Área: INO

Acid activation of vermiculite and its performance in methylene blue dye adsorption

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Highlights

Modified vermiculite shows high Methylene Blue adsorption efficiency.
VMKX2 achieved 96.5 mg/g adsorption capacity.
Promising material for water treatment filters.

Abstract

Industrial effluents frequently contain toxic and persistent substances that are difficult to remove even after conventional treatments. In this context, the use of modified clays, such as vermiculite, presents a sustainable alternative for the remediation of emerging contaminants, specifically dyes. Upon undergoing processes of expansion, grinding, and acid treatment, vermiculite acquires superior adsorptive properties compared to the in natura material. This enhancement is attributed to its interlayer structure, which facilitates the storage and intercalation of exchangeable cátions. The present work aims to apply chemically modified vermiculite as a substrate for the removal of Methylene Blue dye. The expanded and ground vermiculite subjected to a 2-hour acid treatment (VMKX2) proved effective for the adsorption of Methylene Blue dye, demonstrating an adsorbed dye quantity of 96.5 mg/g. In contrast, the non-expanded, ground vermiculite with a 2-hour acid treatment (VML2) showed an adsorption capacity of 25 mg/g for the same dye. Vermiculite samples (VML24 and VMKX24) subjected to a 24-hour acid treatment also achieved significant dye adsorption; however, VML24 was more adsorptive, retaining 84 mg/g of Methylene Blue dye, while VMKX24 adsorbed 48.5 mg/g. These results demonstrate the high efficiency of vermiculite in the retention of Methylene Blue, with the VMKX2 sample exhibiting the highest adsorption capacity. The superior performance of VMKX2 is attributed to the structural modification processes it underwent, specifically the expansion treatment. Following grinding and acid treatment, the material develops a high cation exchange capacity.[1, 2] In conclusion, modified vermiculite is a promising material for application in continuous filters, offering potential scientific and technological impact in the treatment of dye-contaminated water. This material contributes to more efficient and sustainable decontamination processes.

Referências:

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