Faculty of Applied Sciences
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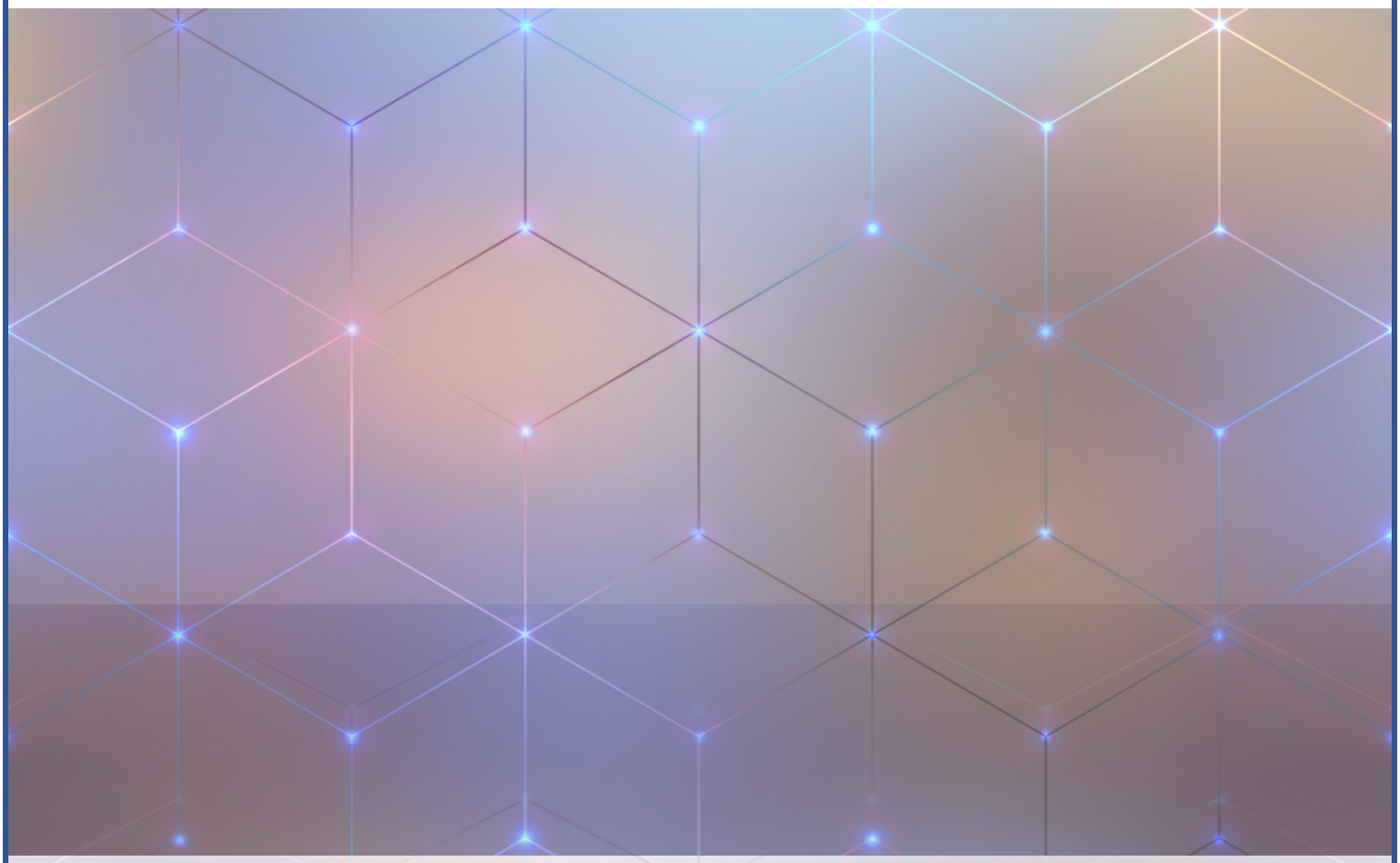

Out of the Press

Our publications - August

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Resource-efficient and eco-friendly model for fruit processing industry waste valorisation using black soldier fly (Hermetia illucens) larvae under tropical conditions

