COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

CEST ITUKUTUKU

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INSIDE THIS ISSUE:

Bula Vinaka & Welcome!

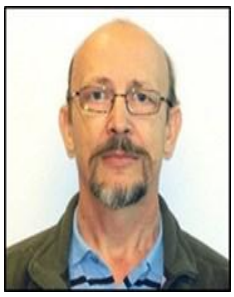
Dr. Jimaima Lako, Associate Dean Research

I would like to welcome all our readers to this e-quarterly newsletter – "ITUKUTUKU". This year 2020, the Research Office decided to revive the e-Newsletter of the College Research Office, after it was discontinued in 2018. This newsletter will not only highlight research developments and achievements, but will also capture information of the whole College activities, developments, initiatives, progress and achievements and share them to the wider community and stakeholders on a quarterly basis. This we hope will help bridge the gaps between the college and stakeholders and to find a common ground of working together in the areas of research, teaching and learning, community services and consultancies.

Enjoy our first revived edition.

New Appointments at the Dean's Office

Recently, the Office of the Dean welcomed its new Acting Dean; Prof. Tibor Pasinszki and it's new Associate Dean—Teaching and Learning; Prof. Todd Dennis.



Professor Tibor Pasinszki took up the position of the Acting Dean on the 3rd August 2020. He joined the Chemistry department at FNU in 2018. As a Chemical Engineer, he graduated from Budapest University of Technology and Economics, Hungary. With an outstanding research and high quality publications, he published a total of 98 journal articles of which more than 93 are peer-reviewed and 3 book chapters, with a sum of impact factors (SCI) of 249.8, citations = 1403, h-index = 21 and i10-index = 43.

His expertise in carbon based adsorbents, nanoparticles and toxins in food will help the college develop and strengthen its research capability and establish of high-quality science and engineering laboratories.

New Appointments at the Dean's Office (cont.)

Professor Todd Dennis took up the Associate Dean position on the 13th July, 2020. He is a renowned environmental conservationist, who graduated from the University of Virginia, USA. He joined the Biology Department at FNU in 2018. His research interests are related to movement ecology and behavior, conservation, biogeography, and ornithology. Professor Todd publishes in high ranked journals with a citation of over 2,000, h-index 21 and i10-index of 31.

He brings to the college a rich and wider research culture and perspectives.

ACTIVITIES:

"A good scientist is a person with ORIGINAL ideas. A good engineer is a person who makes a design that works with as few original ideas as possible. There are no prima donnas in engineering."
Freeman Dyson

Engineering Schools ROBOCON Competition

The first ever domestic ROBOCON competition between The University of South Pacific (USP) and Fiji National University was held in June 2019, hosted by Fiji TV, Fiji Broadcasting Cooperation and the Fijian Government. The aim of the competition was to *cultivate young people's interest and curiosity in developing Robotics applications by leveraging on electronic, mechanical, automation and information technologies – a real integration of STEM.*

Photo Credit: Fiji Village

The chief guest, the Minister for Education, Heritage and Arts Hon. Rosy Akbar stated that such competition is moving Fiji towards a society of technology, automation and efficiency. Fiji National University was represented by five member teams from College of Engineering, Science and Technology – School of Electrical/ Electronic Engineering & School of Mechanical Engineering.

AWARDS & RECOGNITION 2019-2000

College Teaching Excellence Award 2019

Dr Ravita Prasad received the "College Teaching Excellence Awards 2019". She is a Lecturer at the Physics Department, based at Nabua campus.

"No amount of experimentation can ever prove me right; a single experiment can prove me wrong."
Albert Einstein

Vice-Chancellor's Award for Research Excellence

Dr Shiu Kumar won the Vice-Chancellor's Research Excellence Award in the category of Higher Degree Researcher for 2019. Dr Kumar has published over 20 international journal and conference papers, six of which were published in highly ranked journals and has a citation H-Index of 10 and i10-Index of 10. Dr Kumar's contribution to knowledge is in the discipline of Electrical and Electronics Engineering, Artificial Intelligence, Machine Learning and Pattern Recognition

Vice-Chancellor's Award for Research Excellence

Dr Ronesh Sharma won the Vice Chancellor's Award for Research Excellence 2019, in the category of Early Career Researcher. A senior Instructor in the School of Electrical and Electronics Engineering, to date he has published seven Q1 journal papers, one Q2 journal paper, and one paper in a conference proceeding. He has a citation H-Index of 7 and 10-Index of 5. His contribution to knowledge is in the discipline of Electrical and Electronics Engineering Bioinformatics and Artificial Intelligence.

