

Techno-economic assessment of the separation of samarium, europium and gadolinium

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ABSTRACT

Spiking of the rare earth demand and price globally has put tremendous pressure to look for a new alternative in extractant that could provide better separation and higher output, yet with minimal cost. This work aimed to perform the techno-economic assessment on the new extractant against the conventional extractants; DEHPA and 2-ethylhexyl phosphoric acid-2-ethylhexyl ester (EHEHPA) in pursuance of evaluating the feasibility of these extractants on an industrial scale. This work focused on a recent extractant type, which incorporates two common extractants and produces a bifunctional ionic liquid called [A336][DEHPA]. It is a mixture of Aliquat 336 (A336) and di-(2-ethylhexyl)phosphoric acid (DEHPA) through acid/base neutralization. Previously, [A336] [DEHPA] has shown good extraction capabilities with low extraction stages in the separation of samarium, europium, and gadolinium. EHEHPA has been selected as the baseline using the information from the literature. The assessment is divided into two scenarios; 1) the separation of samarium from the middle rare earth concentrate and 2) the separation of europium and gadolinium. The analysis outcome reveals that for both scenarios, DEHPA manages to provide 99.9% purity and 90% recovery of rare earth with lower investment compared to the EHEHPA. Although the [A336][DEHPA] could provide an environmental-friendly option, the enormous expenses make the process infeasible.

Keywords: Samarium, Europium, Gadolinium, Techno-economic assessment, Extraction

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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