Implen Journal Club | August Issue

Welcome to our August issue of the #Implen #JournalClub in 2022.
Biomass Edition

In the first issue of Implen NanoPhotometer® Journal Club: biomass edition, we are exploring a possible solution for the impacts of Marine Plastic Debris (MPD) on marine ecosystems, which is among the most critical environmental concerns of the past three decades as plastic pollution has become a worldwide environmental threat, impacting nearly all aquatic and terrestrial ecosystems. Consequently, there is a growing demand for more eco-friendly replacements of conventional plastic polymers, ideally with fit-for-purpose properties and a well-understood life cycle resulting in an increasing research effort directed towards developing bio-based products

that could eventually replace synthetic materials on the market.

Bio-polymers are polymers derived from plants, animals, and microbes. They can be used to manufacture ‘eco-friendly’ bio- plastics for biomedical, industrial, and household applications. Audrézet et. al. recently published in the journal of Frontiers in Marine Science a study that for the first time showed the effect of bio-polymers amended with oyster shell filler on the development and evolution of marine fouling assemblages. Taken together the results of this study suggest that bio-based polymers and composites with increased potential for biodegradability, recyclability, and aptitude for the selective recruitment of marine invertebrates might offer a sustainable alternative to conventional polymers, assisting to mitigate the numerous impacts associated with MPD.Although numerous studies have explored the potential application of shell waste, this research paves the way for future studies investigating the succession of marine micro- and macro- communities onto shell-enriched bio- polymers using DNA metabarcoding.

The NanoPhotometer® was used in this study to assess the quantity and quality of the extracted DNA.

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The second issue is covering a study recently published in Nature by Stathatou et. al. demonstrating how yeast Saccharomyces cerevisiae can effectively remove trace lead (Pb2+) from water via a rapid mass transfer process, called biosorption. Traces of heavy metals found in water resources pose a global threat and conventional treatment processes fail to remove toxic heavy metals, such as lead, from drinking water in a resource efficient manner. It was also shown in this groundbreaking study that the yeast cell wall plays a crucial role in this process, with the contribution of the outer mannan-protein layer of the yeast cell wall in accumulating heavy metal cations being the key potential lead adsorbents.

The rapid biosorption and high Pb2+ uptake is advantageous for the large-scale application of this inexpensive and abundant biomaterial for the removal of trace heavy metals from water.

Exploiting yeast as a biosorbent can be practically feasible and economically attractive as it can be easily cultivated in large quantities and has various beneficial industrial applications in the food, beverage, therapeutics and biofuel production industries. These findings open new opportunities for using environmentally friendly and abundant biomaterials for advanced water treatment targeting emerging contaminants including other heavy metal cations as well, such as copper (Cu2+) and cadmium (Cd2+). This approach compares favorably to many of the highly sophisticated synthetic biology and advanced nanomaterials approaches that have also been examined as candidates for heavy metal removal from water. Applying such a low value resource to remove trace contaminants from water could also result in waste reduction as yeast cells are biodegradable. Moreover, potential desorption processes would allow for heavy metals reclamation, enhancing the application of circular economy models.

The Implen Nanophotometer® was used in this study for yeast strain, culture & OD600 culture density measurements. Discrete time-point OD measurements were performed using 2 mL non-frosted cuvettes and a tabletop, ultraviolet-visible NanoPhotometer® spectrophotometer measuring at 600 nm.

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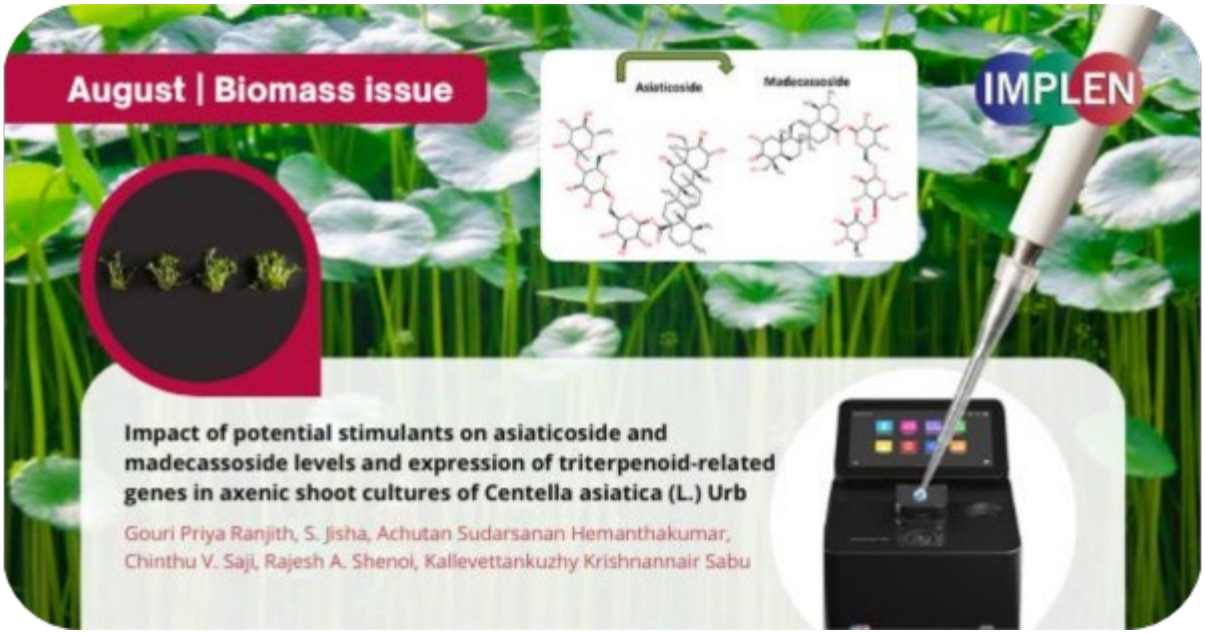