James Cook University Deans Award for Research Higher Degree Excellence

Dr. Alvin Lal, was one of the eleven recipients who were recognized amongst the 133 higher degree research candidates applied for the prestigious Deans Award for Research Higher Degree Excellence at James Cook University (JCU) in Australia in 2019.
His thesis topic entitled *"Groundwater modelling and management."* .

PUBLICATIONS 2020 (To Date)

Ramwant Gupta, Ravi Dutt Sharma & Munna Singh (2020). Energy dissipation and photosynthetic electron flow during the transition from juvenile red to mature green leaves in mango (*Mangifera indica* L.) Plant Biosystems [10.1080/11263504.2020.1810807]

Leaf colouration during development from juvenile red to mature green leaves is a genetically controlled process in mango (*Mangifera indica* L.). This study aimed to determine the pigmentation pattern and electron transport flow in both red and green leaves under varied light intensity. In this study, 5- and 10-day old juvenile red and mature green leaves, respectively, were used. Three different photosynthetic active radiation (PAR) levels (600 ± 5, 1000 ± 5, and 1200 ± 5 µmol m^{-2} s^{-1}) were chosen to examine chlorophyll a fluorescence (O-J-I-P) transients. The vacuole of spongy cells in mesophyll contained anthocyanin in the juvenile leaf and rapidly degraded during the colour transition from red to green. A significant difference in chlorophyll, carotenoid, and anthocyanin pigments was observed in both leaf types. The O-J-I-P parameters revealed that light intensity has a greater influence on the PSII electron transport chain than on PSI. Furthermore, the PSI of both leaves appeared to be more tolerant than that in PSII. The red leaf performed more energy dissipation than the green leaf after elevated light intensity exposure. O-J-I-P transients can be used as a sensitive, non-destructive method for measuring energy dissipation induced by intense radiation in plants.

"It's not faith in technology. It's faith in people. Steve Jobs

Ronesh Sharma, Shiu Kumar, Tatsuhiko Tsunoda, Thirumananseri Kumarevel, Alok Sharma (2020). Single-stranded and double-stranded DNA-binding protein prediction using HMM profiles. Analytical Biochemistry [https://doi.org/10.1016/j.ab.2020.113954]

Background: DNA-binding proteins perform important roles in cellular processes and are involved in many biological activities. These proteins include crucial protein-DNA binding domains and can interact with single-stranded or double-stranded DNA, and accordingly classified as single-stranded DNA-binding proteins (SSBs) or double-stranded DNA-binding proteins (DSBs). Computational prediction of SSBs and DSBs helps in annotating protein functions and understanding of protein-binding domains. *Results:* Performance is reported using the DNA-binding protein dataset that was recently introduced by Wang et al., [1]. The proposed method achieved a sensitivity of 0.600, specificity of 0.792, AUC of 0.758, MCC of 0.369, accuracy of 0.744, and F-measure of 0.536, on the independent test set. *Conclusion:* The proposed method with the hidden Markov model (HMM) profiles for feature extraction, outperformed the benchmark method in the literature and achieved an overall improvement of approximately 3%. The source code and supplementary information of the proposed method is available at https://github. com/roneshsharma/Predict-DNA-binding-proteins/wiki.

Satyanand Singh, Pragya Singh (2020). Speaker Specific Feature based Clustering and Its Applications in Language Independent Forensic Speaker Recognition. International Journal of Electrical and Computer Engineering. [DOI: 10.11591/ijece.v10i4.pp3508-3518]

