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Optimization of Samarium Extraction via Nanofluid-Based Emulsion Liquid Membrane Using Cyanex 272 as Mobile Carrier

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Abstract : Samarium as a rare-earth element is playing a growing important role in high technology. Traditional methods for extraction of rare earth metals such as ion exchange and solvent extraction have disadvantages of high investment and high energy consumption. Emulsion liquid membrane (ELM) as an improved solvent extraction technique is an effective transport method for separation of various compounds from aqueous solutions. In this work, the extraction of samarium from aqueous solutions by ELM was investigated using response surface methodology (RSM). The organic membrane phase of the ELM was a nanofluid consisted of multiwalled carbon nanotubes (MWCNT), Span80 as surfactant, Cyanex 272 as mobile carrier, and kerosene as base fluid. 1 M nitric acid solution was used as internal aqueous phase. The effects of the important process parameters on samarium extraction were investigated, and the values of these parameters were optimized using the Central Composition Design (CCD) of RSM. These parameters were the concentration of MWCNT in nanofluid, the carrier concentration, and the volume ratio of organic membrane phase to internal phase (Roi). The three-dimensional (3D) response surfaces of samarium extraction efficiency were obtained to visualize the individual and interactive effects of the process variables. A regression model for % extraction was developed, and its adequacy was evaluated. The result shows that % extraction improves by using MWCNT nanofluid in organic membrane phase and extraction efficiency of 98.92% can be achieved under the optimum conditions. In addition, demulsification was successfully performed and the recycled membrane phase was proved to be effective in the optimum condition.

Keywords : Cyanex 272, emulsion liquid membrane, MWCNT nanofluid, response surface methology, Samarium
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