Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 49 2025

Colloquium on Applied Sciences 1 2025
20-24 January 2025, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Lauric Acid Modification of Peanut Shell For Oil Removal

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Structured Abstract

Background: Oil pollution from oily water presents a significant environmental threat, harming marine life and ecosystems. Common clean up methods include physical, chemical, biological, and sorption techniques, with adsorption being the most efficient and eco-friendly. Peanut shells, a byproduct of agriculture, show potential as bio-sorbents but require modification to improve their hydrophobicity and adsorption capacity. Treatment with lauric acid enhances their oil adsorption and water-repellent properties, making them a sustainable alternative to synthetic sorbents for oil-water separation.

Methods: The preparation and characterization of peanut shell-based adsorbents involves several steps. Raw peanut shells are cleaned, cut, dried, and ground into powder before being treated with lauric acid to improve their hydrophobicity and adsorption capacity. After treatment, the shells are washed, dried, and stored for use. Characterization techniques include SEM for surface morphology, FTIR for functional group analysis, and hydrophobicity testing. Oil sorption experiments assess the adsorption and retention capacities using palm and lubricant oils, while selectivity tests evaluate the material's efficiency in separating oil from water. Key metrics such as weight gain and hydrophobicity degree are calculated using established formulas to determine the adsorbent's performance.

Results: The study shows that lauric acid-modified peanut shells significantly outperform raw shells in oil adsorption, as confirmed by SEM and FTIR analyses. The modification adds hydrophobic functional groups, enhances surface area and porosity, and removes impurities, transforming the shells into efficient oil sorbents. These improvements boost oil absorption, retention, and oil-water separation, making the modified shells highly effective for environmental cleanup and resource recovery.

Conclusion: Modification improves the peanut shell surface, creating larger cavities and uniform pores. FTIR analysis shows structural changes in MPS, with new peaks for aliphatic chains (~2925 cm^{-1}) and ester groups (~1700 cm^{-1}). While RPS shows a slight decrease in hydrophobicity (56.92 to 56.34), MPS improves (68.41 to 70.28). MPS also enhances oil sorption, retention, and removal efficiency for both cooking and lubricant oils, making it a more effective material for oil absorption and separation.

Keywords: Hydrophobicity, Lauric Acid Modification, Oil Sorption, Peanut Shell, Oil-Water Separation

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