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Harnessing Water Lettuce for Effective Oil Sorption

Yuzanor Harissa Mohd Yusof[a], Shariff Che Ibrahim[ab*]

Structured Abstract

Background: The presence of oil in water poses significant environmental challenges, necessitating effective treatment methods for oily wastewater. Water lettuce (Pistia stratiotes) has potential as a biomass-based adsorbent for oil removal due to its high surface area and porous structure. This study aims to evaluate the chemical and physical properties of water lettuce and assess its adsorption efficiency for pure oils and oil-water mixtures under varying parameters like adsorbent weight and soaking time.

Methods: The methodology involves collection, cleaning, and preparation of water lettuce samples, followed by characterization using FTIR spectroscopy, SEM analysis, and bulk density measurement. Oil sorption experiments were conducted using oils and oil-water mixtures to evaluate adsorption capacity under different adsorbent weight and soaking time conditions

Results: FTIR spectroscopy revealed characteristic peaks for -OH, C-H, and C=O functional groups in water lettuce. SEM imaging showed a highly textured surface with papillae-like structures and needle-like trichomes. The average bulk density gain for water lettuce is 0.26 g/ml, suggesting a porous structure. This study also shows adsorption capacity increased with longer soaking times (1 to 9 minutes) for both cooking oil and lubricant oil. Lubricant oil had higher adsorption capacities compared to cooking oil, likely due to its higher viscosity. As adsorbent weight increased from 0.3 g to 0.7 g, adsorption capacity decreased for both oils. For oil-water mixtures, adsorption capacity increased with soaking time but was lower than for pure oils. At a given time, adsorption capacity decreased as adsorbent weight increased for oil-water mixtures.

Conclusion: Water lettuce exhibits promising properties for oil adsorption, with higher capacities for lubricant oil compared to cooking oil. Adsorption is enhanced by longer contact times but decreases with increasing adsorbent weight. Water lettuce could serve as a sustainable solution for oil pollution remediation in aquatic environments. Future research is recommended to explore the effects of different oil types and environmental conditions on adsorption performance.

Keywords: Water Lettuce, Oil Adsorption, FTIR, SEM, Environmental Cleanup

*Correspondence: sha88@uitm.edu.my

[a] School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

[b] Industrial Waste Conversion Technology Research Group, Universiti Teknologi MARA, Shah Alam, Malaysia