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Microplastic removal from Water Using Biodegradable Green Solvents

Microplastics (MP) are tiny plastic particles (<5mm in size), that come from various sources, including synthetic textiles, tires, cosmetics, fragmentation of larger plastics (bottles, food containers, pvc pipes, etc.) and industrial processes. These complex compounds have become a mayor environmental concern due to their widespread presence and potential risk to human health and organisms[1]. Many attempts have been made to address this issue, technologies such as membrane filtration systems, electrocoagulation, plastic-eating enzymes, etc., offer unique approaches for the removal of microplastics, yet still face obstacles like high costs, limited scalability, environmental consequences, partial removal efficiency, and generation of more waste as filters have life cycles[1]. Additionally, microplastics are complex molecules, posing significant challenges for detection and complete elimination due to their small size and diverse composition, making it difficult to develop solutions to address the issue. Therefore, this work assesses said problematic by employing green solvents (GS) derived from renewable sources, as an eco-friendly alternative for microplastic in water pollution control. By harnessing the low toxicity, biodegradability, versatility and compatibility, GS can mitigate the environmental impact of microplastics pollution. In this work, two decanoic-based GS were synthesized, characterized and evaluated on the removal of PET (Polyethylene terephthalate) and Polyesterene (PET), and a mixture of both. The removal process was assessed using UV-Vis spectroscopy and infrared spectroscopy techniques. Overall results revealed a remarkable 99% removal of PET/PS mixture within 180 min. Total Organic Carbon measurements were also conducted to assess microplastic removal efficacy and to detect any potential contamination from the GS into the solution. This study demonstrates the effectiveness of GS in removing PET, PS and mixtures, achieving significant removal rates in short timeframes, confirming the potential of GS as promising solutions for microplastic pollution mitigation, promoting ecosystem health and contributing to a more sustainable management of our natural resources

Keywords

Microplastics, Green solvents, Water Pollution, Emerging contaminants, Environmental remediation

Reference

[1] Iyare, Paul U., Sabeha K. Ouki, and Tom Bond. “Microplastics removal in wastewater treatment plants: a critical review.” Environmental Science: Water Research & Technology 6.10 (2020): 2664-2675.

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