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Chenglong Shi, Yan Jing, Jiang Xiao, Xingquan Wang, Yongzhong Jia

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Liquid-liquid extraction of lithium using novel phosphonium ionic liquid as an extractant

Chenglong Shi[a,b,c], Yan Jing[a,b], Jiang Xiao[a,b,c], Xingquan Wang[a,b,c], Yongzhong Jia[a,b*]

[a] Qinghai Institute of Salt Lakes, Chinese Academy of Sciences, 810008, Xining, China

[b] Key Laboratory of Comprehensive and Highly Efficient Utilization of Salt Lake Resources, Chinese Academy of Sciences, 810008, Xining, China

[c] University of Chinese Academy of Sciences, 100049, Beijing, China

Abstract

A novel phosphonium ionic liquid (IL), tetrabutylphosphonium bis(2,4,4-trimethylpentyl)phosphinate([P_{4444}][BTMPP]), was prepared and characterized by NMR spectroscopy. The solvent extraction behavior of lithium from aqueous solution by this IL in toluene was investigated. The extraction behavior was carried out as a function of various parameters such as aqueous acidity, temperature and extractant concentration. The extraction efficiencies obtained in [P_{4444}][BTMPP] were compared with those observed in molecular extractant bis(2,4,4-trimethylpentyl) phosphinic acid (HBTMPP), from which the anion of the ionic liquid extractant was prepared. The extraction efficiency for extraction of lithium by [P_{4444}][BTMPP] was much higher than that for extraction by HBTMPP. The extracted species were ascertained from slop analysis method which indicated 1:1 (metal : ligand) ratio in the complex. In addition, the effects of thermodynamic parameters, the stripping of lithium from the ionic liquid, and the reusability of the phosphonium ionic liquid were studied in detail.

Keywords: Lithium; Solvent extraction; Ionic liquid