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HYDROPHOBIC TEXTILE MEMBRANE WITH RECYCLED ZnO NANOPARTICLES FOR SEPARATION OF OIL-CONTAMINATED WASTEWATER

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Hydrophobicity and oleophilicity are crucial factors in the development of effective oil/water separation membranes. Transition metals and their oxide materials have been extensively utilized to create hydrophobic surfaces on textile membranes. This is not only due to their surface topography, which allows for controllable nanostructures leading to water repellency, adhesion, and wettability, but also because of their diverse array of special properties. Currently, one of the most pressing environmental concerns is oily wastewater disposal, which poses significant pollution threats to water bodies. Consequently, there has been a recent surge in demand for membranes capable of separating and remediating oil-contaminated water. Textile membranes treated with a polymeric component and a metal oxide, using a simple and cost-effective synthesis method, have emerged as effective and sustainable solutions to enhance conventional separation processes. This project aims to create an economical and eco-friendly textile membrane by using recyclable materials, particularly cotton textiles treated with ZnO nanoparticles derived from discarded alkaline battery anodes and processed through mechanical milling. The findings yielded promising results for the intended application. Scanning Electron Microscopy (SEM) analysis demonstrated a homogenous dispersion of nanoparticles across the textile fibers, with sizes ranging from 40 to 100 nm. Verification of the ZnO wurtzite phase was achieved via X-Ray Diffraction (XRD)analysis. Initial contact angle measurements recorded a value of 140 degrees at 0 seconds, gradually decreasing to 139± .7 degrees after 5 minutes, indicating a minor reduction in hydrophobicity over time.

Keywords: Oil/water separation membrane, hydrophobicity, recycled ZnO nanoparticles, simple synthesis method, contact angle