Formulation of green emulsified liquid membrane for toxic chromium (Cr(VI)) recovery: characterization, demulsification and diluent reuse

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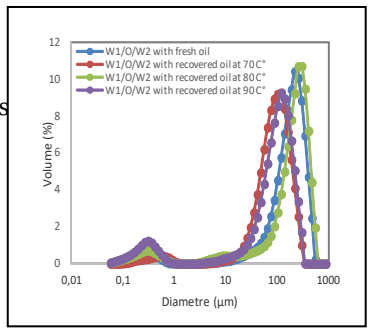
1. Introduction – Extraction processes using emulsified liquid membranes (ELM) have received significant attention due to its potential as an effective technique for a variety of applications involving selective and controlled transport of many chemicals. This system promote many advantages including simple operation, high selectivity, low energy requirement. Recently, ELMs are recognized as an emerging technique for the extraction and recovery of heavy metals [1-3] and organic pollutants [4] from wastewater. For economic considerations, the reuse of the ELM organic phase is one of the most crucial factors for developing a commercially viable ELM process. So, the aim of this work is the extraction and the recovery of Cr(VI) by ELMs process. The feasibility of the heat treatment demulsification was investigated and the ELMs formulated using the recovered oil were characterized.

2. Experimental - The W_1/O emulsions were prepared by dispersing the stripping aqueous solution into the oil phase using high shear mixing with Heidolph Silent Crusher M homogenizer. All the formulations were characterized in terms of droplet size distribution, zeta potential, visual microscope inspection.

3. Results and Discussion - An extraction efficiency more than 99 % was observed in the chromium concentration interval of 0.043ppm to 50ppm. Demulsification of W_1/O was made by heat treatment. The effect of the temperature on the emulsion destabilization is investigated in the range of 30-90°C. It was observed that the DE increased from 4.69 % to 96.02 % with increasing the temperature from 30°C to 80°C. The ELMs formulated with oil recovered were characterized in terms of droplet size distribution, stability and EE of Cr(VI). The droplet size distributions for these ELMs indicates that the ELMs prepared with the fresh and the recovered oils present polydisperse distribution; similar droplet size is obtained in all cases. Moreover, the quality of the recovered oil after demulsification was considered in terms of the water content and the oil quality. Demulsification efficiency values higher than 90 % were obtained and the recovered oil was reused up to four times to extract Cr(VI) from simulated aqueous solutions with an extraction efficiency up to 99 %.



4. Conclusions - We can conclude that these results are very interesting for two reasons: firstly, the use of this method can be a way of pre-concentrate the Cr (IV) in aqueous solutions and facilitate its analysis in trace amounts and the possible recycling of these metallic species in the industrial process. Secondly, the fact of the use of a bio-sourced oil and the possibility of its reuse for several cycles.

5. References

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