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Determination of the speciation and bioavailability of Indium with electroanalytical techniques

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Indium is one of the metallic elements that causes significant environmental concern due to its toxicity, as well as acute and chronic poisonings when builds up in the body [1]. Therefore, it is very critical to be able to precisely determine its presence and its various chemical forms in various medias. Despite intensive work, Ion selective electrodes (ISE) for Indium are not commercially available. The main goal of this thesis is to investigate the capacity of the electroanalytical technique AGNES (Absence of Gradients and Nernstian Equilibrium Stripping) in determining free Indium concentration in synthetic aqueous solutions. The hypothesis is that AGNES is a suitable technique for determining In^{+3}, since Indium is an amalgamating element and has a negative standard redox potential [2]. To evaluate the speciation of Indium using AGNES, ligands such as Nitrilotriacetic acid (NTA) and Oxalate are used in this study. The lability degree of Indium is obtained through a novel technique named accumulation under diffusion limited conditions (ADLC). The free concentrations of Indium in precipitated solutions are measured at pH values in the range 5 to 6, reaching the picomolar range. A comparison between the measurements of AGNES and the predictions of VMINTEQ 3.1 is carried out for accuracy validation. When dealing with the system In-NTA, models reported by Harris et al. [3] and Biver et al. [4] are in good agreement with AGNES measurements if the proportion of Ligand:Metal is less than 1:1. In the cases that this proportionality reaches 1:1 or when the total ligand concentration is higher than that of Indium, Harris predictions are significantly lower. The high lability and mobility of the In-Oxalate complex at pH 3 allow measurements below nanomolar in just 25 seconds, instead of the needed deposition time of around 3000000 s expected for a totally inert system. Finally, the kinetics and equilibrium dissolution of Indium nanoparticles (In_2O_3) is studied by measuring its free form in synthetic seawater solutions at pH 8 and for dispersions that contain KNO_3 0.1M at pH 2 to 5. If we change the pH from 3 to 4, the free concentration at higher pH shifts to its equilibrium value with In hydroxides. However, no anodic stripping voltammetry peak for Indium is seen when nanoparticles are dispersed in synthetic seawater solutions at pH 8.

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References

1.- White, S. J., & Hemond, H. F. (2012). Environmental Science and Technology, 42: 155-186.

2.- Galceran, J., Huidobro, C., Companys, E., & Alberti, G. (2007). Talanta, 71: 1795-1803.

3.- Harris WR, Chen Y, Wein K. (1994). Inorg Chem; 33: 4991-4998.

4.- Biver T, Friani R, Gattai C, Secco F, Tine MR. (2008). J Phys Chem B, 112: 12168-12173.