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APPLICATION OF NANOMATERIALS IN THE REMOVAL AND REMEDIATION OF HEAVY METALS FROM WATER

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Abstract

Water, an indispensable resource for sustaining life and fostering human development, faces increasing threats due to escalating industrial and urban activities. This surge in water consumption has intensified water scarcity, consequently impeding economic growth. Moreover, contamination by heavy metals constitutes a significant global environmental issue. The pressing demand for clean and safe water has spurred the development of innovative and environmentally friendly water treatment technologies. Nanotechnology has emerged as a promising solution, attributed to the exceptional adsorption capabilities of nanomaterials. These nanomaterials exhibit unique properties, including a large surface area, high reactivity, and tunable surface chemistry, rendering them highly effective adsorbents for heavy metal ions such as arsenic, cadmium, lead, and chromium. This review provides a comprehensive analysis of various nanomaterials employed in the removal of hazardous metals from water. It examines the utilization of diverse natural and engineered materials, such as carbon-based nanomaterials, zeolites, natural polymers, magnetic materials, metal oxides, metallic materials, and silica, in the development of cost-effective, sustainable nanomaterial-based water treatment solutions.

Key words: adsorption, environmental sustainability, heavy metal pollution, nanomaterials, wastewater remediation, water scarcity

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