Accepted Manuscript

Review

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PII: S1385-8947(18)31442-6
DOI: https://doi.org/10.1016/j.cej.2018.07.193
Reference: CEJ 19591

To appear in: *Chemical Engineering Journal*

Received Date: 15 December 2017
Revised Date: 8 July 2018
Accepted Date: 29 July 2018

Please cite this article as: Y. He, K. Chen, C. Srinivasakannan, S. Li, S. Yin, J. Peng, S. Guo, L. Zhang, Intensified extraction and separation Pr (III)/Nd (III) from chloride solution in presence of a complexing agent using a serpentine microreactor, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.07.193

Intensified extraction and separation Pr (III)/Nd (III) from chloride solution in presence of a complexing agent using a serpentine microreactor

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Abstract: The extraction and separation of Pr/Nd from chloride solution containing a complexing agent lactic acid (HLac) is assessed in the intensified serpentine microreactor using 2-ethylhexyl phosphoric acid-2-ethylhexyl ester (EHEHPA, P507) as the solvent phase. The investigations were carried out in micro channels having width of 0.3 mm to 1 mm different phase flow rates forming slug flow with the aqueous solution as the dispersed phase. Extraction and separation of Pr/Nd increased with increase in residence time, while decreased with increase in linear velocity and channel width. A better separation factor of 2.23 could be achieved in microfluidic extractor within 12 s of residence time, while only a separation factor of 2.19, could only be achieved for batch extractor, at a residence time 560 s. The overall volumetric mass transfer coefficient (k_La) was found to increase with increasing linear velocity, decrease in the channel width and decrease with channel length. The k_La of liquid–liquid microfluidic system was several orders of magnitude higher than the conventional extractors (1.01×10^{-2}-4.65×10^{-2} s^{-1}), due to the decreased diffusion path and larger surface-to-volume ratio of microfluidic extractors.

Keywords: Pr (III)/Nd (III); Extraction and separation; Mass transfer; Microreactor

1. Introduction

Rare earths elements have gained considerable attention due to their unique properties and extensive applications in many fields, especially in metallurgy, chemical engineering and nuclear fuel control, etc. Neodymium (III), as one of the most abundant rare earths, used in manufacture of