Forensic speaker recognition (FSR) is the process of determining whether the source of a questioned voice recording (trace) is of a specific individual (suspected speaker). Most existing methods measure inter-utterance similarities directly based on spectrum-based characteristics, the resulting clusters may not be well related to speaker's, but rather to different acoustic classes. This research addresses this deficiency by projecting languageindependent utterances into a reference space equipped to cover the standard voice features underlying the entire utterance set. Then a clustering approach is proposed based on the peak approximation in order to maximize the similarities between language-independent utterances within all clusters. This method uses a K-medoid, Fuzzy C-means, Gustafson and Kessel and Gath-Geva algorithm to evaluate the cluster to which each utterance should be allocated, overcoming the disadvantage of traditional hierarchical clustering that the ultimate outcome can only hit the optimum recognition efficiency. The recognition efficiency of K-medoid, Fuzzy C-means, Gustafson and Kessel and Gath-Geva clustering algorithms are 95.2%, 97.3%, 98.5% and 99.7% and EER are 3.62%, 2.91 %, 2.82%, and 2.61% respectively. The EER improvement of the Gath-Geva technique based FSRsystem compared with Gustafson and Kessel and Fuzzy C-means is 8.04% and 11.49% respectively.

Alvin Lal, Bithin Datta (2020). Application of the group method of data handling and variable importance analysis for prediction and modelling of saltwater intrusion processes in coastal aquifers. Neural Computing and Applications. [https://doi.org/10.1007/s00521-020-05232-8].

Data-driven mathematical models are powerful prediction tools, which are utilized to approximate solution responses obtained using numerical saltwater intrusion simulation models. Employing data-driven prediction models as a replacement of the complex groundwater flow and transport models enables prediction of future scenarios. Most important, it also helps save computational time, effort and requirements when developing optimal coastal aquifer management methodologies using complex and large-scale coupled simulation–optimization models. In this study, a new data-driven mathematical model, namely group method of data handling (GMDH)-based prediction models, is developed and utilized to predict salinity concentration in a coastal aquifer by mimicking the responses of a variable-density flow and solute transport numerical simulation model. For comparison and evaluation purpose, the prediction performances of GMDH models were compared with well-established support vector machine regression and genetic programming based models. In addition, one important characteristic of the GMDH models is explored and evaluated, i.e. the ability to identify a set of most influential input predictor variables (pumping rates) that had the most significant impact on the outcomes (salinity concentration at monitoring locations). To confirm variable importance, 3 tests are conducted in which new GMDH models are constructed using subsets of the original datasets. In TEST 1, new GMDH models are constructed using a set of most influential variables (consisting of pumping rates at selected locations) only. In TEST 2, a subset of 20 variables (10 most and least influential variables) is used to develop new GMDH models. In TEST 3, a subset of the least influential variables is used to develop GMDH models. The performance evaluation results demonstrate that GMDH models developed using the entire dataset had reasonable prediction accuracy and efficiency. The comparison performance evaluation results for the three test scenarios highlighted the importance of the appropriate selection of relevant input pumping rates when developing accurate prediction models. The results suggested that incorporating the least influential variables deteriorate the accuracy of the prediction models; thus, considering the most influential pumping rates it is possible to develop more accurate and efficient salinity prediction models. Overall, the evaluation results from this study establish that the GMDH models and the inherent input variable ranking capability can be utilized as accurate and efficient coastal saltwater intrusion prediction models. Hence, GMDH models are viable saltwater intrusion modelling tools, which can be employed in future regional-scale saltwater intrusion prediction and management investigations.

Melinda Krebsz, Tibor Pasinszki, Tran Thanh Tung, Md Julker Nine, Dusan Losic (2020). Multiple applications of bio-graphene foam for efficient chromate ion removal and oil-water separation. Chemosphere. [https://doi.org/10.1016/j.chemosphere.2020.127790]

Highlights

⇒ Synthesis of bio-graphene foams (bGFs) from a mixture of glucose, citric acid, urea, and graphene oxide.

⇒ The developed bGFs processes unique porous architecture and high specific surface area.

⇒ The bGFs use as a new adsorbent for the removal of chromate ions and oil contaminants from waste waters.

⇒ The developed materials show an outstandingly high adsorption capacity of 245 mg of Cr(VI)/g at neutral pH.

⇒ Outstanding performance for continuous oil-water separation efficiency for toluene (99%) and petroleum (98.8%).

"Science without religion is lame. Religion without science is blind." Albert Einstein

Tibor Pasinszki, Jimaima Lako, and Todd E. Dennis (2020). Advances in Detecting Ciguatoxins in Fish. Toxins. [https://doi.org/10.3390/toxins12080494].

