

A Comparative Study on Oil Sorption Capabilities of Vermiculite Clay and Coconut Husk

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Structured Abstract

Background: Oil pollution is a serious environmental issue, particularly in industrial and marine settings, where spills can damage ecosystems and human health. Conventional methods are often expensive and harmful to the environment. As a result, biodegradable and widely available agricultural wastes have gained attention as eco-friendly sorbents. This study explores the oil sorption abilities of vermiculite clay and coconut husk, two natural materials with different physical and chemical characteristics.

Methods: Raw vermiculite clay (RVC) and raw coconut husk (RCH) were prepared, dried, and analyzed using SEM and FTIR to examine changes in structure and functional groups before and after oil exposure. Oil sorption performance was tested using cooking oil (CO) and lubricant oil (LO). Key parameters assessed included oil uptake, oil-water selectivity, pH, bulk density, and hydrophobicity.

Results: Coconut husk showed higher oil sorption than vermiculite, especially with cooking oil. It absorbed 1.69 g/g of CO and 1.05 g/g of LO, while vermiculite absorbed 0.98 g/g (CO) and 0.92 g/g (LO). Vermiculite's neutral pH (7.1) makes it suitable for various environments. SEM images revealed structural changes after oil absorption, and FTIR analysis confirmed interactions with oil components. Coconut husk also had better oil-water selectivity and higher removal efficiency. Cooking oil was absorbed more easily due to its lower viscosity, while lubricant oil formed a thinner layer.

Conclusion: Both materials show promise as eco-friendly sorbents for oil spill cleanup. However, coconut husk outperformed vermiculite in oil uptake and selectivity, making it a more effective and sustainable option.

Keywords: Oil Sorption, Coconut Husk, Vermiculite Clay, Cooking Oil, Lubricant Oil

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