Next, we are highlighting the work of Ranjith et, al. recently reported in the Journal of Phytochemistry on Centella asiatica (L.) Urb., commonly known as Asiatic pennywort or Gotukola, a low-growing perennial herb of the Apiaceae (Umbelli- ferae) family. Saponins containing triterpene acids and their sugar esters - asiatic acid, madecassic acid, asiaticoside (ASD), and madecassoside (MSD) - collectively called centellosides, are major metabolites responsible for the pharmacological value giving them a wide range of applications in pharmaceutical and cosmetic industries. These specialized metabolites are highly specific structures designed through evolution and used by plants in response to various stresses, for example, attractants for pollinators and protectants against damaging effects of UV irradiation. Biological activities attributed to these bioactive compounds include neuro-protective and neuro-regenerative properties, wound healing and other dermatological properties, hepato-protective

properties, anti-inflammatory, anti-oxidative, anti-diabetic, antibacterial, and antifungal properties.

In this study it was shown that silver nitrite (AgNO3) can act as a metabolite stimulant, to enhance the formation of triterpenoids in axenic shoot culture of C. asiatica, which could be utilized in studying the regulation of terpenoid biosynthesis and biotechnological application for the increased production of these bioactive molecules. These results point out that the treatment of metabolite stimulants strategy has a great potential to be utilized in improving the valuable triterpenoids production in the plant in vitro cultures. Adding to it, the axenic shoot cultures of C. asiatica can be used as a fundamental tool for the study of the effects of various metabolite stimulants on the triterpenoids produced by the plant.

The qualitative and quantitative estimation of RNA were done by NanoPhotometer® spectrophotometer.

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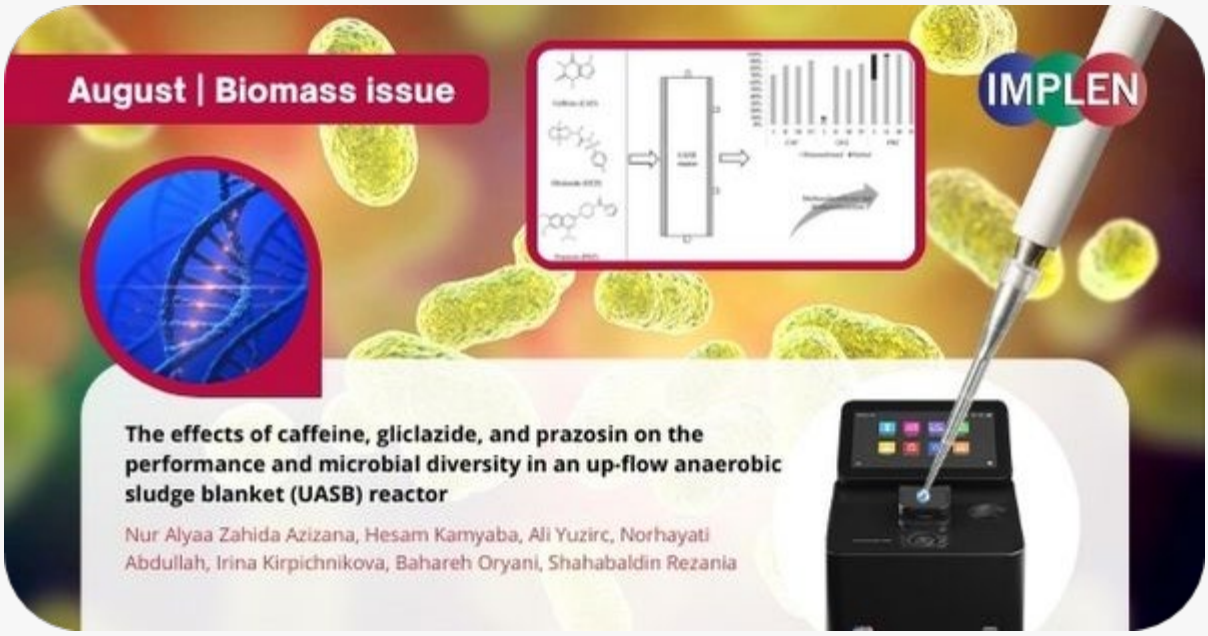