Ciguatera fish poisoning (CFP) is currently the most common marine biotoxin food poisoning worldwide, associated with human consumption of circumtropical fish and marine invertebrates that are contaminated with ciguatoxins. Ciguatoxins are very potent sodium-channel activator neurotoxins, that pose risks to human health at very low concentrations (>0.01 ng per g of fish flesh in the case of the most potent Pacific ciguatoxin). Symptoms of CFP are nonspecific and intoxication in humans is often misdiagnosed. Presently, there is no medically approved treatment of ciguatera. Therefore, to mitigate the risks of CFP, reliable detection of ciguatoxins prior to consumption of fish tissue is acutely needed, which requires application of highly sensitive and quantitative analytical tests. During the last century a number of methods have been developed to identify and quantify the concentration of ciguatoxins, including in vivo animal assays, cell-based assays, receptor binding assays, antibody-based immunoassays, electrochemical methods, and analytical techniques based on coupling of liquid chromatography with mass spectrometry. Development of these methods, their various advantages and limitations, as well as future challenges are discussed in this review.

Alvin Lal, Bithin Datta (2020). Performance Evaluation of Homogeneous and Heterogeneous Ensemble Models for Groundwater Salinity Predictions: A Regional-Scale Comparison Study. Water, Air, & Soil Pollution : An International Journal of Environmental Pollution. [https://doi.org/10.1007/s11270-020-04693-w]

Accurate prediction of salinity concentration in the aquifer in response to fluctuating groundwater pumping pattern is an essential component of any coastal groundwater planning and management framework. Data-driven prediction models have been proved efficient in predicting groundwater salinity levels in coastal aquifers. The use of ensemble prediction models is known to be more accurate with robust prediction capabilities when compared with standalone prediction models. This study compares the performances of homogeneous and heterogeneous ensemble models for groundwater salinity predictions. A homogeneous ensemble model is composed of several standalone models of the same type (i.e. employs one machine learning tool) whereas a heterogeneous ensemble model is composed of several standalone models of different types (i.e. employs multiple machine learning tools). Specifically, homogeneous and heterogeneous ensemble models of various standalone machine learning tools such as artificial neural network (ANN), genetic programming (GP), support vector regression (SVR), and Gaussian process regression (GPR) are developed to predict groundwater salinity concentrations in a small Pacific island coastal aquifer system. Standalone and ensemble prediction models are trained and validated using identical pumping and resulting salinity concentration datasets obtained by solving numerical 3D transient density-dependent coastal aquifer flow and transport model. After validation, the ensemble models are used to predict salinity concentration at selected monitoring wells in the modelled aquifer under variable groundwater pumping conditions. Prediction capabilities of the developed ensemble models are quantified using standard statistical procedures. The performance evaluation result suggested that the predictive capabilities of the developed standalone prediction models (ANN, GP, SVR, and GPR) were comparable with the numerical groundwater variable density-dependent flow and salt transport model. However, GPR standalone models had better prediction capabilities when compared with the other standalone models. Also, SVR and GPR standalone models were more efficient (i.e. took less computational training time) than other standalone models. In terms of ensemble models, the performance of the homogeneous GPR ensemble model was established to be superior to other homogeneous and heterogeneous ensemble models. The homogeneous GPR ensemble model was favoured both in terms of efficiency. Overall, based on the limited performance evaluation result, GPR homogeneous model was considered to be the best prediction model when compared with all the standalone models, other homogeneous ensemble model, and the heterogeneous ensemble model. Therefore, it can be utilised as a reliable groundwater salinity prediction tool and also used as an approximate simulator in coupled simulation-optimization models needed for prescribing optimal groundwater management strategies.

A man who dares to waste one hour of time has not discovered the value of life. —
Charles Darwin

Tibor Pasinszki , Melinda Krebsz (2020). Synthesis and Application of Zero-Valent Iron Nanoparticles in Water Treatment, Environmental Remediation, Catalysis, and Their Biological Effects. Nanomaterials. [doi:10.3390/nano10050917]

Present and past anthropogenic pollution of the hydrosphere and lithosphere is a growing concern around the world for sustainable development and human health. Current industrial activity, abandoned contaminated plants and mining sites, and even everyday life is a pollution source for our environment. There is therefore a crucial need to clean industrial and municipal effluents and remediate contaminated soil and groundwater. Nanosized zero-valent iron (nZVI) is an emerging material in these fields due to its high reactivity and expected low impact on the environment due to iron's high abundance in the earth crust. Currently, there is an intensive research to test the effectiveness of nZVI in contaminant removal processes from water and soil and to modify properties of this material in order to fulfill specific application requirements. The number of laboratory tests, field applications, and investigations for the environmental impact are strongly increasing. The aim of the present review is to provide an overview of the current knowledge about the catalytic activity, reactivity and efficiency of nZVI in removing toxic organic and inorganic materials from water, wastewater, and soil and groundwater, as well as its toxic effect for microorganisms and plants.

