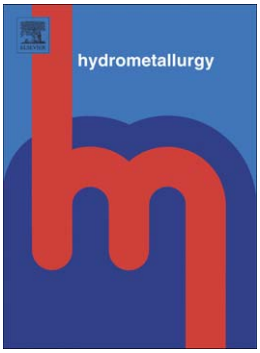

Extraction and separation of trivalent rare earth metal ions from nitrate medium by *p*-phosphonic acid calix[4]arene

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Extraction and separation of trivalent rare earth metal ions from nitrate medium by *p*-phosphonic acid calix[4]arene

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Abstract In the present work, the extraction behavior of lanthanides (except Pm) with calix[4]arene tetraphosphonic acid (H_4**L**) in chloroform was studied from nitrate medium. The stoichiometry of the extracted species of lanthanides was determined based on the slope analysis method. Equilibrium constants and thermodynamic functions ΔH, ΔG and ΔS were evaluated. Furthermore, the separation factors between adjacent rare earths were calculated, which indicated that the present extractant shows some potential in the single rare earth separation. The stripping of Yb was studied.

Keywords: Rare earths; Solvent extraction; Separation; Calix[4]arene tetraphosphonic acid

1. Introduction

Rare earths are a kind of important elements for the high technology and advanced materials. Due to the increasing demand for the high purity rare earths, the separation and purification of these elements have attracted considerable attentions (Xie et al., 2014). There are many separation methods for rare earths, among which solvent extraction has developed into a major technique in industry due to its advantages such as high separation efficiency, large selectivity and flexibility, straightforward continuous operation and simple equipment. Various extractants were developed to extraction and separation of rare earths (Liu et al., 2008; Banda et al., 2012; Jia et al., 2009; Song et al., 2009; Sun et al., 2014), among which organophosphorus compounds such as di-(2-ethylhexyl) phosphate (D_2EHPA) (Sivaraman et al., 2002), 2-ethylhexyl phosphonic acid mono-2-ethylhexyl ester (HEHEHP) (Kubota et al., 1993), di-(2,4,4-trimethylpentyl) phosphinic acid (Cyanex272) (Xiong et al., 2005), bis(2,4,4-trimethylpentyl) monothiophosphinic acid (Cyanex302) (Tong et al., 2009) were proved to be a kind of efficient extractants for rare earth separation. Notably, HEHEHP shows higher separation factor for the adjacent rare earths and larger extraction capacities so that it has attracted much attention (Kubota et al., 1993;

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