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Fast and efficient chromium(VI) pertraction with Aliquat 336 in emulsion liquid membrane using sunflower oil as a high potential solvent

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ABSTRACT

In this work, pertraction of hexavalent chromium(Cr(VI)) from acidic aqueous solution by emulsion liquid membrane (ELM) using sunflower oil has been investigated. Sunflower oil was used as high potential, cost-effective and environmentally benign solvent in membrane phase. To prepare the primary emulsion, Span 80 as surfactant, Aliquat 336 as carrier and sodium hydroxide as internal stripping reagent were employed. The influences of various operational parameters such as initial pH of the feed phase solution, surfactant concentration, carrier concentration, mixing speed and treatment ratio on Cr(VI) pertraction were investigated and the optimal condition was determined. Results indicated that, at optimum condition, 99% of Cr(VI) ions could be extracted from acidic feed aqueous solution within 10 min in such a way that more than 94% of them were extracted within first 2 min. To evaluate the efficiency of sunflower oil, the effects of common petroleum diluents such as kerosene, toluene and butyl acetate are also tested and the overall mass transfer coefficient (K_{od}) in the water and oil layers at the external interface of emulsion drop was calculated. It was found that although mass transfer coefficient in sunflower oil–based ELM is lower than the others, its higher viscosity results in more stable membrane and higher extraction compared with the other solvents. Furthermore, an empirical correlation for prediction of emulsion globule size was proposed as a function of mixing speed. This paper demonstrates the feasibility of using eco-friendly, safe and cheap solvents for efficient pertraction of Cr(VI) from wastewater.

Keywords: Pertraction; Cr(VI); Emulsion liquid membrane; Sunflower oil; Green solvent; Mass transfer coefficients

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