ABSTRACT

Emulsion liquid membrane (ELM) has been proven to be a competent extraction technology to extract heavy metals or organic compounds from industrial wastewaters. In this process, a prepared emulsion is dispersed into a feed phase which contains the solute to be removed. Single stage operation and less power consumption make this technology more favorable over pressure-driven membrane process and solvent extraction. Despite its comparative advantages, ELM process suffers from emulsion instability and swelling under high shear and stress during extraction, causing breakage in the membrane. The instability and swelling of the emulsion allow extracted solute and internal reagent to mix with the feed phase, and hence the percentage removal efficiency of ELM reduces. Remedies such as adding more surfactants into the membrane phase, increasing the membrane viscosity and adding non-Newtonian fluid to enhance the stability were compromised with the removal efficiency.

In this work, ionic liquid $[BMIM]^+[NTf_2]^-$ acted as a stabilizer while kerosene, Span 80, TOMAC and NaOH were used to prepare an emulsion as solvent, surfactant, carrier, and internal reagent, respectively. The prepared emulsion was employed to extract Cr from the feed phase. For the optimization of the whole process, several experimental studies were carried out to investigate the effects of the following parameters: homogenization speed, carrier concentration, internal phase concentration, agitation speed, treat ratio, internal to membrane phase ratio, surfactant concentration, pH of the feed phase and $([BMIM]^+[NTf_2]^-$ concentration on the percentage removal of Cr. Statistical optimization and modelling of the process were accomplished by using Response Surface Methodology (RSM). The statistical and experimental optimized values of the parameters were in good agreement. Under optimum conditions, 97% Cr could be recovered.