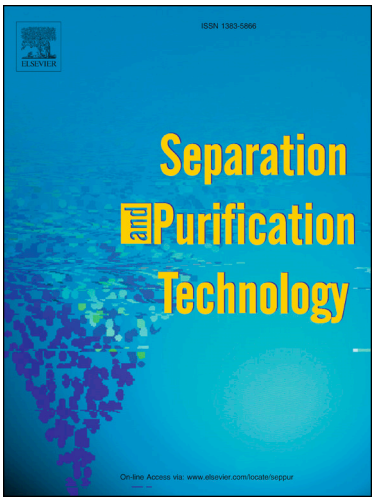

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Guiqing Zhang, Qiang Wang, Wenjuan Guan, Li Zeng, Qinggang Li, Zuoying Cao, Liansheng Xiao, Qin Zhou

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Batch preparation of ammonium isopolymolybdate solution from ammonium molybdate solutions using bipolar membrane electrodialysis

Guiqing Zhang [1, 2], Qiang Wang [1, 2], Wenjuan Guan [1, 2,3*], Li Zeng [1, 2], Qinggang Li [1, 2], Zuoying Cao [1, 2], Liansheng Xiao [1, 2], Qin Zhou [1, 2]

1. School of Metallurgy and Environment, Central South University, Changsha 410083, China;

2. Key Laboratory of Metallurgical Separation Science and Engineering, Central South University, Changsha 410083, China

3. Department of Materials Engineering, University of British Columbia, 309-6350 Stores Road, Vancouver, BC V6T 1Z4, Canada

Abstract: The disadvantage of the traditional ammonium tetramolybdate (ATM) production process is a large consumption of nitric acid. Therefore a novel process for the generation of ammonium isopolymolybdate solution from ammonium molybdate solution using bipolar membrane electrodialysis (BMED) was developed and the batch experiment was carried out in this paper. The BMED process was studied to optimize various parameters such as initial base solution, final electrolytic pH value of salt solution, current density, initial NH_4HCO_3 concentration of base solution and Mo concentration in feed solution. The average current efficiency was 82%, the power consumption was 0.058 kWh/mol NH_4^+ or 0.887 kWh/mol Mo, and the recovery rate of Mo reached 99.4% under the optimal conditions of a current density of 500 A/m^2 , an initial Mo concentration of 173 g/L in the salt compartment, an initial NH_4HCO_3 concentration 2.0 mol/L in the base compartment, an initial $(NH_4)_2CO_3$ concentration of 1.0 mol/L in the electrode solution and 32 ± 0.5 °C and a final solution pH of 4.0 in the salt compartment .

Key words: ammonium isopolymolybdate solution; ammonium molybdate solution; bipolar membrane; electrodialysis

1 Introduction

Ammonium tetramolybdate ($(NH_4)_2Mo_4O_{13}·2H_2O$, ATM) is one of the most important intermediate products in the metallurgy of molybdenum. It can not only be used to produce high-purity ammonium dimolybdate and ammonium paramolybdate but also molybdenum powder and molybdenum wire directly [1].

Currently, the ammonium tetramolybdate production process widely used in the industrial is acid precipitation crystallization [2,3]. In this process, ammonium molybdate solution is used as feed solution. The pH of ammonium molybdate solution is adjusted to 1.5-2.0 by adding inorganic acid so that most of molybdenum in the solution precipitates as ammonium tetramolybdate while most of the impurities remain in the crystallization mother solution. The common inorganic acids, such as nitric acid, sulfuric acid and hydrochloric acid, can be used as acid adjusting reagents. The nitric acid is the most widely used in the industry because it has the following advantages: (1) no introduction of impurities such as Cl and S into the ATM products; (2) prevention of the generation of the molybdenum blue in the crystallization process as it is a strong oxidant; (3) less corrosive compared to hydrochloric acid [4]. The crystallization rate of Mo can reach 95% using ammonium molybdate solution with specific gravity of 1.16-1.20 under pH value 2-2.5 at

*Corresponding author at: School of Metallurgy and Environment, Central South University, Changsha 410083, China.
Tel:+86 0731 88830472.
E-mail address：guanwenjuan1985@163.com (W. Guan)