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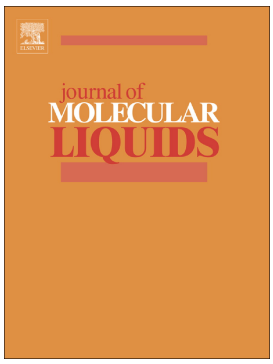

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Partitioning of perrhenate anion by aqueous two-phase systems using design of experiments methodology

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Abstract

Rhenium is a valuable metal in very low concentration and it is being increasingly used in industry due to its multiples properties, mainly in the aeronautics and oil industries. For this work, the PEG/$CuSO_4$ aqueous two phase system (ATPS) was used for the partition of perrhenate anion. For the partition tests the NH_4ReO_4 salt was used. The effects of temperature, pH, salt concentration, PEG concentration and their interactions on the partition were analyzed by using experimental design 2^k. Moreover, density, kinematic viscosity and sound velocity were determined for the top and bottom phases. The optimal conditions obtained by the model for the perrhenate partition in the ATPS formed by PEG and $CuSO_4$ were 13.7% PEG 4000 (w/w), 13% $CuSO_4$ (w/w) and 35 °C, obtaining a distribution coefficient, K_{ReO4-} , of 7.72 ± 0.31. Also, an increase of K_{ReO4-} with increasing PEG and $CuSO_4$ concentration was observed, i.e. their effects are significant on the perrhenate partition. On the other hand, the effects of temperature and pH do not have high significance on the partition. Of all the studied parameter, the pH had less significance on the partition. Thus, to simplify the statistical model the pH was not considered in the model.

For both phases, only density is inversely proportional to pH. With exception of the sound velocity of bottom phase all properties for both phases are inversely proportional to temperature. Moreover, all properties are proportional with the PEG and $CuSO_4$ concentrations in both phases.

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