Next issue is highlighting the work of Azizana et al. recently published in the Journal of Biomass and Energy, which was the first report of the drug prazosin (PRZ) removal in an anaerobic bioreactor. The occurrences of trace pharmaceutical compounds in Malaysian waterways have been linked to the incomplete removal of the compounds during treatment in conventional wastewater treatment processes. Among the detected compounds were psychostimulant caffeine (CAF), anti-diabetic drug gliclazide (GCZ), and anti-hypertensive drug PRZ. These compounds pose risks of bioaccumulation and toxicity to aquatic species and have shown the prospect of changing the metabolic behavior of microorganisms.
Anaerobic digestion (AD) has been acknowledged as one of the prospective enhancements to the existing conventional treatment processes to eliminate pharmaceutical compounds that are present in wastewater. The application of AD is favorable as it is known to be robust in treating various wastewater types, may operate with minimal energy requirements, and has biogas potential for energy recovery. The application of a laboratory-scale up-flow anaerobic sludge

blanket (UASB) bioreactor to this study successfully removed up to 87–99% of CAF, GCZ, and PRZ, mainly through biotransformation.

The Implen NanoPhotometer® N60/N50 spectrophotometer was used in this study to quantify gDNA.

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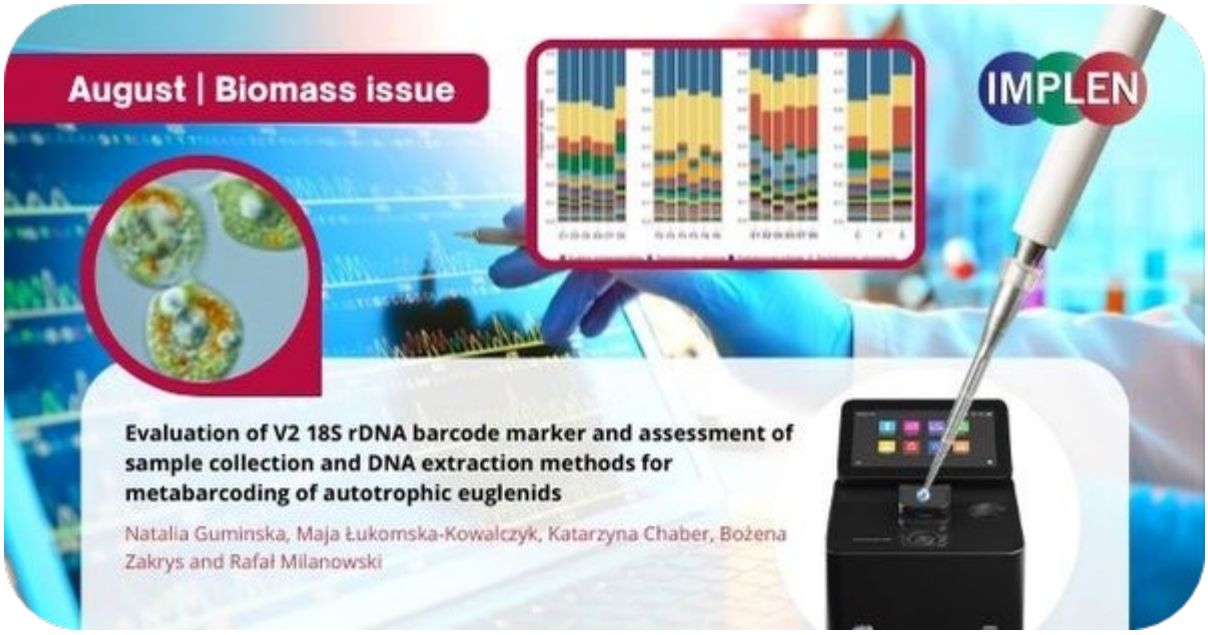

The last issue is discussing the advancement of next-generation sequencing (NGS) technologies, DNA metabarcoding has become a powerful molecular tool frequently used for biodiversity assessment. The interest in metabarcoding in environmental studies is emerging as is highlighted in the work featuring Euglenids- one of the several groups of eukaryotic microorganisms known to be underrepresented in metabarcoding studies. In this study, using metabarcoding resulted in obtaining a high fraction (85%) of euglenid reads and species-level identification of almost 90% of them. Fifty species were detected by the metabarcoding method, including almost all species observed using a light microscope.

This study proposed a highly efficient protocol for HTS based identification of autotrophic euglenids in environmental samples using the V2 18S rDNA fragment, euglenid specific primers and the database enriched with curated sequences. The GeneMATRIX Soil DNA Purification Kit (Eurx) was chosen as the most suitable method of DNA isolation due to the best quality and quantity of obtained DNA as well as the relatively low costs and workload. From the studied biomass harvesting methods, both centrifugation and filtering outperformed scrapes and the choice between them is not crucial for the reliability of the analysis.

The quality of the DNA isolates was evaluated spectrophotometrically with NanoPhotometer NP80.

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