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Study of Chemical Speciation in Solution with Liquid-LiquidElectrochemistry

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Topic: Old Elements, New Technologies: how to improve the quality of life

Abstract:

The study of ion transfer processes between two immiscible liquid phases is of great importance in different fields, such as chemical analysis, electrocatalysis and liquid|liquid extraction [1]. In this context, electrochemical techniques are very powerful, since the liquid|liquid interface can be externally polarized and the flux of ions can be controlled in a fast, simple and economic way[2]. In addition, the interface can be considered as a simple model for the ion transport through biological membranes. Thus, one of the parameters that can be extracted experimentally is the lipophilicity of the species, which is of great relevance in the design of new drugs [3].

Ion transfer processes are usually affected by chemical reactions in solution that define the stability and reactivity of the species[4]. In this communication, the ACDT (aqueous complexation-dissociation coupled to transfer) mechanism of ion transfer is discussed (Figure 1). In this scheme, two ionic species (X and XL) can be transferred from water to an organic solution while they interconvert each other in the initial phase with another species (L). This situation can correspond, for example, with the transfer of two chemical species in presence of a neutral or charged ligand.

Simple analytical equations are reported for the study of the ACDT mechanism with different electrochemical techniques at macro, micro and nanointerfaces. These equations enable us to perform an analysis of the influence of the chemical kinetics and thermodynamics and the mass transport on the partition and distribution of ionic species. Thus, diagnosis criteria and methodologies are proposed for the quantitative characterization of the ACDT mechanism. The conclusions reached have a potential impact on speciation studies, such as the determination of the (bio)availability of metal complexes and the evaluation of the toxicity of an element.

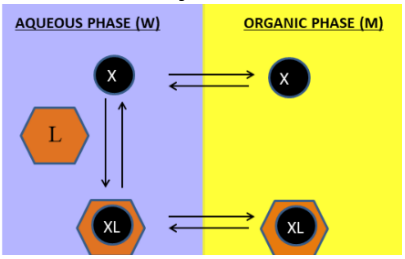

Figure 1. ACDT mechanism of ion transfer.

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