# UNIVERSITI TEKNOLOGI MARA

# WASTE COOKING OIL BASED EMULSION LIQUID MEMBRANE FOR ZINC EXTRACTION FROM AQUEOUS SOLUTION

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# ABSTRACT

Zinc was identified as one of the most toxic heavy metals and often found contaminating the water sources as a result of inefficient treatment of industrial effluent. In this work, Emulsion Liquid Membrane (ELM) was proposed as a method to minimize the concentration of zinc ions in an aqueous solution. Instead of the common petroleum-based diluent, the emulsion is reformulated with waste cooking oil (WCO) which was collected from the food sector as a sustainable and cost-effective diluent. The formulation also includes Bis(2-ethylhexyl) phosphate (D2EHPA) as carrier, Span 80 as surfactant, sulfuric acid ($H_2SO_4$) as internal phase while zinc sulfate ($ZnSO_4$) solution was used as the external phase. The WCO characterization and emulsion formation studies were first carried out by utilizing an electronic rheometer, microscope and FTIR analysis. The liquid-liquid extraction (LLE) method was then used to confirm the compatibility of WCO with D2EHPA for the extraction of zinc ions from the external phase, as well as to investigate the extraction equilibria of zinc extraction in ELM and the external phase pH. To obtain the best-operating conditions for zinc extraction using the newly formulated ELM, the extraction time and speed, carrier, surfactant and internal phase concentrations, and W/O ratio were varied. 95.17% of zinc ions were removed under the following conditions; 0.001M of $H_2SO_4$ in external phase, 700 rpm extraction speed for 10 minutes, 8 wt% of carrier and 4 wt% of surfactant concentrations, 1:4 of W/O ratio and 1 M of internal phase concentration. The use of WCO was proven as the alternative green diluent in ELM method substituting the toxic petroleum-based diluents. The findings of this study shall serve as a milestone in the development of a safer technology to treat heavy metal ions from aqueous solutions.

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# TABLE OF CONTENTS