



## Extraction of ethanol from aqueous solutions by emulsion liquid membrane: optimization of operating conditions and influence of salts in the feed phase

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### ABSTRACT

Extraction of ethanol from aqueous solutions with or without salts by emulsion liquid membranes (ELMs) was investigated. The important parameters governing the extraction behavior of ethanol were analyzed. These parameters were surfactant concentration and nature, type of diluents, volume ratio of membrane phase to internal phase, emulsification time, stirring speed and treat ratio. Excellent performances in terms of both extraction efficiency and kinetics were achieved by using a w/o (water-in-oil) emulsion formulated on the basis of Span80 as a surfactant, hexane as a diluent and distilled water as an internal phase. The highest ethanol extraction was obtained by using 8 wt% of Span 80, volume ratios of organic membrane phase to internal phase of 1 and of emulsion to external phase of 0.0667, an emulsification time of 10 min and a stirring speed of 400 rpm for an initial ethanol concentration in the external phase of 0.8 M. The ethanol extraction was close to 95% for a contact time of 8 min. It was observed that the presence of a salt in the external aqueous phase decreases the extraction efficiency of ethanol, and that this phenomenon depends on both salt nature and concentration. It was found that the lowering of the ethanol extraction efficiency follows the following order:  $\text{CaCl}_2 > \text{NaCl} > \text{KCl}$ , which was assigned to both osmosis phenomenon and co-transport of water by salt diffusion.

*Keywords:* Emulsion liquid membrane; Ethanol; Extraction; Salt effect; Span 80

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