Fe3O4-loaded Ion Exchange Resin for Chromatographic Separation of Boron Isotopes: Experiment and Numerical Simulation

Guo Xianghai[1], Qingfeng Wang[1], Tao Chen[1], Peng Bai[1], and Jiafei Lyu[1]

[1]Tianjin University

August 31, 2020

Abstract

Fe3O4-loaded ion exchange resin composites (Fe3O4@Resin) were optimally constructed through ion exchange and co-precipitation of Fe2+ and Fe3+ on strong acid ion exchange resin. The as-synthesized Fe3O4@Resin composite was sophisticatedly characterized and investigated for 10B/11B separation including effect of pH, kinetics and isotherms through batch adsorption experiment which can be well described by pseudo-second order kinetics and Langmuir model. In the chromatographic column packed with Fe3O4@Resin, 10B was selectively retained with a high dynamic separation factor of 1.312. Considering the consistency between simulated and experimental breakthrough curves within Fe3O4@Resin packed column, chromatographic 10B/11B separation performance was simulated under various conditions which were further optimized by response surface methodology method. Consequently, the annual yield of 10B reached the maximum of 612 g with feed concentration of 7.567 g·L-1, flow rate of 38.57 mL*min-1, the length of column of 45 cm. In addition, five-cycle adsorption/regeneration experiments indicated its merit of reusability.

Hosted file

`Manuscript.doc` available at https://authorea.com/users/354910/articles/478377-fe3o4-loaded-ion-exchange-resin-for-chromatographic-separation-of-boron-isotopes-experiment-and-numerical-simulation