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Advancing Environmental Remediation Through the Production of Functional Porous Materials from Phosphorite Residue Tailings

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Abstract : Environmental remediation is a pressing global concern, necessitating innovative strategies to address the challenges posed by industrial waste and pollution. This study aims to advance environmental remediation by developing cutting-edge functional porous materials from phosphorite residue tailings. Phosphorite mining activities generate vast amounts of waste, which pose significant environmental risks due to their contaminants. The proposed approach involved transforming these phosphorite residue tailings into valuable porous materials through a series of physico-chemical processes including milling, acid-base leaching, designing or templating as well as formation processes. The key components of the tailings were extracted and processed to produce porous arrays with high surface area and porosity. These materials were engineered to possess specific properties suitable for environmental remediation applications, such as enhanced adsorption capacity and selectivity for target contaminants. The synthesized porous materials were thoroughly characterized using advanced analytical techniques (XRD, SEM-EDX, N2 sorption, TGA, FTIR) to assess their structural, morphological, and chemical properties. The performance of the materials in removing various pollutants, including heavy metals and organic compounds, were evaluated through batch adsorption experiments. Additionally, the potential for material regeneration and reusability was investigated to enhance the sustainability of the proposed remediation approach. The outdoors of this research holds significant promise for addressing the environmental challenges associated with phosphorite residue tailings. By valorizing these waste materials into porous materials with exceptional remediation capabilities, this study contributes to the development of sustainable and cost-effective solutions for environmental cleanup. Furthermore, the utilization of phosphorite residue tailings in this manner offers a potential avenue for the remediation of other contaminated sites, thereby fostering a circular economy approach to waste management.

Keywords : functional porous materials, phosphorite residue tailings, adsorption, environmental remediation, sustainable solutions
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