants. This new *Panchagavya* can be used for organic farming as it plays a very important role in the growth and development of plants and also in increasing the immunity of plants. This is safe and eco-friendly and contributes to agricultural sustainability.

Keywords: Pest repellents, Fungus inhibition, Organic farming, Sustainability, Open plastic tunnel.



STUDY ON ARSENIC CONTAMINATION IN GROUNDWATER AND SURFACE WATERS IN CHITWAN DISTRICT, NEPAL

 **Rudra Prasad Upreti**

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Principal Investigator: rudra.upreti@ku.edu.np

Project Summary

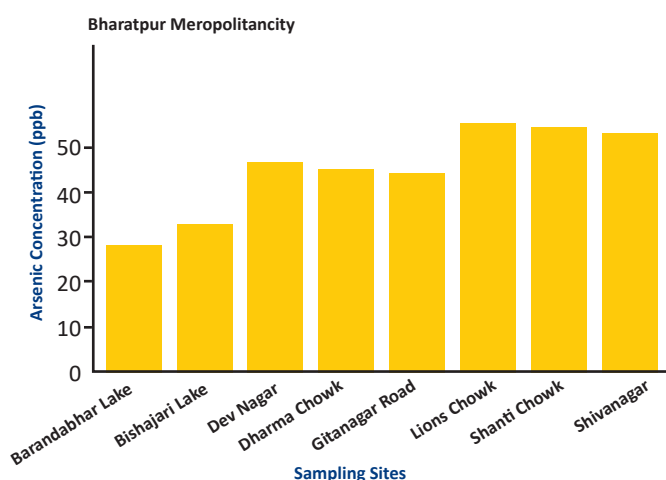
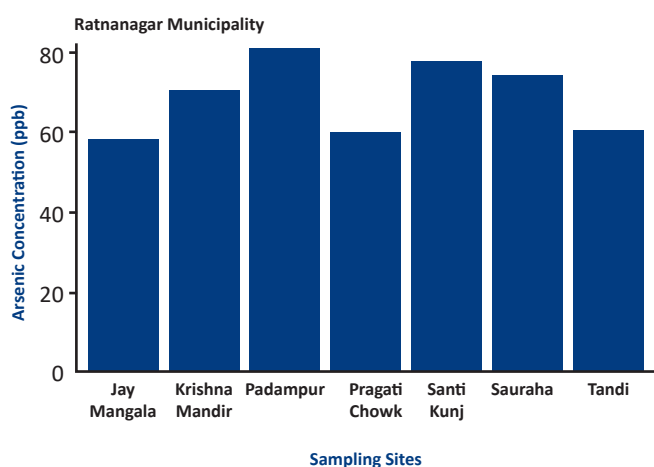
The study was conducted to assess the level of arsenic (As) contamination in groundwater and surface waters in four municipalities in Chitwan district, Nepal. The study utilized Hydride Generation Atomic Absorption Spectrophotometry (HG-AAS) to analyze the total arsenic content in water samples collected from various sources.

The study analyzed 30 water samples from four municipalities, revealing that almost all samples exceeded both WHO (10 ppb) and Nepal (50 ppb) arsenic standards. Arsenic levels ranged from 26.9595 ppb to 81.2107 ppb, with an average of 55.8769 ppb. The highest arsenic concentrations were found in Ratnanagar municipality, particularly in Padampur, while the lowest concentrations were in Barandabhar Lake of Bharatpur Metropolitan. Groundwater showed higher arsenic levels than surface water sources, indicating a significant threat to human health.

The widespread presence of elevated arsenic concentrations in the water samples suggests an alarming situation, especially in Ratnanagar and Khairahani municipalities, where all samples exceeded Nepal's arsenic standard. Groundwater was identified as the primary source of arsenic contamination, likely resulting from natural water-rock interactions.

The study underscores the urgent need for mitigation strategies to address arsenic contamination in water sources in Chitwan and neighboring regions. Recommendations include setting proper guidelines, raising public awareness, and securing governmental and donor support for tackling this issue.

Keywords: Spectrophotometry, Arsenic concentrations, Groundwater, Mitigation strategies.



2020 - 2021

SYNTHESIS AND CHARACTERIZATION OF CARBON-BASED DERIVATIVES FOR PEROVSKITE SOLAR CELL

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Project Summary

Graphene is a two-dimensional sheet of carbon with a hexagonal lattice structure which is 200 times stronger than strongest steel despite its flexibility and light weight. Apart from this, it is conductive and also transparent. Due to these properties, it provides a broad field for research and application in thin film solar cells. In this project, graphene oxide (GO) was obtained from graphite flakes by using modified hummers method which is different from conventional hummer's method. After this process, the obtained graphite oxide was mechanically extra foliated to get graphene oxide. Then, it was reduced by either of the processes which involves treating graphene oxide with Hydrazine hydrate, and by thermal heating. Thus, obtained graphene oxide was confirmed by UV-Visible spectrum, XRD spectrum, RAMAN spectrum and FTIR spectrum.

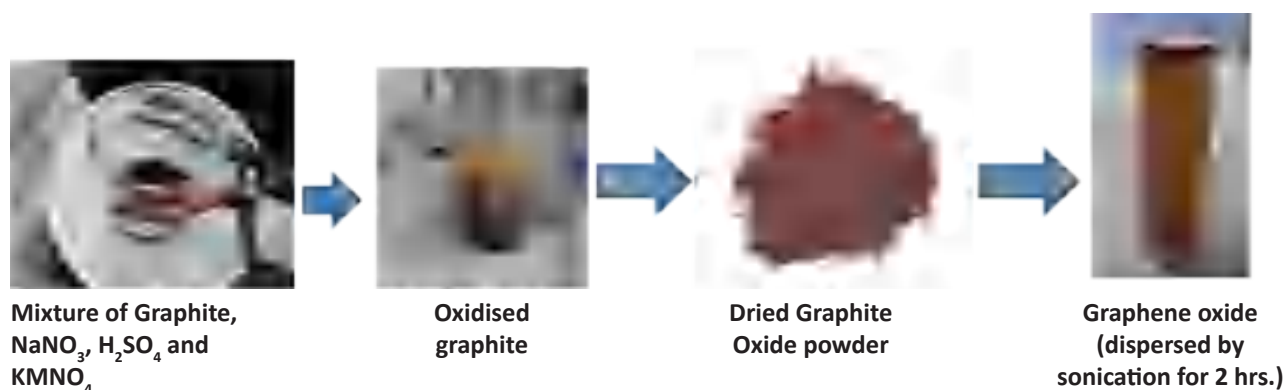


Figure: Preparation of graphene oxide by Hummer's method

The synthesis of rGO was done by Hummer's method and the verification was carried out by various optical characterization methodologies. Furthermore, the film was prepared from different methodologies. This study suggests that the multilayer graphene derivatives can be simply synthesized and have a graphene like nature with good conductivity value as suggested by the earlier measurements carried out. However, mono layer graphene by solution processing was still not observed which could be suitable for conducting layer in perovskite based thin film solar cells.

Keywords: Graphene oxide, Hummer method, Hydrazine hydrate, Optical characterization.

तरुण तपसीमा मानवतावाद

✍ राम चन्द्र पौडेल

सहप्राध्यापक, स्कूल अफ आर्ट्स, काठमाडौं विश्वविद्यालय

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शीर्षकको सार

तरुण तपसीमा मानवतावाद शीर्षकको प्रस्तुत अनुसन्धान पत्र सात खण्डमा विभाजित छ । पहिलो खण्डमा यसको परिचय, समस्याकथन, पूर्वकार्यको समीक्षा, अनुसन्धानको उद्देश्य, औचित्य, महत्व र उपयोगिता जस्ता पक्षलाई प्रकाश पारिएको भने अनुसन्धानको सीमा, सामग्री सङ्कलनको विधि र रूपरेखा जस्ता पक्षलाई पनि प्रस्तुत गरिएको छ ।

दोस्रो खण्डमा जीवनीको परिभाषा, व्युत्पत्ति, कोशीयार्थ प्रस्तुत गरिएको छ भने लेखनाथ पौड्यालको जन्म, जन्मस्थान, शिक्षा, पेशा र जीवनयात्राका क्रममा उनले भोगेका कठिनाईलाई यथाशक्य केलाउने प्रयत्न गरिएको छ ।

तेस्रो खण्डमा लेखनाथ पौड्यालको काव्ययात्रा, काव्यको रचनाधर्मिता, उनले जीवयात्राका क्रममा भोगेका विभिन्न समस्या र त्यसले उनको जीवनी र काव्यको अन्तर सम्बन्ध कस्तो रहेको छ भन्ने विषयका बारेमा पनि चर्चा गरिएको छ । उनले आफ्ना भावहरूलाई युगसापेक्ष अनुरूप नै तरुण तपसी नव्यकाव्यमा वर्णन गरेका छन् भन्ने विषयको अनुशीलन भएको छ ।

