Removal of tripolyphosphate from water by ion exchange resins

Mustafa Ali Güngör, Özgür Özalp, Ö zgür Arar*

Faculty of Science, Department of Chemistry, Ege University, Izmir 35100, Turkey, Tel. +902323112389, email: m.aligungor1994@gmail.com (M.A. Güngör), ozgur.ozalp55@gmail.com (Ö. Özalp), ozgur.arar@ege.edu.tr, ozgurarar@gmail.com (Ö. Arar)

Received 18 July 2017; Accepted 16 September 2017

ABSTRACT

In this paper, two different ion-exchange resins namely strongly basic Purolite A420S and hybrid anion exchange resin infused with iron oxide, Purolite FerrIX A33E, were evaluated for the removal of tripolyphosphate (TPP) from an aqueous medium. Resins were compared in terms of their TPP removal capacity, kinetics, and regeneration efficiency under batch conditions. The results of batch experiments show that the maximum adsorption capacities were 256.91 mg-TPP/g-resin for A420S and 222.32 mg-TPP/g-resin for FerrIX A33E resin. The sorption kinetics of TPP onto A420S is well governed by the pseudo-first-order kinetic model, and pseudo-second-order model for FerrIX A33E resin. Sorption isotherm data were well described by the Langmuir model for the resins. The regeneration studies were also examined for such resins and obtained results showed that FerrIX A33E resin can be fully regenerated with 1 M NaCl and A420S resin can be regenerated with 4 M HCl with 95% efficiency. It was also found that, the percentage removal of TPP was maintained at more than 85% as compared to the initial value, even after five sorption–regeneration cycles. Thermodynamic studies showed that the sorption of TPP onto ion exchange resins is an exothermic process. The negative values of free energy change ($\Delta G^o$) indicate the spontaneous nature of the sorption process.

Keywords: Anion exchange resin; Hybrid anion ion exchange resin; Purolite A420S; Purolite FerrIX A33E; Tripolyphosphate