Supplementary Materials for

Separation of cesium and rubidium from solution with high concentration of potassium and sodium

Xie Junjie[1], Li Kang[1], Shi Zhuonan[1], Min Changli[1], Li Shina[2*], Yin Zichen[1] and Ma Ruixin[1,3*]

1 School of Metallurgical and Ecological Engineering, University of Science and Technology Beijing, Beijing; 100083, China

2 Tianjin Research Institute of Water Transport Engineering, Ministry of Transport, Tianjin; 30000, China

3 Beijing Key Laboratory of Special Melting and Preparation of High-end Metal Materials, Beijing; 100083, China

Mailing address: 30 Xueyuan Road, Haidian District, Beijing 100083, China

**Corresponding Authors: maruixin@ustb.edu.cn.*

The SI file includes:

- Table S1.

Table S1. The top ten journal articles that related to the separation of cesium and rubidium in recent year.

EXTRACTION CONDITIONS	RESEARCH CONTENTS	EXTRACTION EFFICIENCY	REFERENCES
0.46 G/L CS; 2.66 G/L RB; 17.84 G/L K	Separate Cs from Rb,K	Cs: 99.2%; Rb:10.44%	[1]
0.24 G/L CS; 10.26 G/L RB; 40.74G/L K	Separate Rb from K	Rb: 97.02%; K:17.28%	[2]
0.34 G/L CS; 6 G/L RB 22.89 G/L K	Separate Cs from Rb,K	Cs: 99.18%; Rb:15.78%; K:0.5%	[3]
5.12 G/L RB; 22.78 G/L K;	Separate Rb from K	Rb:99.07%; K:18.84%	[4]
21.5 MG/L CS; 206.7 MG/L RB	Separate Cs and Rb from K	Cs: 99.1%; Rb: 86.5%	[5]
2 MG/L CS; 20 MG/L RB	Separate Cs and Rb from K	Rb: 95.04%; Cs: 99.80%	[6]
20 MG/L CS; 200 MG/L RB	Separate Cs and Rb from K	Cs:99.06%; Rb:99.14%; K:19.4%	[7]
200×10^{-6} MOL/L RB	Separation of Rb	Extraction equilibrium constant $K_{Rb}=3.44\times10^{-12}$ L/mol	[8]
0.47 G/L RB; 15.55 G/L K	Separate Rb from K	Rb: 98%	[9]
113.7 MG/L CS; 101.3 MG/L RB; 10.57 G/L K	Separate Cs and Rb from K	Rb: 84.11%; Cs: 94.99%	[10]

Reference

[1] Zhang XF, Qin ZF, Aldahri T, Rohani S, Ren S, Liu WZ. Separation and recovery of cesium sulfate from the leach solution obtained in the sulfuric acid baking process of lepidolite concentrate. Hydrometallurgy. 2021;199:105537. https://doi.org/10.1016/j.hydromet.2020.105537.

[2] Zhang XF, Qin ZF, Aldahri T, Ren S, Liu WZ. Solvent extraction of rubidium from a sulfate solution with high concentrations of rubidium and potassium using 4-tert-butyl-2-(α-methylbenzyl)-phenol. J Taiwan Inst Chem E. 2020;116:43-50. https://doi.org/10.1016/j.cplett.2018.10.021.

[3] Lv YW, Ma BZ, Liu YB, Wang CY, Zhang WJ, Chen YQ. Selective extraction of cesium from high concentration rubidium chloride leach liquor of lepidolite. Desalination. 2022;530:115673. https://doi.org/10.1016/j.desal.2022.115673.

[4] Lv YW, Liu YB, Ma BZ, Wang CY, Chen YQ. Preferential extraction of rubidium from high concentration impurity solution by solvent extraction and preparation of high-purity rubidium salts. Desalination. 2023;545:116162. https://doi.org/10.1016/j.desal.2022.116162.

[5] Zhang JF, Yang LR, Dong TT, Pan F, Xing HF, Liu, HZ. Kinetics-Controlled Separation Intensification for Cesium and Rubidium Isolation from Salt Lake Brine. Ind Eng Chem Res. 2018;57:4399-4406. https://doi.org/10.1021/acs.iecr.7b04820.

[6] Liu SM, Liu HH, Huang YJ, Yang WJ. Solvent extraction of rubidium and cesium from salt lake brine with t-BAMBP-kerosene solution. Trans Nonferrous Met Soc China. 2015;25(1):329-334. https://doi.org/10.1016/S1003-6326(15)63608-1.

[7] Li Z, Pranolo Y, Zhu ZW, Cheng CY. Solvent extraction of cesium and rubidium from brine solutions using 4-tert-butyl-2-(α-methylbenzyl)-phenol. Hydrometallurgy. 2017;171:1-7. https://doi.org/10.1016/j.hydromet.2017.03.007.

[8] Wang JW, Che DH, Qin W. Extraction of rubidium by t-BAMBP in cyclohexane. Chinese J Chem Eng. 2015;23(7):1110-1113. https://doi.org/10.1016/j.cjche.2015.04.005.

[9] Xing P, Wang GD, Wang CY, Ma BZ, Chen YQ. Separation of rubidium from potassium in rubidium ore liquor by solvent extraction with t-BAMBP. Miner Eng. 2018;121:158-163. https://doi.org/10.1016/j.mineng.2018.03.014.

[10] Huang DF, Zheng H, Liu ZY, Bao AM, Li B. Extraction of rubidium and cesium from brine solutions using a room temperature ionic liquid system containing 18-crown-6. Pol J Chem Technol. 2018;20(2):40-46. https://doi.org/10.2478/pjct-2018-0021.