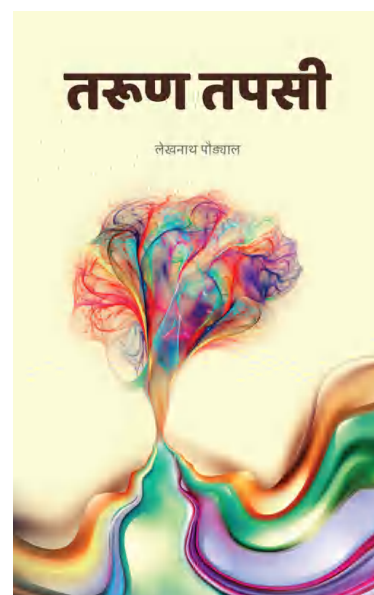
चौथो खण्डमा मानवताको सैद्धान्तिक पक्ष र प्रकारलाई सामान्य रूपमा चर्चा गरिएको छ । त्यसकै आधारमा तरुण तपसी नव्यकाव्यमा कविद्वारा व्यक्त गरिएको मानवतावादी चिन्तनका विषयमा प्रकाश पारिएको छ ।

पाँचौ खण्डमा तरुण तपसी नव्यकाव्यलाई विधातकका आधारमा विश्लेषण गरिएको छ । जसअनुसार तरुण तपसी नव्यकाव्यको कथावस्तु, चरित्रविधान, परिवेश विधान, भावविधान, केन्द्रीय कथ्य, कथन पद्धति छन्द/लयविधान, अलङ्कारको प्रयोग भाषा शैली, शीर्षक विधान र अन्तिम निचोडलाई क्रमशः देखाइएको छ ।

छैटौं खण्डमा मानवतावादको दृष्टिमा तरुण तपसी भन्ने शीर्षक छ । यसमा विभिन्न मानवतावादी चिन्तकहरूले प्रतिपादन गरेका दर्शनको सापेक्षतामा लेखनाथ पौड्यालद्वारा तरुण तपसी नव्यकाव्यमा व्यक्त गरेका मानवतावादी चिन्तनका विषयको वर्णन छ ।

सातौं खण्ड वा अन्तिम खण्डमा समग्र निष्कर्ष प्रस्तुत छ । जसमा तरुण तपसी नव्यकाव्यमा लेखनाथद्वारा व्यक्त गरिएका मानवतावादको स्वर सशक्त रूपमा प्रकट भएको छ भन्ने कुराको बारेमा चर्चा गरिएको छ । प्रस्तुत काव्यमा मानवताका स्वर मुखरित हुनुमा कविले आजीवन उपनिषद्, विभिन्न आस्तिकदर्शन, श्रीमद्भगवद्गीता, पौराणिक एवं साहित्यिक ग्रन्थहरूको अध्ययनको प्रभाव हो भन्ने कुराको चर्चा छ । लेखनाथद्वारा उल्लिखित ग्रन्थहरूको अध्ययनको प्रतिफल नै तरुण तपसी नव्यकाव्यको प्राप्ति हो भन्ने कुराको निचोड हो ।

उल्लिखित ग्रन्थहरूले जीवन र जगत्का हीत सम्बन्धी विशद् व्याख्या र वर्णन गरेका छन् । ती मध्ये पौराणिक ग्रन्थहरूमा पाइने परोपकार : पुण्याय पापाय परपीडनम् । उक्तिको आधारमा मानव हीतमै लाम्बु पर्छ भन्दै जडतातिर उन्मुख हुँदै गएको नेपाली समाजलाई मानवताको सम्मान गर्न आग्रह छ । प्रस्तुत नव्यकाव्यमा श्रीमद्भगवद्गीताको कर्म योगले बताएअनुसार कुनै काम गर्दा निस्काम भावले गर्नु पर्छ र फलमा आशक्ति हुनु हुँदैन भन्ने अनुरूपको भाव पनि प्रस्तुत नव्यकाव्यको मुख्यभाव रहेको छ । कविले प्रस्तुत नव्यकाव्यमा विभिन्न मानवतावादी अभियन्ताहरूले व्यक्त गरेका विचारहरूलाई पनि ग्रहण गरेका छन् । त्यसकाउनले भारतमा हिन्दू पुनर्जागरणले समाजमा राम्रो सन्देश दिएको भन्दै नेपालमा पनि यस जागरणको आवश्यकतामा जोड दिएका छन् । यही नै प्रस्तुत अनुसन्धानको मुख्य सार हो ।



2020 - 2021

THE STUDY OF VARIATION IN TURBIDITY LEVELS IN WATER FROM TRADITIONAL WATER SUPPLY SYSTEM: A CASE STUDY OF BHAKTAPUR MUNICIPALITY-DATTATREYA SQUARE AREA

 **Manish Prakash**

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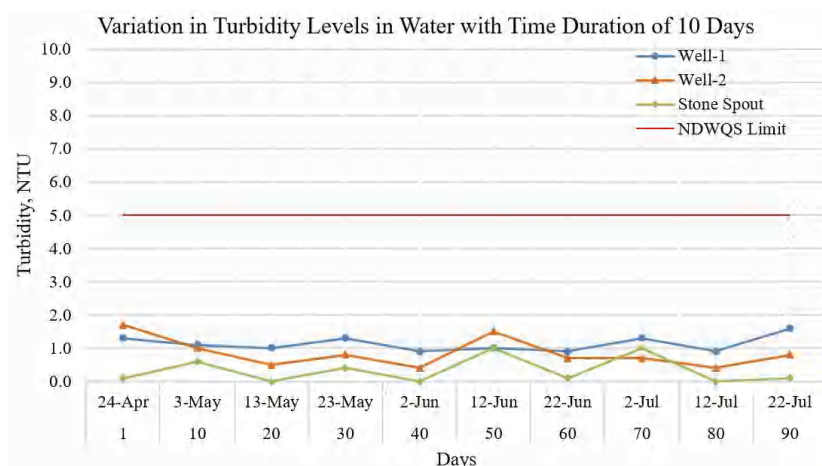
Principal Investigator: manish33@ku.edu.np

Project Summary

Bhaktapur city was the capital of the Kathmandu Valley during Malla period from 12-15th century. Groundwater through dug wells and artistically carved stones spouts were constructed during the Lichhavi period before 12th century which were the main sources of drinking water in the city. In the present context, pipe water supply is the major source of water in the municipality but due to insufficient and intermittent supply, traditional water supply systems such as dug wells, stone spouts and ponds are still in use to meet daily needs. The variation in the turbidity levels in water from the three different traditional water supply system located at Dattatreya Square Area were studied for a period of 90 days from April 24 to July 22, 2021. Out of three sources, one was stone spout whereas remaining two were dug wells. The selected sources are the oldest, functioning and most commonly used traditional water supply systems in the municipality.

Water samples from each of the test wells and stone spout were collected at the interval of 10 days and were tested for turbidity and temperature. The discharge of stone spout was also measured in order to study the variations in turbidity levels with variation in discharge. During the days of maximum water usage and even during the monsoon period, the variations in turbidity levels in water from both the test wells and stone spout were not drastic and significant. The variations in turbidity levels in water from both the test wells and stone spout were well below the prescribed limit of 5 NTU by National Drinking Water Quality Standards, Nepal (NDWQS, 2005). The variation in the discharge of water from the stone spout showed significant variation which was mainly due to the increase in rainfall during the monsoon period. With the increase in the discharge of water from the stone spout there was also an increase in the turbidity levels in water but the variations were not drastic and significant. The variation in the temperature of water from both the test wells and stone spout were on the increasing trend which was mainly due to the increase in the temperature of the surrounding area with the change in season.

Keywords: Stone spout, Temperature, Traditional water supply system, Turbidity levels, Well.



UNIVERSITY STUDENTS' PERCEPTION OF QUALITY EDUCATION

✉ **Khagendra Acharya, PhD**

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Project Summary

Universities around the world are working to provide quality education through various efforts like hiring high quality faculties, and recruiting efficient staffs. The end-recipients of all these services, students, appraise the quality of services offered to them based on their perception. As per one recent review (Acharya et al., 2019), available studies have examined students' perception of quality education in medical institutions, private universities, open universities, and international branch campuses using Dundee Ready Education Environment Measure (DREEM), Service Quality (SERVQUAL), Higher Education Performance (HeDPERF), Service Performance (SERVPERF), among others. The same study (Acharya et al., 2019) pointed to the need to carry out institution specific study so that the particular institution may find the study results not only appropriate in formulating policies but also in executing apposite action plan. This project aimed to identify, from among the available scales, the most appropriate instrument to study students' understanding of quality education in the universities offering science and engineering programs, and examine the students' perception of quality education in a technical university through sequential mixed method design.

