

A Comparison of Oil Sorption Efficiency Between Coconut Husk and Cotton

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Structured Abstract

Background: Oil spills present a significant threat to aquatic ecosystems and human health due to their persistence and toxicity. While synthetic sorbents are effective, their high cost and environmental impact have spurred interest in natural, biodegradable alternatives. This study compares the oil sorption efficiency of two natural materials—raw coconut husk (RCH) and raw cotton (RC)—using cooking oil and lubricant oil as test substances. The aim is to evaluate their sorption, retention, and oil-water selectivity properties for potential use in eco-friendly oil spill remediation.

Methods: Raw coconut husk and cotton were prepared through washing, drying, and sieving. Characterization was performed using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and hydrophobicity tests using a water–n-hexane mixture. Oil sorption and retention tests were conducted by submerging 2 g of each material in 100 mL of oil, followed by weight measurements after specific durations. Oil-water selectivity was assessed by immersing each adsorbent in a mixture of oil and water to observe preferential absorption. Bulk density and pH were also evaluated.

Results: Raw cotton showed significantly higher oil sorption capacity (12.95 g/g for cooking oil and 11.37 g/g for lubricant oil) and better oil retention (over 94%) than raw coconut husk. Cotton also exhibited greater hydrophobicity (86%) versus coconut husk (36.5%). However, coconut husk demonstrated superior oil-water selectivity, absorbing more oil in mixed environments. FTIR and SEM results confirmed physical adsorption as the dominant mechanism.

Conclusion: In conclusion, raw cotton is more efficient for high-capacity oil absorption and retention, making it ideal for direct spill cleanup. Meanwhile, coconut husk's better oil-water selectivity suggests potential for use in mixed aquatic environments, particularly after surface modification. Both materials are biodegradable and locally available, offering sustainable alternatives for environmental remediation.

Keywords: Oil Sorption, Oil Retention, Raw Cotton, Raw Coconut Husk, Hydrophobicity, Oil-Selectivity, Environmental Remediation, Natural Sorbents, Sustainable Cleanup, Biomass Materials

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