Salvin Sanjesh Prasad, Anirudh Singh (2020). Economic feasibility of biodiesel production from Pongamia Oil on the Island of Vanua Levu. SN Applied Sciences. [https://doi.org/10.1007/s42452-020-2985-8].

This study presents the economic feasibility of biodiesel production from Pongamia oil, which can be potentially produced from approximately 58,897 ha of unutilized marginal lands available on the Island of Vanua Levu. The production analysis shows that approximately 488 million litres of Pongamia oil and 645 million litres of biodiesel can be produced from the total available land area. A cost–benefit analysis carried out to investigate the viability of such project displays a positive net present value and a benefit–cost ratio greater than 1 at all the discount rates up to 10%. The implications of economic feasibility for this project was investigated by carrying out sensitivity analysis, which shows that the project will be viable up to 5% discount rate with at least 5% increase in net present cost. The study projects large scale Pongamia biodiesel production from total available land area, however, such venture can be scaled down to some suitable scale of production at any lower costs upfront to substitute or blend Pongamia biodiesel with neat diesel for running inter-island shipping vessels, fishing boats and providing household electrification in the outer and remote islands of Pacific Island Countries.

Satyanand Singh, Pragya Singh (2020). High level speaker specific features modeling in automatic speaker recognition system. International Journal of Electrical and Computer Engineering (IJECE). [DOI: 10.11591/ijece. v10i2.pp1859-1867]

Spoken words convey several levels of information. At the primary level, the speech conveys words or spoken messages, but at the secondary level, the speech also reveals information about the speakers. This work is based on the high-level speaker-specific features on statistical speaker modeling techniques that express the characteristic sound of the human voice. Using Hidden Markov model (HMM), Gaussian mixture model (GMM), and Linear Discriminant Analysis (LDA) models build Automatic Speaker Recognition (ASR) system that are computational inexpensive can recognize speakers regardless of what is said. The performance of the ASR system is evaluated for clear speech to a wide range of speech quality using a standard TIMIT speech corpus. The ASR efficiency of HMM, GMM, and LDA based modeling technique are 98.8%, 99.1%, and 98.6% and Equal Error Rate (EER) is 4.5%, 4.4% and 4.55% respectively. The EER improvement of GMM modeling technique based ASR system compared with HMM and LDA is 4.25% and 8.51% respectively.

"Engineering is not about what you learn or practice; Engineering is about what you imagine to learn and practice"
— Sir P.S. Jagadeesh Kumar

Ramwant Gupta (2020). Manganese Repairs the Oxygen-Evolving Complex (OEC) in Maize (*Zea mays* L.) Damage During Seawater Vulnerability. Journal of Soil Science and Plant Nutrition. [https://doi.org/10.1007/s42729-020-00220-2].

This study was aimed to investigate how exogenous manganese (Mn) would limit damage in the oxygen-evolving complex (OEC) and photosynthetic apparatus of maize seedlings caused during seawater vulnerability. In this study, seawater was applied in 2-week-old maize (Zea mays L.) seedling, and the degree of damage of photosynthetic pigment pool, the OEC, and net electron transport rate were observed. Mn supplement was also added in maize seedlings to limit the damage of the OEC and photosynthetic apparatus caused during salinity. Leaf relative water content (RWC), fresh weight (FW), and photosynthetic pigment pool (chlorophyll a, chlorophyll b, and carotenoids) sharply declined after 7 days of treatment; however, Mn supplement increased these values. Chlorophyll fluorescence induction (OJIP) transients showed low Fv/Fo, an additional K step, enhanced variable fluorescence (VK) and degree of damage to the OEC (WK) during salinity, and indicates damage of OEC at electron donor side of photosystem II (PSII). The OEC intact within PSII was a primary damage center during salinity which inhibited electron transport process that resulted in a huge loss of maximum quantum yield of PSII (Fv/Fm), but a significant recovery in photosynthetic apparatus was observed after exogenous application of manganese. Structural and functional integrity of the photosynthetic apparatus was recovered up to a certain extent after exogenous application of Mn. Findings from this study should help to understand the basic knowledge of photosynthetic apparatus efficiency in response to damage caused by exposure to seawater. Outcomes of this study will be used to mitigate salinity problem with Mn supplement for growth and development of crops.