The study of KU students' perception on quality education through thematic analysis revealed 55 codes; these codes were further clustered and categorized, and finally themes were derived. Altogether, eight themes – teachers' attributes, pragmatic curriculum, physical facilities, teaching methods, university atmosphere, opportunities, self-responsibility, and academic resources – were identified. Summing up the finding, students perceived eight factors as the markers of quality education.

These themes in comparison to the existing instruments appear quite different, implying that a new instrument needs to be developed to study students' perception of quality education in Kathmandu University. The analysis of the data derived from a new instrument through principle component factor analysis showed relative importance of these components.

Key Words: Students' perception, Quality education, Mixed method, Partial relevance of existing methods.

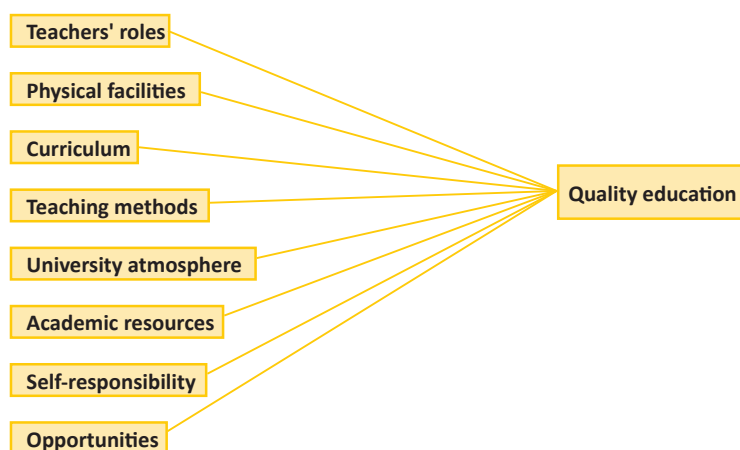


Figure. 1: The Markers of Quality Education

2020 - 2021

UPGRADING LOW-COST SPRAY PYROLYSIS SETUP FOR SYNTHESIZING NANO-MATERIALS BASED THIN FILMS FOR SOLAR CELL APPLICATIONS

✉ Bhim P. Kafle^{*1}, Aarati Thapa², Prakash Paudel² and Manoj Pandey³

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Project Summary

Fabrication of organic and perovskite solar cells require thin films (nanometer to sub-micron thick) for absorption of solar radiation and photo-generated charge (electrons and holes) transport. One of the techniques to produce such films is 'spray pyrolysis'. In the present work, we have upgraded our existing low-cost spray pyrolysis device for producing thin layers of nanomaterials for perovskite solar cells. Specifically, the upgraded device comprises a Computerized Numerical Control (CNC) machine integrated with nanomaterial coating facility. Particularly, we have upgraded existing CNC machine by integrating hardware and software for mechanization (automatic deposition system) that will allow moving the coating system in 3D motion in a controlled manner.

The reflectance (R%) vs wavelength curves of the thin films was prepared by using NiOx nanoparticles calcinated at different temperatures. Unlike transmittance spectra, the figure displayed clear dependence of reflectance of the thin films on the calcination temperatures of the NiOx nanoparticles. To note, the reflectance was found to decrease with calcination temperature of nanomaterials. This monotonically decrease in reflectance (%) with increase in calcination temperature might be due to the structural variation of the materials or the stoichiometric variation.

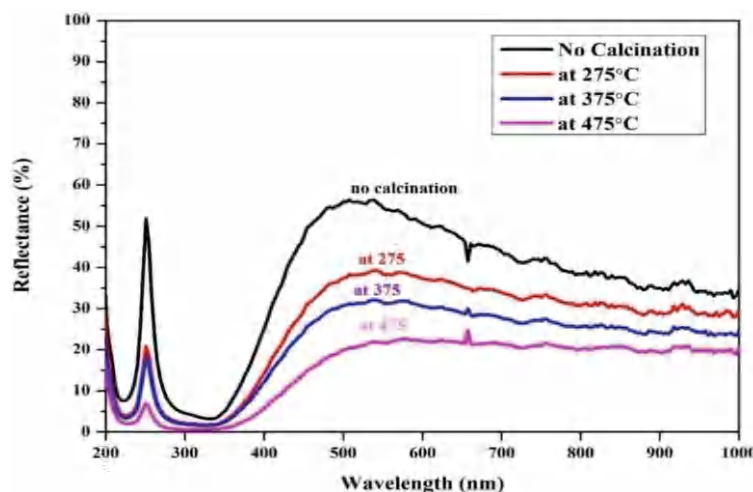


Figure 1 Reflectance (R%) vs wavelength curves of the thin films

We have developed a spray pyrolysis system for coating of thin film of nanomaterials that can be applied, but not limited to, for solar cells and bio sensor preparations. We have tested its performance by successfully preparing thin films of nickel oxide nanoparticles on the glass substrate. We found that the films of nickel oxide nanomaterials prepared by calcinating at different temperatures show different surface reflectance.

Keywords: Solar radiation, Nanomaterials coating, 3D motion, Nickel oxide nanoparticles, Reflectance.



WIRELESS HEALTH MONITORING SYSTEM

✉ **Om Nath Acharya**

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Project Summary

In this project, a wireless communication system was designed and developed for remote patient monitoring. The primary function of this system is to monitor the body temperature, heart rate and oxygen level and display the same to LCD and the doctor using the website. This system can provide significant health service by continuously monitoring health conditions. The system is anticipated to enable medical doctors to observe their patient health parameters on site, to monitor their vital signs and to give them advice for first-aid treatments. Regular monitoring of vital signs is essential as they are primary indicators of an individual's physical wellbeing. The wireless health monitoring system is essential in hospitals and old age homes for frequently monitoring the health conditions such as blood pressure, body temperature and heartbeat of patients. This system can provide significant health service by continuously monitoring health conditions. The designed wireless health monitoring system overcomes the traditional system disadvantages such as long measuring time, low monitoring precision, and deployment of more manpower.

Interfacing external devices and creating web interface with microcontroller unit is a challenging task. At room temperature, data from the sensors are taken to Wi-Fi based microcontroller. With the proper programming, the data from the sensors are directed to the LCD and the website. At different time intervals, the sample data are taken from the sensors and it is observed that there is minor fluctuation in values in terms of oxygen level and heart rate, a phenomenon commonly occurring in normal life. In this project, arbitrary number of patients was taken. Data related to two users – user1 and user2 – were taken as a patients and their health conditions were displayed in the LCD and also the data base was created in the website which could be accessed by respective doctors by logging in that website.

Keywords: Remote patient monitoring, Oxygen level, Physical wellbeing, Monitoring precision, Microcontroller.



2021 - 2022 CATEGORY 1

A COMPARATIVE STUDY ON THE EFFECTS ON MECHANICAL PROPERTIES OF CEMENT CONCRETE BY PARTIAL REPLACEMENT OF COARSE AND FINE AGGREGATE WITH WASTE PLASTIC.

✉ **Manish Prakash^{*1}, Kameshwar Sahani²**

1,2 Assistant Professor, Department of Civil Engineering, School of Engineering, Kathmandu University

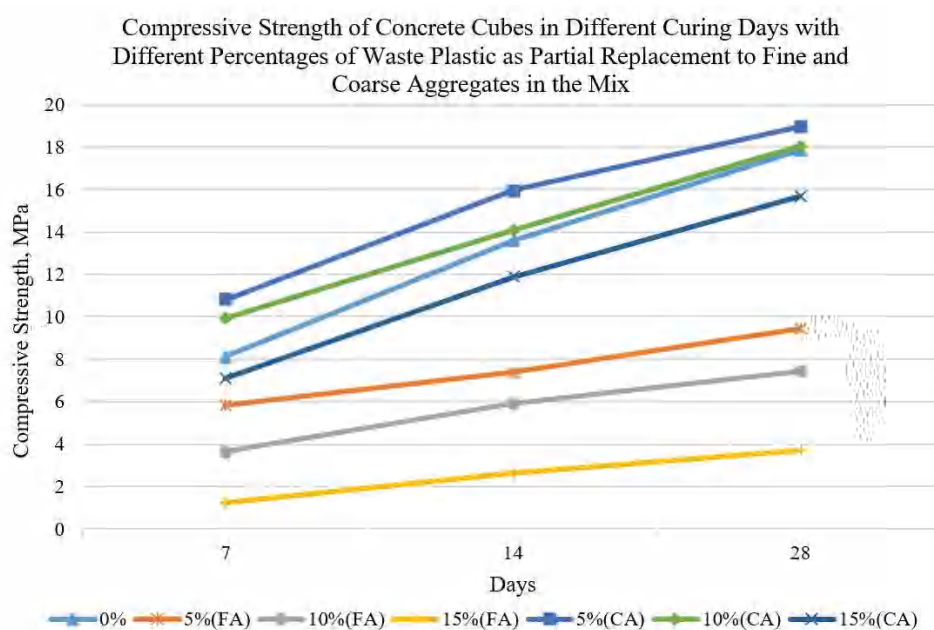
**Corresponding Author:* manish33@ku.edu.np

Project Summary

This study dealt with the effects on mechanical properties of cement concrete by incorporating waste plastic as a partial replacement to natural aggregates in cement concrete mix. For the study, the partial replacement of waste plastic as fine aggregates and coarse aggregates from 0%, 5%, 10% and 15% were used to prepare the M20 grade concrete mixes. The slump cone test for workability, compressive strength test for compressive strength and split tensile strength for tensile strength were carried out as per the Indian Standards for the prepared mixes.

