261b Removal of Arsenic and Chromium Ions from a Mixed Aqueous Solution Using a Continuous, Hybrid Field-Gradient Magnetic Separation Device

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A continuous flow colloidal affinity magnetic separation device is used for the removal of mixture of As(V) and Cr(VI) ions from an aqueous solution. The removal from a mixture containing equal concentrations of As(V) and Cr(VI) was compared with the elimination of these ions when only one cation was present. The adsorption isotherms are determined with Orica MIEX® magnetic ion-exchange resin-coated particles. Beginning with a solution containing 30ppm of ions, 58.3% of Cr(VI) or 37.6% of As(V) was removed in a single pass through the system. In the mixture, 53% of Cr(VI) and 33.3% of As(V) was removed. This selective removal of Cr(VI) from the mixture is consistent with the presence of a higher concentration of the higher valence ion in the proximity of a charged (ion-exchange) surface. Feed flow rates and magnetic particle loading have been varied to allow maximum removal in a single stage. The maximum removal is limited only by the adsorption kinetics of ions on the particle surface. The magnetic resin particles were regenerated with 1M NaCl solution; regeneration efficiency was more than 75% forall the cases. The MIEX® particles have a mean diameter of 180μm, with pores revealed by scanning electron microscopy. They are paramagnetic , with a saturation magnetization of 17 EMU/g. The magnetic potential energy at saturation is orders of magnitude higher than thermal energy, implying that the particles will ‘chain' at these high field strengths. The lack of residual magnetization at zero field allows these particles to be reused after regeneration.