Bimal Aklesh Kumar, Munil Shiva Goundar, Sailesh Saras Chand (2020). A framework for heuristic evaluation of mobile learning applications. Education and Information Technologies. [https://doi.org/10.1007/s10639-020-10112-8].

Heuristic evaluation is a fast and cheap method that can be used to identify usability flaws in mobile learning applications. In this paper, we proposed a framework for heuristic evaluation of mobile learning applications to ensure that best practices are followed, hence saving time and effort in conducting a heuristic evaluation. Ten case studies on heuristic evaluation of mobile learning applications were selected, and an analysis was conducted to identify the best practices that were later incorporated into a framework. The framework was utilized to conduct heuristic evaluation to show the feasibility of our approach. The results indicate that it provides clear guidance, and it's fast and easy to conduct heuristic evaluation.

Ravita D. Prasad, Atul Raturi. Solar Energy for Power Generation in Fiji: History, Barriers and Potentials – Chapter 8. *Translating the Paris Agreement into Action in the Pacific*, Advances in Global Change Research 68, © Springer-Nature Switzerland AG 202. [https://doi.org/10.1007/978-3-030-30211-5_8]

I

n the last 5 years, there has been rapid growth in "behind the meter" solar photovoltaics (solar PV) installations for several commercial companies around the main island of Fiji, Viti Levu. In total, around 4 MW of solar PV is installed with some grid-connected solar systems planned and many off-grid solar system planned by Fiji Department of Energy with funding from Fijian government and overseas donor agencies. This chapter reviews solar PV developments in Fiji and discusses the future development plans that are documented in publically available domains. Some barriers and challenges are also discussed for slow deployment of solar PV. The theoretical potential of solar PV power generation was found to be around 170 GWh/year which would result in around 150,000 metric tonnes of carbon dioxide avoided emissions. Using Long Range Energy Alternative Planning System (LEAP), grid electricity model was constructed and a range of new renewable energy technologies were used for future electricity generation with addition of solar PV. It was found that 90 MW of new solar PV on Viti Levu's grid, 5 MW in Vanua Levu's grid and 4 MW in Ovalau's grid, would have the potential of generating167 GWh by 2030 with around 148,000 metric tonnes of avoided carbon dioxide emissions.

Mohammed Boulhaoua, Ana Torvisco & Tibor Pasinszki. Toward the synthesis of thiadiazole-based therapeutic agents: synthesis, spectroscopic study, X-ray analysis, and cross-coupling reactions of the key intermediate 3,5-diiodo-1,2,4-thiadiazole. Res. Chem. Intermed. [DOI: 10.1007/s11164-019-04047-0]

The 1,2,4-thiadiazole moiety is an important component of several biologically active compounds, and varying substituents on this aromatic ring is one of the possible methods to develop novel thiadiazole-based drugs for medicine. A key building block to this end, namely 3,5-diiodo-1,2,4-thiadiazole (1), has been synthesized and characterized in this work for the first time. 1 has exhibited high selectivity for the replacement of iodine atom at position C5 (carbon next to sulfur) in Sonogashira-type cross-coupling reactions with phenylacetylene. Therefore, 3-iodo-5-(phenylethynyl)-1,2,4-thiadiazole (4) or 3,5-bis(phenylethynyl)-1,2,4-thiadiazole (5) could be synthesized selectively depending on reaction conditions. All three novel molecules have been characterized by NMR, IR, Raman, mass, and UV spectroscopies, and their solid phase structures have been determined by single-crystal X-ray diffraction. 1 is expected to be a key starting material for producing thiadiazole-based therapeutic agents using cross-coupling reactions.

"The world steadily grows better because the human mind, applying itself to environment, makes it better... with hands... with tools... with horse sense and science and engineering."