The partial replacement of waste plastic as a coarse aggregate in the concrete mix was found to be a more effective option of replacement than as a fine aggregate in the concrete mix without alteration on the mechanical properties of the concrete mix. The partial replacement percent of 5% and 10% of waste plastic as a coarse aggregate in the concrete mix were found to have greater compressive strength than the conventional concrete, with maximum compressive strength at the replacement percent of 5%. The partial replacement of 5% of waste plastic as a coarse aggregate in the concrete mix was found to have slightly greater tensile strength than the conventional concrete. Thus, the potential use of plastic waste in cement concrete provides a noble recycling option as cement concrete is the second most widely consumed material globally which will reduce substantial volume of waste plastic.

Key Words: Aggregate, Cement Concrete, Recycling, Waste plastic.



ASSESSMENT OF GAPS AND CHALLENGES OF FAECAL SLUDGE MANAGEMENT (FSM) SYSTEM: CASE STUDIES FROM DHULIKHEL, BANEPA, AND PANAUTI MUNICIPALITIES

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Project Summary

The aim of this study was to assess existing situation, gaps and challenges of faecal sludge management (FSM) in Dhulikhel, Banepa, and Panauti municipalities. The study selected two wards in each of three different Municipalities as representative case studies from Kavrepalanchowk district, Bagmati Province, Nepal. Moreover, the study considered the four domains viz. individual and institutional arrangements and capacities, financial arrangements, environmental arrangements, and socio-cultural acceptance for assessing the gaps and challenges in FSM. The study surveyed of 400 households using semi-structured questionnaires, Key Informant Interviews (KII) of relevant stakeholders, and field inspections. In addition, characterization and quantification of faecal sludge were carried in the study area.

It was found that the pour-flush latrine is the most practiced latrine in these three municipalities. Similarly, a holding tank (unlined) is the most practiced containment type in Dhulikhel and Panauti municipalities, whereas single pit containment is most practiced in Banepa municipality. The faecal sludge generation was estimated as 18 m³/d, 27.5 m³/d, 31.7 m³/d using the population data of the 2021 national census. Banepa Municipality was not found to offer emptying services and did not have its own treatment plant for faecal sludge collected, whereas Panauti and Dhulikhel municipalities provided emptying services with vehicles of capacity 4 m³ and practiced final disposal in the treatment plants built for wastewater treatment plants. The treatment plant was partially functioning in Panauti and it was under maintenance phase in Dhulikhel municipality. 38.7 percent in Dhulikhel municipality, 31 percent in Banepa municipality, and 30 percent of households in Panauti municipality had emptied their containment at least once since its construction. The households were practicing different approaches for emptying while only a few of them were familiar with municipal service providers, some of the households were practicing manually emptying by themselves, and some of the households were practicing hiring private services both for manual and mechanically emptying.

Keywords: Faecal sludge, Socio-cultural acceptance, Holding tank, Financial arrangements.

User interference	A gap between HH owners (service seeker) and the service provider were identified
	Households were not fully aware about the desludging service provided by municipality.
Collection & transportation	From the overview of faecal sludge accumulation rate per day is 18 (m ³) in Dhulikhel, 27.5(m ³) in Banepa, 31.7(m ³) in Panauti municipality is generated which shows that the emptying vehicle may not sufficient for collection and transportation of sludge to the treatment plant.
Disposal & Treatment	It is observed that in Banepa municipality the faecal sludge is discharged in near by drain which results in the environment effect and possess health risk.
	Treatment plant was in maintenance phase in Dhuikhel Municipality whereas in Banepa municipality they do not have treatment plant. Panauti municipality have their own treatment plant but it is partially functioning.

Figure 1. Gaps and challenges in FSM in Dhulikhel, Banepa and Panauti Municipalities of Kavre District.

2021 - 2022 CATEGORY 2

CHARACTERIZATION OF NEPALESE FABRICS USED FOR MASKS, MEDICAL GOWNS, AND LABORATORY COATS IN COVID - 19 PANDEMIC

 **Ganesh Kuwar Chhetri**

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Project Summary

This research aimed to characterize different Nepalese fabrics used in masks, medical gowns, and laboratory coats during the COVID - 19 pandemic and assessing the impact of washing and plasma treatment on their surface properties along with determining the best fabric.

The most common hand-woven fabrics manufactured in Nepal and used in face mask, medical gowns and laboratory coats, such as cotton, wool, silk, linen, dhaka, and banana fabric, were collected from different places of Nepal. The effects of the plasma and washing on the hydrophilicity of Nepalese fabrics were studied using contact angle goniometry. A water impact penetration tester was used to measure the fabric's resistance to water penetration by impact. The water contact angle of silk and linen decreased quickly compared to wool and cotton. Wool and cotton fabrics maintained their hydrophobicity until the long plasma treatment time. Both wool and cotton fabrics remained hydrophobic until the fourth wash. Fabrics treated with plasma had more water absorption ability than untreated fabrics. Plasma treatment increased the water absorption ability of banana fabric more than dhaka fabric. The weight loss (%) of banana fabric was the greatest due to the plasma treatment, and the weight loss (%) of wool fabric was the greatest due to washing. The banana fabric showed the least resistance to water penetration, while wool, cotton, and linen showed better resistance to water penetration.

Keywords: Nepalese fabrics, dielectric barrier discharge, nonthermal plasma, Lissajous figure, hydrophilicity, surface free energy, wicking performance, water penetration

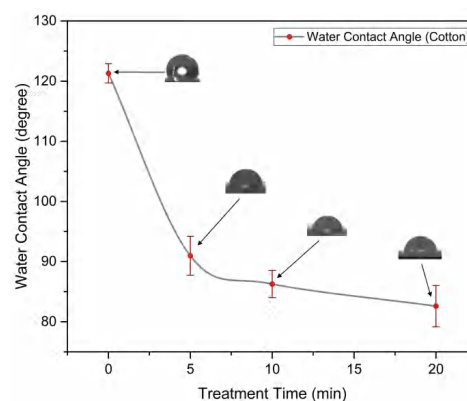


Figure 1: Plot of water contact angle as a function of treatment time for cotton fabric

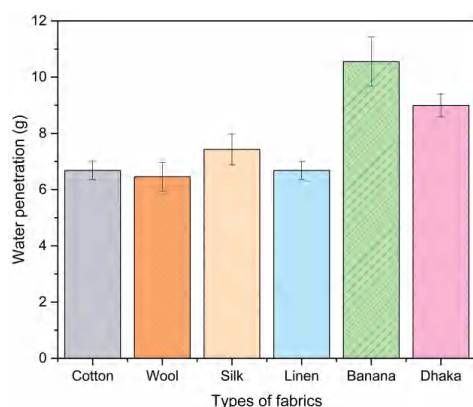


Figure 2 Water penetration of different fabrics

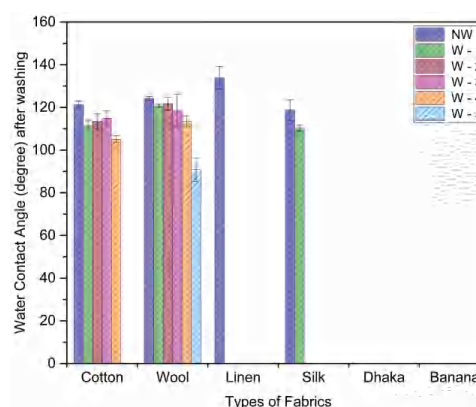


Figure 3 Effect of washing on water contact angle of Nepalese fabric

DOCUMENTATION OF HISTORICALLY IMPORTANT BUILDING OF DHULIKHEL MUNICIPALITY FOR CONSERVATION PURPOSE

✉ Ar. Buddha Shrestha^{*1}, Er. Ramesh Adhikari², Er. Santosh Chaudhary²

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**Principal Investigator:* buddha.shrestha@ku.edu.np

Project Summary

This project has documented art and architecture of the old settlements and traditional buildings of the Dhulikhel through various mediums such as maps, sketches, drawings and photographs, and also prepared the adaptive reuse plan for some selected ancient buildings. The preliminary part of this documentation includes historical narratives of the settlement. The next part includes the sets of maps categorizing building in terms of age, existing condition and construction technology. The inventory part includes the photographs of buildings with brief description about the condition, material and style. Furthermore, it includes the detail measured drawings of two selected buildings and their possible adaptive reuse plan.