K.S.L. Perera, C.J. Liyanage, H.R.N. Jinadasa, P.M. Korale Gedara, and W.A.I.P. Karunaratne

Abstract

A pilot facility was developed to evaluate the digestion efficiency of mixed fruit peel waste by black soldier fly (*Hermetia illucens* (L.) (Diptera: Stratiomyidae); BSF) larvae in Sri Lanka. Larval biomass was characterised by proximate analysis and the techno-functional properties of BSF larvae flour protein were determined. A cost-benefit analysis was conducted to assess the feasibility of operating an onsite BSF digestion facility for a medium scale fruit juice manufacturer. The observed optimum feeding rate was 1.5 g/larva. A bioconversion rate of 15.41 was achieved. The waste reduction index was 1.73. The feed conversion rate was 3.85. The efficiency of conversion of digested food was 0.29. The highest wet and dry weight reductions were 61.72 and 55.10% respectively, indicating very efficient digestion. The crude protein content of BSF larvae was 40.87% while the crude fat content was 26.67%, proving it is a potential protein source as a feed ingredient. The protein fraction also had highly desirable techno-functional properties (water-binding capacity 3.00 g/g_{DM}, oil binding capacity 5.22 g/g_{DM}, emulsifying capacity 36.00 ml/g, foaming capacity 0.48, and foaming stability 0.15). The waste is currently being dumped in a non-sustainable manner at US$ 10.00 per one metric ton. The cost-benefit analysis showed a net benefit of US$ 3,963.76 per month from this valorisation, suggesting it is a highly viable, eco-friendly option for processing fruit processing industry or similar organic waste under tropical conditions in middle income countries.

About the Journal

Journal of Insects as Food and Feed

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DNR

Current Insight into Culture-Dependent and Culture-Independent Methods in Discovering Ascomycetous Taxa

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Abstract

Culture techniques are vital in both traditional and modern fungal taxonomy. Establishing sexual–asexual links and synanamorphs, extracting DNA and secondary metabolites are mainly based on cultures. However, it is widely accepted that a large number of species are not sporulating in nature while others cannot be cultured. Recent ecological studies based on culture-independent methods revealed these unculturable taxa, i.e., dark taxa. Recent fungal diversity estimation studies suggested that environmental sequencing plays a vital role in discovering missing species. However, Sanger sequencing is still the main approach in determining DNA sequences in culturable species. In this paper, we summarize culture-based and culture-independent methods in the study of ascomycetous taxa. High-throughput sequencing of leaf endophytes, leaf litter fungi and fungi in aquatic environments is important to determine dark taxa. Nevertheless, currently, naming dark taxa is not recognized by the ICN, thus provisional naming of them is essential as suggested by several studies.

About the Journal

Journal of Fungi

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From mine to mind and mobiles – Lithium contamination and its risk management

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Abstract

With the ever-increasing demand for lithium (Li) for portable energy storage devices, there is a global concern associated with environmental contamination of Li, via the production, use, and disposal of Li-containing products, including mobile phones and mood-stabilizing drugs. While geogenic Li is sparingly soluble, Li added to soil is one of the most mobile cations in soil, which can leach to groundwater and reach surface water through runoff. Lithium is readily taken up by plants and has relatively high plant accumulation coefficient, albeit the underlying mechanisms have not been well described. Therefore, soil contamination with Li could reach the food chain due to its mobility in surface- and ground-waters and uptake into plants. High environmental Li levels adversely affect the health of humans, animals, and plants. Lithium toxicity can be considerably managed through various remediation approaches such as immobilization using clay-like amendments and/or chelate-enhanced phytoremediation. This review integrates fundamental aspects of Li distribution and behaviour in terrestrial and aquatic environments in an effort to efficiently remediate Li-contaminated ecosystems. As research to date has not provided a clear picture of how the increased production and disposal of Li-based products adversely impact human and ecosystem health, there is an urgent need for further studies on this field.

