CHAPTER 5

CONCLUSIONS

The present work focuses on the stability aspects of ELMs and, in this context, the experimental investigations identify the use of hydrophobic ionic liquid 1-butyl-3-methylimidazolium bis (trifluoromethylsulfonyl)imide, $[BMIM]^+[NTf_2]^-$ as a stabilizer with the preparation of the ELM containing TOMAC as a carrier. The enhanced stability of the ELM caused by the addition of $[BMIM]^+[NTf_2]^-$ could be explained by the strong interactions such as coulombic, dipolar and ionic interactions among the ionic liquids and NaOH. It was observed that the stability of the ELM could be enhanced for a duration of up to 7 h. Cr removal amounting to 80% could be achieved even after keeping the emulsion for 2 h before the extraction experiments were carried out. The sedimentation rate of the stabilized membrane for the next 3 h after its maximum stability time was found to be decreasing with an increase in the concentration of $[BMIM]^+[NTf_2]^-$ up to 3% (w/w). It started to increase with a further increase in the concentration of $[BMIM]^+[NTf_2]^-$. An empirical correlation relating the stability time of the emulsion as a function of $[BMIM]^+[NTf_2]^-$ concentration (% w/w) and the initial rate of sedimentation of the emulsion has been proposed. It was found that the predicted stability time is in good agreement with the experimental stability time. This work reflects the potential use of "task specific" ionic liquids as a stabilizer in the field of ELM.

Subsequently, various parameters such as 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 were individually optimized for experimental purposes. The pH of the feed phase was found to be a key factor for the separation of Cr as a Cr-carrier complex formation was dependent on the type of Cr ion present in the feed phase. Carrier concentration was found to be effective up to 3% (w/w) and the removal of Cr remained almost constant with a further increment. Ionic liquid $[BMIM]^+[NTf_2]^-$ hindered the mass transfer of Cr by its polymeric form but the effect was quite insignificant. Finally, 97% of Cr could be separated from the feed phase at the combined optimized conditions.

Modelling of the process was carried out by RSM using Design of Experiment software. Experimentally optimized parameters and RSM optimized parameters were in good agreement. The results showed that the model can be used to estimate the optimized values of the parameters and to achieve the maximum removal efficiency of Cr by ELM.

Overall, an efficient and highly stabilized ELM process was formulated by utilizing ionic liquid $[BMIM]^+[NTf_2]^-$ and a conventional solvent, surfactant and carrier. Since this study explores the potential application of $[BMIM]^+[NTf_2]^-$ as a stabilizer over conventional stabilizers which makes this technique cleaner and more environmental friendly, it is expected to draw a great amount of attention for further studies.