Future Recommendations

Preservation and Restoration: Based on the documentation findings, it is recommended to prioritize the preservation and restoration of heritage buildings that are in a state of disrepair or at risk of further deterioration. This may involve collaborations with local authorities, heritage organizations, and funding sources.

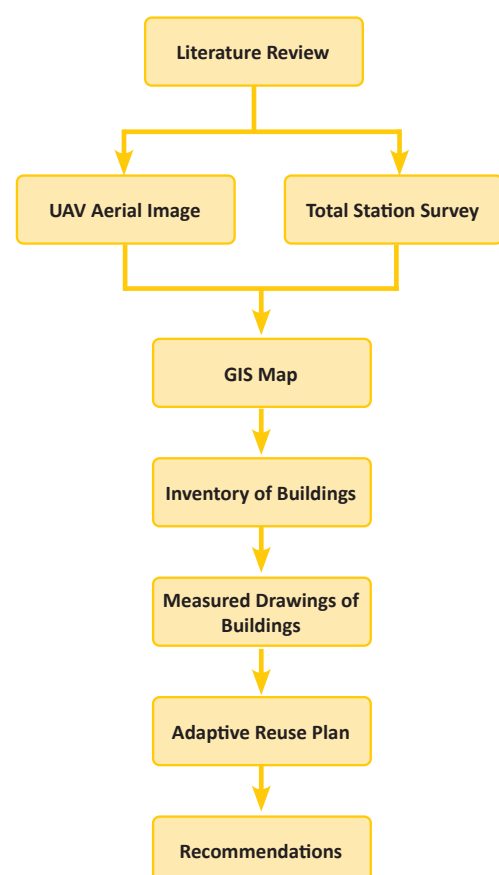
Public Awareness: This documentation will be an effective medium to create educational programs and awareness campaigns to inform the local community and visitors about the historical and cultural significance of the old city. This can also be used to engage residents and tourists in heritage conservation efforts to implant a sense of ownership and responsibility.

By-laws and Heritage Zoning: This documentation could be a crucial resource material to develop by-laws and implement heritage zoning regulations to protect the old city's architectural character and prevent inappropriate development that could compromise its heritage value. This includes enforcing building codes that respect traditional architectural styles and materials.

Adaptive reuse plan: The adaptive reuse plan prepared for the selected two buildings could be the examples of the new uses of the old buildings. This will help develop sustainable cultural tourism initiatives that showcase the heritage of Dhulikhel. Further, it will encourage responsible tourism practices that respect the local culture and contribute to the economic well-being of the community.

Keywords: Old settlements, Construction technology, Reuse plan, Heritage buildings.

Methodology



2021 - 2022 CATEGORY 2

FORMULATION AND EVALUATION OF MOUTH DISSOLVING FILM OF TOPIRAMATE USING NATURAL POLYMERS

✉ Prof. Panna Thapa¹, Anup Luitel^{*2}, Mr. Lok Raj Bhandari³

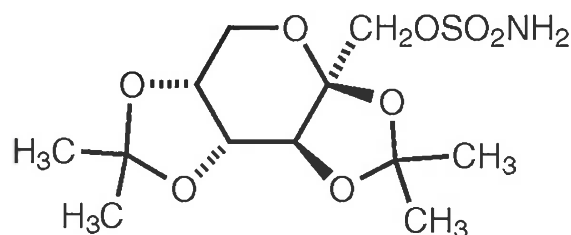
- 1 Professor, Department of Pharmacy, Kathmandu University School of Science
- 2 Assistant Professor, Department of Pharmacy, Kathmandu University School of Science
- 3 Graduate Student, Department of Pharmacy, Kathmandu University School of Science

**Corresponding Author:* anup.luitel@ku.edu.np

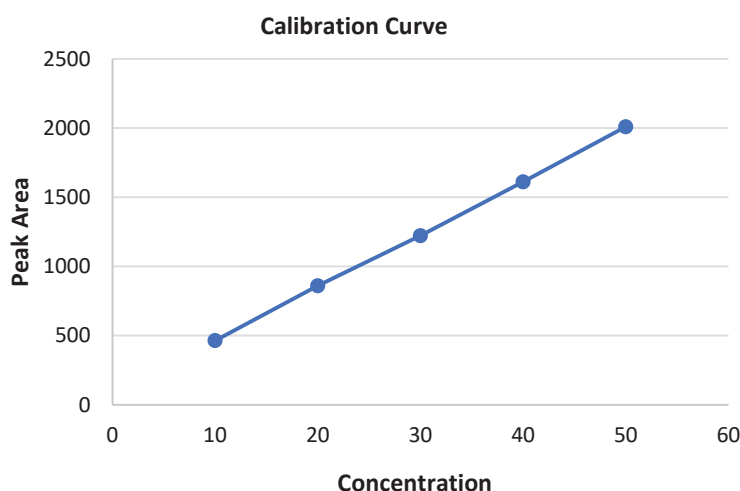
Project Summary

In this research work, a different trail was done by changing the concentration of pullulan and glycerin in the formulation to check the effect on film-forming capacity, DT, folding endurance, film thickness and drug release. We used Central Composite Design to experiment with total two independent factors i.e., pullulan and glycerin and three dependent variables i.e., film thickness, DT, and drug release. The mouth-dissolving film was prepared by solvent casting method with pullulan as film-forming polymer, glycerin as a plasticizer, citric acid as saliva stimulating agent and sucralose as a sweetening agent. The Physicochemical properties like general appearance of films, weight variation, thickness of films, pH, disintegration time, assay, and invitro drug dissolution were evaluated of 13 different batches. Response Surface Methodology (RSM) analysis was used to interpret the results for the formulations and optimization using Minitab 17 software.

The software recommended optimized formulation contains mg 305.27 pullulan 1 ml Glycerin. Disintegration time was found to be 34 seconds; the Optimized film of Topiramate showed the thickness of 0.13 mm and folding endurance of 146. The in-vitro drug percentage release of Topiramate from the optimized batch at 1st, 2nd, 3 minutes, 6 minutes and 9 minutes were 67.28, 83.35, 86.42, 93.47, and 100.25%, respectively. Overall, these findings indicate that fast dissolving mouth dissolving film of Topiramate can be formulated and is a conventional dosage form for clinical use in the treatment of anti-epilepsy and antimigraine where a prompt onset of action is required.



Keywords: Topiramate, Mouth dissolving film, Solvent casting, Pullulan, Glycerin.



FORMULATION AND IN-VITRO EVALUATION OF MICROEMULSION BASED ORAL SOLID DOSAGE FORM OF ETODOLAC

✉ Dr. Ashwinee Kumar Shrestha¹, Dr. Rajan Shrestha², Dr. Shailendra Shakya³

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³ Assistant Professor, Department of Pharmacy, School of Science, Kathmandu University

