EuroSciCon

7th Edition of International Conference and Exhibition on

Separation Techniques

July 05-07, 2018
Berlin, Germany

Axel Vansteene, Arch Chem Res 2018, Volume 2
DOI: 10.21767/2572-4657-C3-008

A MICROFLUIDIC TOOL FOR THE INVESTIGATION OF LIQUID-LIQUID EXTRACTION KINETICS

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Techniques devoted to liquid-liquid extraction kinetics studies have seen a tremendous development in the last decades. Various contactors, including Lewis-type cells, moving drops, and Rotating Membrane Cells (RMC) are used. However, these standard methods suffer from major drawbacks, i.e. poor definition of the diffusing films thickness at the liquid-liquid interface 1, large volumes of solvents and reagents needed, and potential effect of the membrane in RMC technique. In order to decrease the manipulated quantities of reagents and control accurately the specific interfacial area, segmented flow in microsystems were investigated as a new tool to determine kinetics of liquid-liquid extraction. Indeed, internal mixing of the solutes and complexes within the dispersed and continuous phases is ensured by both diffusion at small scale (microchannels width < 100 µm) and recirculation circles2. Therefore, the kinetics of the extraction of a well-known chemical system (Eu(III) by the N,N'-dimethyl N,N'-dibutyl tetradecylmalonamide, in nitric media) was studied. The determined value of pseudo-kinetic mass transfer coefficient K (m.s-1) is in good agreement with the values obtained with standard techniques, including Nitsch cell3 and RMC4. Then, the use of segmented flow microfluidics should therefore be considered in the future of liquid-liquid extraction kinetics studies.

Recent Publications

1. **Danesi, P. R., Solvent Extraction Kinetics. In Solvent Extraction Principles and Practice, New York, 2004; pp 203-251.**
2. **Burns, J. R.; Ramshaw, C., The intensification of rapid reactions in multiphase systems using slug flow in capillaries. Lab Chip 2001, 1 (1), 10-5.**
3. **Weigl, M.; Geist, A.; Gompper, K.; Kim, J.-I., Kinetics of Lanthanide/Actinide Co-Extraction with N,N'-Dimethyl-N,N'-Dibutyltetradecylmalonic Diamide (Dmdbtdma). Solvent Extraction and Ion Exchange 2001, 19 (2), 215-229.**
4. **Simonin, J. P.; Perrigaud, L.; Perrigaud, K.; Vu, T., Kinetics of Liquid/Liquid Extraction of Europium(III) Cation by Two Malonic Diamides. Solvent Extraction and Ion Exchange 2014, 32 (4), 365-377.**

Biography

Axel Vansteene, PhD student at CEA Saclay, grew up in France and received both a bachelor's degree from Paris Chemistry Engineering School and a Bachelor's degree in nuclear engineering from INSTN in 2015. Before his graduation, he joined Reiner's Lab at Memorial Sloan-Kettering Cancer Centre in New York, in order to develop radioactive tumor tracers for PET imaging. He joined Mariet's Microfluidics Lab in November 2015, to pursue a PhD thesis in the development of microsystems for the liquid-liquid extraction of radioactive compounds. Research interests are radiochemistry, liquid-liquid extraction, microfluidics, computational fluid dynamics (CFD)

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