Turning the Tide: The Potential of Geopolymer in Microplastic Pollution Control

A Review

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Abstract

Microplastics, serving as sources and vector transport for organic and inorganic contaminants in terrestrial and marine ecosystems, are emerging as significant micropollutants of growing concern, owing to their potential adverse impacts on the environment, biota, and human health. Sorbed contaminants on the surface of microplastics, such as heavy metals, polycyclic aromatic hydrocarbons (PAHs), and other hydrophobic organic compounds, pose additional environmental and ecological risks. While several methods have been explored to mitigate microplastic pollution, including nano zero-valent iron and membrane bioreactors, they often fall short of eliminating microplastics, highlighting the need for alternative and more effective approaches. Geopolymer technology, despite its potential, remains largely untapped in microplastic pollution control. Leveraging the inherent properties of geopolymers presents a viable solution for capturing and immobilizing microplastics. This review paper aims to evaluate the potential of geopolymers in mitigating microplastic pollution by examining their physical, chemical, and mechanical characteristics. To enhance the scope of the study, the review delves into their synthesis and makes distinctions among conventional, porous, and pervious geopolymers. By accentuating the potential role of geopolymers in tackling microplastic pollution, this paper underscores the urgent need for continued research and development in this domain to achieve robust and sustainable environmental protection measures.

Keywords: Microplastics, Geopolymer technology, Pollution mitigation, Environmental degradation, Sustainable solutions