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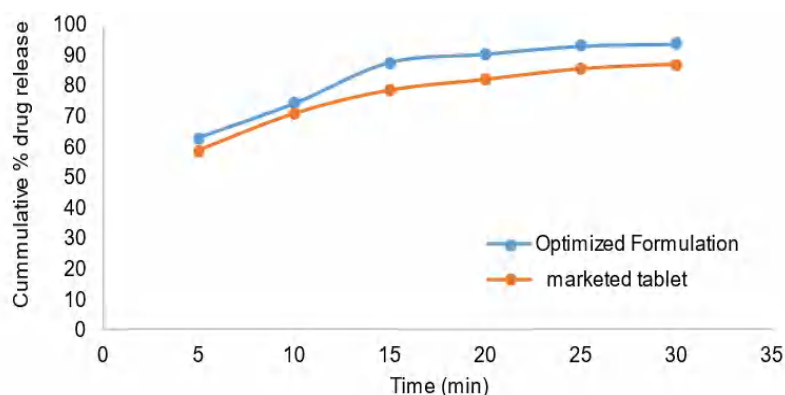
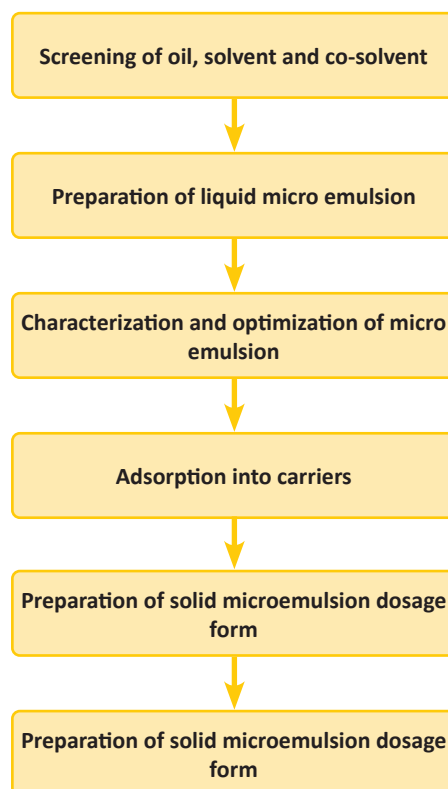
Project Summary

Microemulsion is a thermodynamically stable colloidal dispersion of oil and water that is stabilized by inclusion of surfactants and co-surfactants in the formulation. An attempt was made to develop and optimize micro-emulsion in order to enhance solubility and to convert it to oral solid dosage form.

Suitable experimental design such as pseudo ternary diagram and mixture de-sign were used for the selection of excipients, and optimization of the formulation. The optimized formulation contained Oleic acid (5.1%), Tween 20 (47.74%), PEG 400 (15.91%) and water (31.24%) with the globule size of 7.2nm, a PDI of 0.266, zeta potential of 0.1 mv, transmittance 97.2% at 100 times dilution, a viscosity of 108cp and a conductivity 31.9 μ s/cm.

Drug was loaded in the optimized blank formulation resulting drug loaded micro-emulsion with the particle size of 8.9 nm, PDI of 0.308, zeta potential of -33.8 mv, transmittance of 95.8%, viscosity of 122 cp, and conductivity of 26.6 μ s/cm. A dye test was carried out in the formulation and the appearance of oily globules in the continuous water phase ensured the formation of O/W type micro-emulsion. The solubility of the drug in the optimized formulation appeared to be 235 mg/ml.

The optimized micro-emulsion was adsorbed in the MCC pH 10.2 and Aerosil 200 mixed in the ration of (5:1) and converted to free-flowing granules, which were used to fill hard gelatin capsule. The percentage release of the optimized micro-emulsion in hard gelatin capsule was compared with the marketed tablet dosage form. The drug release from the capsule containing adsorbed micro-emulsion appeared to be higher than marketed tablet dosage form in 30 minutes.



Comparative dissolution profile of adsorbed microemulsion and marketed tablet

Keywords: Microemulsion, Oral solid dosage, Pseudo ternary diagrams, Drug solubility, Free-flowing granules.

2021 - 2022 CATEGORY 1

HYDROLOGICAL STUDY OF ROSHI RIVER WITH EMPHASIS ON DISCHARGE MEASUREMENT

✉ Suman Shrestha^{*1}, Bigan Niraula, Biraj Thapa, Bhesh Raj Joshi, Jeewal Kunwar, Reejan Karmacharya²

1 Assistant Professor, Department of Civil Engineering, Kathmandu University School of Engineering

2 Undergraduate Student, Department of Civil Engineering, Kathmandu University School of Engineering

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Project Summary

This study aimed to measure the discharge of Roshi River by three methods – float, current meter, and salt dilution— and compare their discharge. The discharge and cross-section were measured once a month from January to December 2022 at the DHM gauge station. The discharge of Roshi River by float method, current meter method, and salt dilution method was determined followed by a comparison of the discharge of current meter and salt dilution method. The maximum discharge was observed in August with a value of 6.009, 5.224, and 3.192 m³/s by float, current meter, and salt dilution method, respectively. The discharge of the current meter method was compared with the salt dilution method taking the current meter method as the base.

The results showed that the average variation between the current meter and salt dilution method was 14.82% taking the current meter reading as a base. The cross-section was plotted for each month and showed the bed variations in each month. Considering the average depth and taking the minimum average depth of February to be the base maximum change in bed was observed in October with a value of 0.346m. The maximum depth across the cross-section was observed in October with a value of 0.55m.

The longer span of study with frequent and several measurements to collect more data at different seasons of the year are suggested to obtain more reliable results. Further monitoring and studies are required to address the availability of water, demand of water, requirement for environmental flow, and impact of sediment.

Keywords: Area velocity, Discharge, Float, Roshi, Salt dilution.

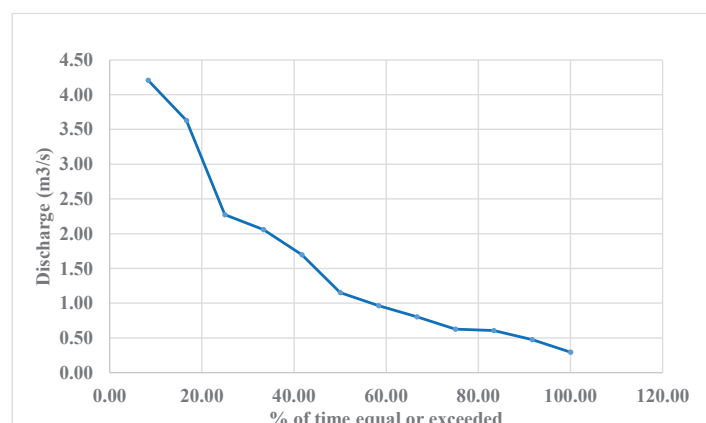
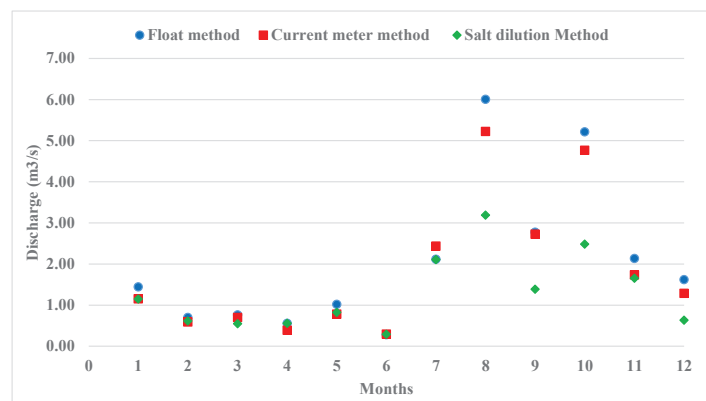


Figure 1 Comparison of Float, Current meter and Salt dilution method

PREDICTION OF IN VIVO PERFORMANCE OF DABIGATRAN CAPSULES MARKETING IN NEPAL FROM IN VITRO (DISSOLUTION) DATA USING NUMERICAL CONVOLUTION METHOD

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Project Summary

The main objective of this study was to predict in vivo study data of locally produced Dabigatran capsules (coded as Product A and Product B) which are marketed without in vivo performance study using In vitro in vivo correlation (IVIVC) method. Among two approaches of IVIVC i.e., Convolution and Deconvolution, the Convolution approach was used for the prediction of in vivo performance of the products from the dissolution data. The plasma drug concentration was determined via dissolution study, a numerical convolution technique. "Product A" and "Product B" were the two test products. From predicted plasma drug concentration-time data, the Area under the curve (AUC), and maximum plasma drug concentration (C_{max}) were determined for both test products. Whether they were statistically different or not was determined and, on that basis, would be concluded whether test products are bioequivalence or not. The observed value of C_{max} and AUC of the Reference Product was 105.63 ng/ml and 1708.28 ng*hr/ml respectively. Similarly, C_{max} and AUC of "Product A" from the convolution method was found to be 105.08 ng/ml, 1722.91 ng*hr/ml while the C_{max} and AUC of "Product B" was found to be 96.83 ng/ml, and 1583.40 ng*hr/ml. The percentage prediction error (%PE) values for C_{max} and AUC were found to be 0.52% and -0.85% for "Product A" and 9.09% and 7.89% for "Product B", respectively. The predicted error of AUC and C_{max} were within the $\pm 20\%$ range for both local generic products (Product A & Product B). Therefore, dissolution method given by National Medicine laboratory (NML) was found to be non-biorelevant. The rate and extent of absorption of test products were found to be similar in convolution method.

Keywords: Bioavailability, Bioequivalence, Dissolution method, Convolution, Deconvolution, In vitro in vivo correlation (IVIVC).