— Robert A. Heinlein

Tibor Pasinszki, Melinda Krebsz, Deepak Chand, László Kótai, Zoltán Homonnay, István E. Sajó, and Tamás Váczi. Carbon microspheres decorated with iron sulfide nanoparticles for mercury(II) removal from water. Journal of Material Science.

A new and simple method is developed to synthesize carbon microspheres decorated with iron sulfide nanoparticles for mercury ion removal from water. The synthesis is based on carbonizing polystyrene–divinylbenzene-based and iron(III) sulfate-loaded cation exchange resins between 500 and 1000 °C. The phase composition, surface area, and morphology of these materials are characterized by various spectroscopic and diffraction techniques, including Mössbauer spectroscopy, powder X-ray diffraction, Raman and scanning electron microscopy, and BET analysis. Pyrrhotite is found to be the dominant iron-containing phase. The adsorption performance of microspheres for mercury ion removal from water is studied as a function of adsorbent load and contact time at pH 6.5 using a solution of 40 mg dm^{-3} mercury ion. Pyrrhotite nanoparticles played a key role in mercury ion removal amounting to 70–90% of the extracted amount. A high adsorption capacity of 104 mg of mercury/g of adsorbent at an adsorbent load of 0.33 g dm^{-3} is achieved, and the removal kinetics could be well fitted with a pseudo-second-order kinetic model, indicating chemical sorption. The synthetic method is easy to scale up for large-scale production and materials are easy to handle, which is significant for large-scale environmental applications.

Kai Ke, Kiran Kumar Kondamareddy, Fan Gao, Xiang Zhang, and Xiao Yuan. Fabrication of Highly Efficient and Stable Hole-Transport Material-Free Perovskite Solar Cells through Morphology and Interface Engineering: Full Ambient Process. Energy Technology. [https://doi.org/10.1002/ente.201900446].

Carbon-based hole-transport material (HTM)-free perovskite solar cells (PVSCs) with low cost and high stability attract research interest. Herein, a facile way to improve the performance of HTM-free PVSCs by employing two strategies is reported: first, adding a small amount of tetrahydrofuran (THF) in lead iodide (PbI2)/N, N-dimethylformamide (DMF) solution to improve the quality of the perovskite film; second, introducing an ultra-thin Al2O3 film at the interface of TiO2/perovskite to reduce charge recombination. THF is found to facilitate the formation of homogenous perovskite films with better coverage, while the ultrathin Al2O3 layer avoids the direct contact of TiO2 with CH3NH3PbI3. The Al2O3 layer can effectively block holes and prevent charge recombination, thus leading to a dramatic improvement of open-circuit voltage and fill factor in PVSCs. Moreover, the PVSCs show excellent long-term stability with no degradation for1000 h under ambient conditions. A facile way for the future commercialization of efficient low-cost HTM-free PVSCs is provided.

Rajeev Lal , L.K. Fifield , S.G. Tims , R.J. Wasson , D. Howe. A study of soil erosion rates using 239Pu, in the wet-dry tropics of northern Australia. Journal of Environmental Radioactivity. [https://doi.org/10.1016/j.jenvrad.2019.106085].

Highlights

- In this study modern soil loss rates were determined using ^{239}Pu.^{239}Pu was released in the 1950s and 1960s by atmospheric nuclear weapons tests.
- The development of ^{239}Pu as a soil tracer represents a viable alternative to the traditionally used ^{137}Cs tracer.
- This represents a new tool in the quantification of catchment soil loss for the Australian semi-arid tropical region.

"Don't be average and lazy, If you want to successes you should work hard to achieve it" — Aymen Tmar

Bimal Aklesh Kumar, Munil Shiva Goundar, Sailesh Saras Chand (2019). Usability guideline for Mobile learning applications: An update. Education and Information Technologies. [https://doi.org/10.1007/s10639-019-09937-9].

Mobile learning application developers have to overcome inherent limitations imposed by mobile devices in order to produce usable applications. There are usability guidelines available to assist in the design process but with technological improvements, these guidelines should be updated and extended. In this research, we proposed an updated usability guideline to assist in the design process of mobile learning applications. A systematic analysis of seventeen usability studies on mobile learning application was conducted, listed usability problems were extracted and analyzed to formulate new usability guidelines and subsequently the guidelines were updated. The validation results indicate that the updated guideline helps to achieve a higher level of usability as compared to previous guidelines.

