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EXPLORING THE POTENTIAL OF MICROALGAE AS MITIGATION AGENTS FOR PLASTIC POLLUTION

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Plastic pollution, particularly micro- and nano-plastics, poses a significant global challenge. However, removing these particles from the environment is a difficult task due to their small size. Traditional physical and chemical methods have proven ineffective and costly in addressing this issue. To tackle the problem, bioremediation has emerged as a promising and eco-friendly solution that harnesses the potential of microorganisms and plants capable of degrading plastic particles. Microalgae exhibit unique biochemical and metabolic abilities, enabling them to efficiently remove several organic compounds and pollutants, making them promising organisms for environmental applications.

Polyvinylidene chloride (PVDC), a thermoplastic polymer, deserves attention due to its remarkable barrier properties and chemical resistance, making it highly suitable for packaging applications, especially in industries suchas food and pharmaceuticals. It's important to note that PVDC and Polyvinyl chloride (PVC) are both vinyl polymers derived from vinyl chloridemonomers, but they differ in their structural composition. PVDC features ahighly chlorinated structure with chlorine atoms attached to every othercarbon atom, distinguishing it from PVC. Extensive research has beenconducted on the biodegradation of PVC, focusing on oxidoreductase enzymeslike laccase that play a significant role in this process. Laccases frommicroalgae have demonstrated promising properties, including the oxidationof various substrates for effective bioremediation.

To investigate the response of microalgae to PVDC microplastics in a contaminated medium, a study was conducted using 19 different microalgae accessions. Remarkably, most of the microalgae exhibited unaffected growth in the contaminated medium compared to the control medium, indicating their resilience. Moreover, the photosynthetic pigment (chlorophyll-a; chlorophyll-b and carotenoid) content of each microalga was analyzed. Four microalgae showed differing content of photosynthetic pigments, suggesting a physiological variation in their responses to PVDC. Additionally, laccase activity in the supernatant of the microalgae accessions grown in both contaminated and treated mediums was assessed to explore the potential interactions between microalgae and PVDC.

In addition to the biological evaluation, Fourier Transform Infrared (FTIR) analysis was performed to evaluate the effects of microalgae on microplastics to identify potential structural changes. Principal Component Analysis (PCA) showed that the two principal components accounting for 80% of the total components, revealed distinct patterns among some PVDC samples, suggesting possible structural variations in microplastic.