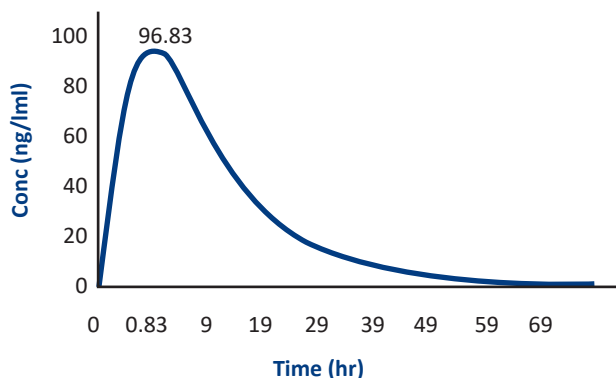


Figure 1 : Plasma drug concentration time profiles of Test Product B derived from in vitro dissolution profiles

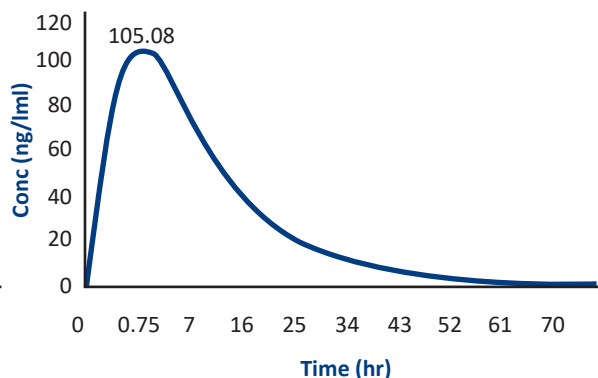


Figure 2: Plasma drug concentration time profiles of Test Product A derived from in vitro dissolution profiles

2021 - 2022 CATEGORY 1

PREPARATION AND CHARACTERIZATION OF REDUCED GRAPHENE OXIDE THIN FILM FOR SOLAR CELL APPLICATIONS

✉ **Manoj Pandey**

Assistant Professor, Department of Physics, School of Science, Kathmandu University

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Project Summary

The key components of a Perovskite solar cell are the Perovskite absorber layer, electron transport layer (ETL), hole transport layer (HTL), and transparent conducting oxide layer (TCO). The absorber layer is sandwiched between ETL and HTL, on which electron-hole pairs are formed when solar energy is absorbed. Despite significant gains in efficiency of the cell, long term stability is still a key challenge.

The current study combined titanium dioxide (TiO₂) as an ETL and reduced graphene oxide (rGO) as an HTL to address the latter problem. The C-TiO₂ film was spin casted on Fluorine-doped Tin Oxide (FTO) glass, while the M-TiO₂ film was casted using the Doctor Blading method. Spray casting was used to make the rGO film on glass substrate. In the case of rGO, bandgap, E_g was 2.1 eV. The band gap energy of the Perovskite over MTiO₂+CTiO₂ coated FTO glass was then estimated to be 1.55 eV. By coating the rGO film on the perovskite film, we were able to create a hydrophobic surface over the perovskite film with contact angles of 126.6° to 134.3°. Our research demonstrated rGO as an overcoat layer may serve perovskite from moisture.



Figure 1 Goniometer

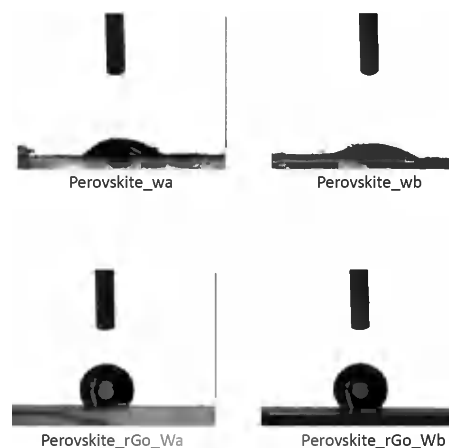


Figure 2 Contact angle measurements of rGO and rGO + Perovskite

The prepared rGO can be a better (cost effective and environment friendly) alternative for application as a hole transport layer and electron blocking layer. The solution processability and hydrophobicity of the rGO can lead to the development of Perovskite solar cells with greater stability and efficiency. The application of a reduced graphene oxide thin layer atop the Perovskite layer protects it against moisture, according to the contact angle study.

Keywords: Perovskite solar cell, Titanium dioxide, Spray casting, Band gap energy, Hydrophobic surface.

STUDY ON SELF EMULSIFYING DRUG DELIVERY SYSTEM (SEDDS) FOR IMPROVEMENT OF GASTRO INTESTINAL PERMEATION OF PIROXICAM

✉ Dr. Rajan Shrestha^{*1}, Dr. Ashwinee K. Shrestha², Dr. Uttam Budhathoki³, Ms. Nomi Shrestha⁴

1,2,3 Associate Professor, Department of Pharmacy, School of Science, Kathmandu University

4 Master's candidate, Department of Pharmacy, School of Science, Kathmandu University

*Principal Investigator: rajanshrestha@ku.edu.np

Project Summary

The limited dissolution rate arising from low solubility frequently results in the low bioavailability of orally administered drugs. Approaches including modification in formulation strategies like Self Emulsifying Drug Delivery Systems (SEDDS) have been suggested to improve the oral absorption of highly lipophilic drug compounds. The enhancement by SEDDS is often presumably related to increased permeation of the drugs through gastro intestinal membrane.

In this study, we evaluated the effect of SEDDS in gastro intestinal permeation of poorly water-soluble drug Piroxicam. For this, first a quantitative analytical method for estimation of Piroxicam in SEDDS by the High- Performance Liquid Chromatography was developed and validated. For this, a C18 (250 mm x 4.6 mm, 5 μ m) column and Phosphate Buffer: methanol in the ratio 35:65 % (v/v) was used as a mobile phase. The injection volume taken was 20 μ l and the column temperature was adjusted to 40oC. The detection wavelength of 254 nm was used in the UV detector. The developed method was precise, accurate, reproducible, and specific for the estimation of SEDDS of Piroxicam. Next, we applied the developed method for estimation of Piroxicam permeated through the goat intestine using in-vitro Franz Diffusion Cell apparatus. The obtained data showed that the permeation was nearly 3.63-fold higher in SEDDS of Piroxicam in comparison to the plain drug.

Thus, we developed and validated an estimation method of Piroxicam in SEDDS by using High-Performance Liquid Chromatography. The method was used for the evaluation of permeability of Piroxicam through goat intestine. The permeability study showed that SEDDS can significantly increase the permeation rate of Piroxicam.

Keywords: Dissolution rate, Water-soluble drug, Liquid chromatography, Goat intestine, Permeation rate.

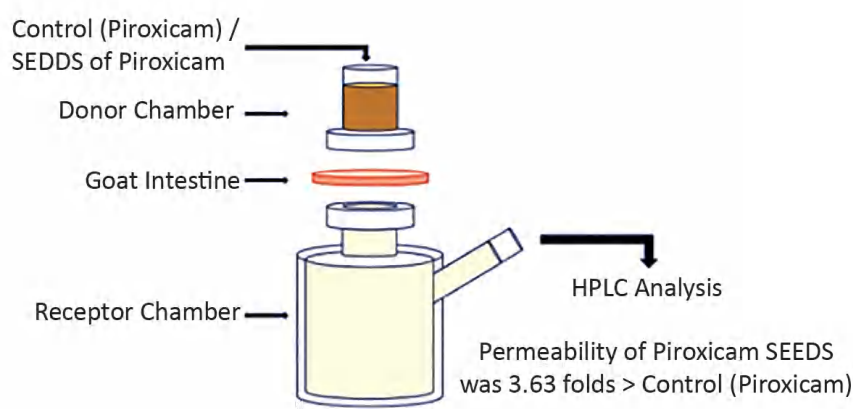


Figure: Franz Diffusion Cell Apparatus

2021 - 2022 CATEGORY 2

THE EFFECT OF ENHANCED STOVE DESIGN ON SHORT-TERM HUMAN HEALTH IMPACT FROM BIOMASS COMBUSTION IN RURAL NEPAL

 **Binaya KC**

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Project Summary

Household air pollution (HAP) from burning solid biomass fuel for cooking (TCS-Traditional Cooking Stove) is a significant environmental and societal challenge in low and middle-income countries, critically affecting public health and economic well-being. Exposure to harmful byproducts of incomplete combustion, including particulate matter, can cause acute and chronic health problems, resulting in premature deaths. Improved cook stoves (ICS) have been proposed as potential solution to reduce HAP exposure, but there are limited studies evaluating their short-term health benefits.