Bimal Aklesh Kumar, Muni Shiva Goundar. Usability heuristics for mobile learning applications. Education and Information Technologies. [https://doi.org/10.1007/s10639-019-09860-z]

Heuristic evaluation is a fast and easy way to detect usability problems. Nielsen (1994) proposed ten heuristics that are being widely used to conduct heuristic evaluation. Utilizing these heuristics for mobile learning applications is not very effective because they are generic and were not developed taking mobile devices into consideration. In this research new heuristics were developed to extend Nielsen (1994) heuristics to support heuristic evaluation of mobile learning applications. Sixteen usability studies on mobile learning applications were retrieved from the literature, the listed usability problems were analyzed and three new heuristics were developed. The validation results indicate that using newly developed heuristics allow evaluators to detect more usability problems while evaluating mobile learning applications.

PhD Completion 2019-2020

Dr Ravita Prasad graduated with her PhD in Physics in 2019, specializing in renewable energy from the University of the South Pacific. Her work is in line with the Fijis iNDCS (internationally National Determined Contributions) to the Paris agreement which focuses on sustainable energy sources that reduce carbon emissions.

Dr. Shiu Kumar graduated with his PhD degree in Engineering from University of the South Pacific, Suva, Fiji His research was based on electroencephalography (EEG) Signal Classification and its Application to Brain-Computer Interface Systems using Computational Intelligence Techniques. Dr Kumar applied feature engineering and pattern recognition to biomedical signals and has developed several state-of-the-art computational models for the prediction of motor imagery (MI) signals.

Dr. Ronesh Sharma graduated with his PhD degree in Engineering from University of the South Pacific, Suva, Fiji. His research was based on Protein Fold Recognition and Structure Class Prediction and MoRF Detection using Computational Intelligence Methodologies. In his PhD research, Dr Sharma applied feature engineering to bioinformatics data to build several state-of-the-art computational models.

"A common mistake that people make when trying to design something completely foolproof is to underestimate the ingenuity of complete fools."

- Douglas Adams

Dr. Alvin Lal graduated with a PhD in Physics from James Cook University with his thesis entitled "*Groundwater modelling and management"* in 2019 "

He is currently an Assistant Professor with the Department of Physics, FNU. He published his thesis in Q1 and Q2 journals and secured travel grants for conferences in Australia, Japan, United States of America and Spain.

Dr. Arishma Ram graduated with a PhD in Geology under the New Zealand Pacific Scholarship award at the University of Auckland, New Zealand. Her thesis topic was "Engineering Geological Investigation of Slope Failures Along Roads in Viti Levu, Fiji."

She is a Lecturer at the Department of Environmental Science, under the School of Applied Sciences—Science based in Natabua Campus.

Master Completion 2019—2020

Mr. Taslim Mohammed graduated with a Master in Maritime Affairs, specializing in Education and Training from the World Maritime University (WMU) in Malmo, Sweden. International Maritime Organization recognizes WMU (IMO) and the United Nations General Assembly, which plays a significant role in maritime and ocean education, research, capacity building and economic development. Taslim spent one and a half years in Sweden. His Master's thesis was based on the "Impact analysis of introducing E-Learning to the Fijian seafarers". He works as the Executive Officer at Fiji Maritime Academy (FMA).

Mr. Rajnil Lal graduated with a Master of Civil Engineering from the University of Auckland in New Zealand, through the New Zealand Scholarship. He is specialized in structural engineer and works as an Assistant Lecturer at the School of Building & Civil Engineering at Derrick Campus, Samabula.

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"The three great essentials to achieve anything worthwhile are, first, hard work; second, stick-to-itiveness; third, common sense."

— Thomas A. Edison

Ms. Salanieta Matai graduated with Master of Environmental Management from Sophia University at the Graduate Global Environmental Studies in Japan through the Japan International Cooperation Agency (JICA) - Pacific LEADS.
She is now a Lecturer at the Department of Environmental Science, School of Applied Sciences—based at Natabua Campus

Science is about knowing; engineering is about doing.

Henry Petroski

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We hope you enjoyed our first revived edition!!
Have a blessed day.

THE END