Harnessing microalgal capacities for bioremediation of contaminated waters: Insights from ex-situ phycoremediation

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Abstract

Microalgae present a promising solution for addressing water contamination through ex-situ phycoremediation, utilizing their diverse metabolic and biochemical properties. This keynote presentation explores several critical aspects that enhance the effectiveness of microalgae in bioremediation. Firstly, microalgae cultivated under controlled conditions exhibit a remarkable metabolic capacity to break down various pollutants, encompassing organic compounds, nutrients, and contaminants like heavy metals. By optimizing growth parameters such as nutrient availability, light intensity, and pH levels, researchers can significantly enhance the efficiency of pollutant removal by microalgal cultures. Secondly, the live biomass of microalgae possesses unique membrane characteristics essential for bioremediation processes. These membranes play a crucial role in physically adsorbing and bioaccumulating contaminants from water sources. Through selective binding, microalgal membranes concentrate pollutants within the biomass, facilitating their subsequent removal during harvesting and separation processes. Furthermore, biopolymers derived from microalgae, such as polysaccharides and proteins, offer promising applications in enhancing bioremediation efficacy. These biopolymers can act as effective biosorbents or bioflocculants, aiding in the aggregation and precipitation of contaminants for easier extraction from water matrices. By integrating these approaches, ex-situ phycoremediation emerges as a sustainable and effective strategy for mitigating water pollution. Harnessing the inherent capabilities of microalgae not only supports environmental remediation efforts but also promotes sustainable water management practices globally. This presentation aims to underscore the transformative potential of microalgae-driven bioremediation in addressing current and future challenges in environmental conservation and water quality improvement.

Keywords: Microalgae, Ex-situ phycoremediation, Metabolic capacity, Biomass properties, Biopolymers, Sustainable water management.