This study aimed to estimate the effect of enhanced stove designs on exposure to particulate matter and its short-term health effects in rural Nepal. Baseline data on personal exposure to PM and personal blood pressure, oxygen saturation, pulse and CO concentration in exhaled breath were collected in rural households that used traditional cook stoves. Subsequently, 30 households were installed with two pot mud improved cook stoves approved by the Alternative Energy Promotion center (AEPC). Subsequent exposure data, along with other health metrics such as exhaled breath CO, pulse, oxygen saturation and blood pressure, were measured immediately after the installation and again six months' post-installation.

The improved cookstove significantly reduced personal exposure to particulate matter by 35% ($p < 0.001$) compared to the traditional cook stove. Additionally, users exhibited a marked decrease in exhaled breath CO (60%, $p < 0.01$) and an increase in oxygen saturation (1%, $p < 0.001$), suggesting better respiratory health. Interestingly, there was no observable change in pulse and blood pressure measurements before and after the introduction of the enhanced stoves. This may indicate that the short-term effects of reduced particulate exposure may not translate into immediately noticeable cardiovascular benefits. It is important to highlight that the time frame of this study was limited to a short-six-month period post-interventions. While significant reductions in particulate exposure and improvements in some respiratory health metrics were evident, it remains unclear how these findings may translate into long term health benefits. The absence of changes in pulse and blood pressure also reinforces the need for extended studies to conclusively determine the overall health benefits of reduced exposure from improved cookstoves. In conclusion, the improved cook stove design showed clear benefits in reducing harmful particulate exposure and provides immediate respiratory benefits. However, the study recommends the need for more longitudinal research to explore long-term health impacts and potential benefits on respiratory and cardiovascular health.

Keywords: Indoor air pollution, Improved cook stove, Particulate matter, Health effects, Solid biomass.

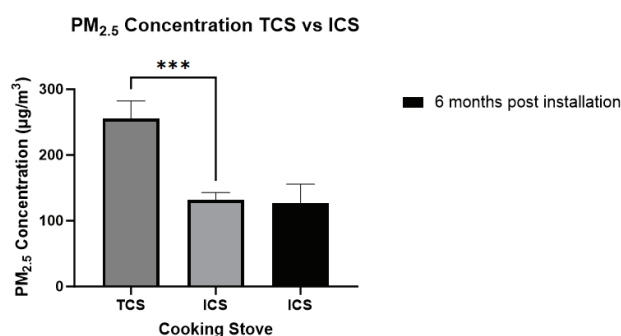


Figure Comparison of the overall mean concentration of particulate matter PM_{2.5} in a household using TCS and ICS, immediately after installation and post 6 months installation. The data shown are the mean ($\pm$ SEM) of all households in the study site with $n=30$. T

UPGRADING LOW-COST SPRAY PYROLYSIS SETUP FOR SYNTHESIZING NANO-MATERIALS BASED THIN FILMS: AN OPPORTUNITY FOR EXPOSURE TO KU STUDENTS ON NANOTECHNOLOGY DURING AND POST COVID ERA

✉ Bhim P. Kafle^{*1}, Prakash Lamichhane², Subarna Paudel³

1,2 Assistant Professor, Department of Chemical Science & Engineering, School of Engineering

3 Researcher, Department of Chemical Science & Engineering, School of Engineering

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Project Summary

We have upgraded the existing low-cost spray pyrolysis device for producing thin films of nanomaterials (in the order of nano meter scale) with thickness controlling mechanism. Specifically, the upgraded device comprises a Computerized Numerical Control (CNC) machine integrated with nanomaterial coating facility. We have upgraded the existing CNC machine by integrating both the hardware and software for mechanization (automatic deposition system) that will allow moving the coating system in 3D motion in a controlled manner. Besides, we also have upgraded a heater comprising copper stage integrated with two C-type 1000 W heating coils to uniformly temperature on the stage for substrate. We have tested our system by producing nickel oxide and graphene oxide films.

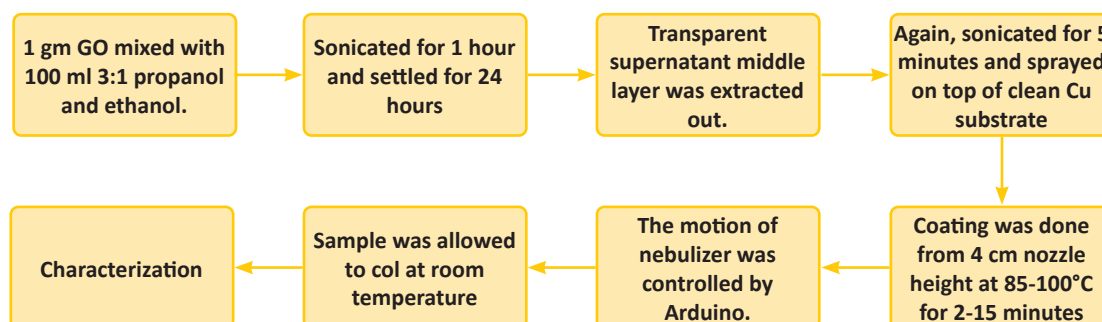


Figure 1 A step-by-step process for coating GO on Cu substrate.

Several sets of GO films on Cu plates were coated by varying deposition temperatures and time. One can notice a very nice circular layer of the graphene oxide on Cu substrate. Characterization of the prepared samples includes the investigation of optical reflectivity. Besides, study of surface morphology and crystallographic features is on the way. We have successfully prepared graphene oxide films on Cu substrates using our improved spray pyrolysis setup. We are now critically studying these films by exploring their optical, surface morphology and crystallographic for application in perovskite solar cells.

Keywords: Nanomaterials, Mechanization, Graphene oxide, Optical reflectivity, Crystallography.

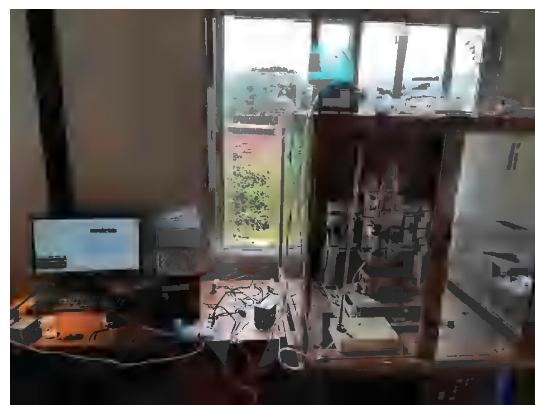


Figure 2 Photograph of our home-made spray system for thin film preparation

RESEARCH ACTIVITIES FROM AUGUST TO NOVEMBER 2023

1. On 11th August, 2023 RDI published notice regarding the proposal submission for internally funded projects 2023 from full time faculties to carry out research activities.
2. On 16th August and 24th August, 2023, RDI completed the meeting with Deans of all schools of KU with agendas of research and development budget channelization, research coordinator appointment in each school, KUSET and discussion on other publications and database of publication. The aim of the meeting is to facilitate, encourage and expand research activities in KU.
3. On 18th August, 2023, RDI successfully conducted a Final Review and Evaluation program of Internally Funded Project 2021/22 at Senate Hall in KU, Dhulikhel, Kavre. The presentation included projects descriptions, research activities, their outcomes and budget.
4. On 1st October, 2023, RDI successfully organized a Special Talk Program from Fulbright Specialist Dr. Joanne D. Fahey. The Program is about research communications strategies and tactics that included branding, web, social media, storytelling, video, print and more.
5. On November 3, 2023, RDI conducted a meeting with research coordinators of all school with agendas of meetings: standardization of the guidelines of the Research Based Degree such as MS, MPhil and PhD within KU, publication of the profiles of PhD students, publication of research of internally funded projects and update of current status of internally funded projects 2023..

Project Category

Year	Budget	
2019 - 2020	Nrs.50,000	
2020 - 2021	Nrs.50,000	
2021 - 2022	Category I	Category II
	Nrs.50,000	Nrs.1,00,000

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RESEARCH INSIGHTS

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Aquatic Ecology Center (AEC) at Kathmandu University aims to impart training and provide analytical services to individuals, government, and non-governmental organizations in the field of Physico-chemical and biological soil and water quality examinations.



Nepal Technology Innovation Center (NTIC), established at Kathmandu University on January 18, 2019, serves as an autonomous body with a primary focus on providing services in agriculture, rural development, alternative and renewable energy, and health-related livelihood.



Turbine Testing Lab (TTL) at Kathmandu University operates within the academic environment of the university and collaborates with the industries and private sectors to address technical and societal aspects of hydro power development and turbine-related issues.



Kathmandu University
Research, Development and Innovation