Bioremediation and Circular Biotechnology

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Published online: 16 June 2021

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In view of the growing interest in the field of Biotechnology in Bioremediation, the question being raised is to develop innovative technologies, which can be ecofriendly, economical and lead to improve the quality of human life. The need is to present the status of the diverse possibilities and the views and opinions of the experts to finally provide mankind with novel, innovative and long-lasting strategies, in the Special Issue of Indian Journal of Microbiology (INJM). INJM is an official Journal of Association of Microbiologists of India (AMI). In view of the vast diversity of experts as evident by their extremely valuable scientific publications in this area: Biotechnology in Bioremediation, we invited a few of them to contribute a review article or original research article to this Special Issue of INJM: **“Bioremediation and Circular Biotechnology”**.

A major threat to environment is posed by synthetic organochlorine pesticides, primarily because of their highly

persistent nature and bioaccumulation. Most of them impact the endocrine systems. Microbial processes for bioremediation of environmental pollutants are being pursued very vigorously. Fungi have the unique metabolic machinery for degrading these toxic and highly recalcitrant pollutants. A detailed biotransformation process and the biomaterial with high adsorbing capacity for removing pesticides and heavy metals have been highlighted in the article by Bokade et al., [1]. For comprehensive valorization of plant biomass waste, metabolic and functional potentials of microbes must be well understood. Whole genome sequencing of *Streptomyces* sp. genome has proven to be a fundamental tool for accurately mapping the lignocellulose metabolizing enzymes [2]. This finds support from the immobilization of degradative enzymes on magnetic nanoparticles [3, 4]. Most industries depend heavily upon petroleum products leading to environmental pollution. The areas surrounding the petroleum refineries are the most adversely affected. An effective approach to mitigate these pollution levels can be the integration of bioremediation and resource recovery. Microbial ability to degrade petroleum refinery wastes with insights into resource reuse and recovery have been dealt in-depth in the article by Iman et al. [5].

Bioenergy production processes are primarily limited by the high feed cost. Microalgae has been attracting researchers as a cheap and clean source of raw material. Advantage can be taken of cultivating microalgae in wastewaters to achieve the target of proving feed and remediate wastewater using ecofriendly approaches. Algal–bacterial interaction has been realized to be the most efficient system, however, there are a few bottlenecks, which need to be overcome to promote a sustainable approach [6]. Dairy industry waste due to a high organic load are not recommended for discharging without

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treatment. Its potential as a source of value-added products such as biopolymers, biosurfactants, biofertilizers and single cell protein has been presented in the review of Adesra et al. [7]. The role of bioactive molecules in advancing biotechnology industries for human welfare have been now well recognized [8–10]. Food, agriculture, bioenergy, bioremediation and pharmaceuticals have integrated mammalian cells and algae as raw materials to reduce the cost of production. However, harvesting techniques for efficient recovery are under different stages of development [11].

Sunita Varjani (Guest Editor),

Abhay Bajaj (Guest Editor),

Hemant J. Purohit (Editor),

Vipin Chandra Kalia (Editor in Chief)

Acknowledgements We are extremely thankful to the authors and staff of the M/S Springer Nature especially Dr. Ms. Mamta Kapila, Ms. Suganya Maharajan, and Ms. Ramya Thulasingham for their kind cooperation and support in bringing out this special issue.

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