Modeling of liquid-liquid extraction of salts between an aqueous phase and a microemulsion

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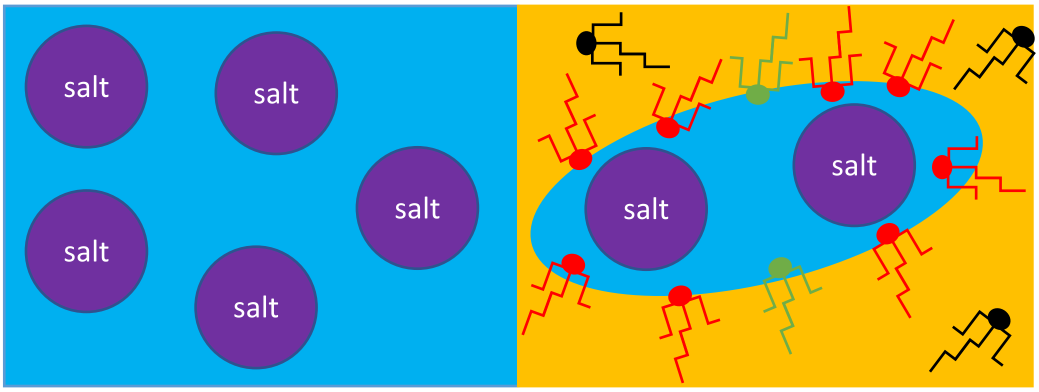

Liquid-liquid extraction with aqueous-organic solvents is widely used for extraction and separation of lanthanides. In particular, it is used in nuclear fuel-cycle management, with processes such as PUREX (Plutonium Uranium Reduction Extraction) and DIAMEX (DIAMide Extraction). In those processes, an acidic aqueous phase containing lanthanide ions is put in contact with a solvent phase containing an extracting agent similar to a water-in-oil microemulsion. The extractant must be soluble in the microemulsion in both monomeric and aggregated forms, but insoluble in the water phase. Once the phases are in contact, the extractant molecules make complexes where the lanthanide ions are extracted together with water and acid.

A theoretical model [1] is employed to study the system at the equilibrium. The extractant is considered to be present in the microemulsion in three forms: as a monomer, in aggregation on a film complexing a salt and in aggregation on a film not complexing a salt. In the current work, the model was used to calculate the concentration of acid extracted into the organic phase given an initial concentration of acid in the aqueous phase and a given concentration of extractants in the solvent phase. Different parameters of the model, such as the dissociation constant of the acid, the number of extractants participating in the aggregate and the critical aggregate concentration were fitted in order to interpret the experimental extraction isotherms reported by Dourdain and colleagues [2].

[1] S. Gourdin-Bertin, J. F. Dufrêche, M. Duvail, T. Zemb. *Solvent Extraction and Ion Exchange*, **2022**, *40(1-2)*, 28-63.

[2] S. Dourdain, C. Déjugnat, L. Berthon, V. Dubois, S. Pellet-Rostaing, J. F. Dufrêche, T. Zemb. (2014). *Solvent Extraction and Ion Exchange*, **2014**, *32(6)*, 620-636.