

# NOVEL MAGNETIC EGGSHELL MEMBRANE FUNCTIONALIZED WITH WASTE PALM FATTY ACID FOR SELECTIVE ADSORPTION OF OIL FROM AQUEOUS SOLUTION

## Abstract

Emulsified oil in wastewater is a severe problem and requires extensive treatment before it can be disposed of in a manner that meets environmental regulation standards. One strategy to remove emulsified oil is by utilizing the adsorption process. The goal of this study is to synthesis magnetic eggshell membrane (ESM) functionalized with waste palm fatty acid, (MNP@ESM-WPFA) for the adsorption of oils (lubricating oil). The synthesis procedure involves three steps including preparation of ESM, functionalization of ESM with waste palm fatty acid (WPFA) and magnetization of eggshell membrane (ESM) functionalized with waste palm fatty acid (ESM-WPFA) through co-precipitation method to obtain MNP@ESM-WPFA. The novel adsorbent was characterized using SEM, FTIR, and EDX analyses. SEM analysis revealed the magnetic nanoparticles scattered throughout the porous and fibrous network structure of ESM-WPFA, confirming the successful synthesis of the MNP@ESM-WPFA. Further FTIR analysis on MNP@ESM-WPFA adsorbent revealed the appearance of peaks at 2933  $\text{cm}^{-1}$  and 2852  $\text{cm}^{-1}$  and 630  $\text{cm}^{-1}$ , thus confirming the presence of the alkyl chain of the waste palm fatty acid (WPFA) and Fe-O band on the surface of MNP@ESM-WPFA. The oil adsorption performance of MNP@ESM-WPFA was optimal at pH 7, treatment time of 50 minutes, and adsorbent dosage of 50 mg. The MNP@ESM-WPFA showed the highest oil adsorption capacity (K) for lubricating oil (4.61 mg/mg), followed by olive oil (2.72 mg/mg), and corn oil (2.00 mg/mg). The MNP@ESM-WPFA adsorbent was also reusable, with a sorption capacity that was maintained after five usage-regeneration cycles.

## Keywords

Adsorbents; Eggshell Membrane; Magnetic Nanoparticles; Oil Removal; Waste Palm Fatty Acids