About the Journal

Environmental Pollution

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DPST

Electron-Affinity Substituent in 2,6-Dicarbonitrile Diphenyl-1λ5-Phosphinine (DCNP) Towards High-Quality Organic Lasing and Electroluminescence under High Current Injection

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Abstract

Rationally manipulating the functional substituents plays a crucial role in tuning the luminescence and lasing properties of organic gain media. Herein, a cyanophenyl-moiety, which exhibits relatively weaker electron affinity, is connected to 2,6-dicarbonitrile diphenyl-1λ5-phosphinine (DCNP) via para-linking. Resultantly, the appreciated locally-excited characteristics ensuring a large oscillator strength and high radiative rate can be reserved in DCNP-4-(4-cyanophenyl) (DCNP-pCN). Interestingly, the weak charge-transfer state from the relative donor (D)/acceptor (A) interplay enables small singlet-triplet splitting (ΔEST ≈ 0.45 eV). Thus, the triplets generated on DCNP-pCN can be efficiently scavenged by 4,4'-bis[(N-carbazole) styryl] biphenyl (BSBCz), which is used as the host with a lower-lying triplet energy level for DCNP-pCN. Moreover, benefitting from the mediation between the conjugated length extension and weak D/A interplay, the emission spectrum cannot be largely shifted, which can effectively suppress the overlap between the lasing emission of DCNP-pCN and the excited-state absorption of BSBCz, thereby avoiding detrimental singlet-triplet annihilation. Thus, high-quality distributed feedback lasings with ≈2.0 μJ cm−2 thresholds are achieved, and the organic light-emitting diodes exhibit external quantum efficiency exceeding 2.0% without efficiency roll off under high current injection, indicating the potential for electrical-pumping organic lasings.

About the Journal

Advanced Functional Materials

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Coaxial Atmospheric Pressure Plasma Jet Property Comparison for Helium and Argon Gases

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Abstract

Atmospheric pressure plasma jets (APPJ) use in many various applications ranging from materials surface modifications to nano particle synthesis. Chemical species generation at atmospheric condition makes these devices perfect for thermo-sensitive applications. Generally, APPJs are used with noble gases like Helium (He) or Argon (Ar) or admixture of gases to generate the plasma conditions using different electrode configurations. Discharge properties of these gases can be seen different to each other due to their atomic and gas properties. These changes can be seen to affect on the plasma jet properties as well as the generation of species at atmosphere. This study focused to compare the changes in the APPJ properties for He and Ar APPJs. Quartz capillaries with outer diameter of 4 mm and inner diameter of 2 mm was used with coaxial electrode configuration to generate He and Ar APPJs. Gas flow with 0.5 and 1.0 L was used to generate plasma in this system. Tungsten wire with diameter of 0.6 mm was used as coaxial electrode which were connected to high voltage waveform of 11 kVp-p with frequency of 30 kHz. Discharge behavior of the He and Ar plasma inside the capillary was collected using CT transformer. Images of APPJs were taken using a digital camera (Nikon D3100) and image-to-bit conversion was used in calculating plasma jet lengths. Time averaged localized optical spectra of the APPJ was collected using the spectrometer system (HAMMAMATSU: PMA-12) to identify the chemical species generation and distribution. Behavior of the discharge current for He and Ar plasma can be seen to differ to each other and maximum discharge current values peak around 2 mA for He plasma, while it peaks around 4 mA for Ar plasma. Increase in gas flow rate also affects in increasing the peak value of discharge current irrespective to the gas. Length of the Coaxial APPJs can be seen shorter for He APPJ compares to the Ar APPJ. Optical emission spectra of excited species along the plasma jet tends to show higher intensity for Ar plasma compares to the He plasma. Constitution of the atomic structure and its properties of the different gases affects to have different discharge behaviors. As the coaxial cable inside the capillary occupied some volume of the discharge container, it effects on gas flow behavior as well as discharge behavior. Viscosity of the gas flow along with density, hence affects the discharge of the plasma and propagation it to the atmosphere causing to varying the plasma jet lengths. In addition, strong discharge inside the capillaries affects on generating higher amount of excited chemical species as the plasma jet propagates in atmosphere.

About the Conference

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