

Sorption of arsenate by stannum(IV)-exchanged zeolite P

ABSTRACT

Zeolites are crystalline, hydrated aluminosilicate containing exchangeable alkaline and alkaline earth cations in their structural frameworks. Previous studies have shown that modification of zeolites with an active metal cations yield sorbents with a strong affinity for certain anions. Recently hydrous tin oxide was found effective to remove arsenic anions from aqueous solution. In this study, sodium ion of zeolite P was exchanged with stannum(IV) and used for sorption of arsenate (As(V)) ion. Among parameters investigated were effect of pH, As(V) initial concentrations, contact time, temperature and effect of foreign ions. The results show that As(V) sorption by stannum(IV) exchanged zeolite P (SnZP) was maximum at about pH 2. The sorption capacities increase with increasing initial As(V) concentrations and follows Langmuir model with maximum sorption capacity of 83.33 mg/g at 25°C. The sorption capacity of As(V) by SnZP increased as temperature increases from 25 to 70°C showing that the process is endothermic with ΔH° value of 83.84 kJ mol⁻¹. The free energy change (ΔG°) for the sorption was negative showing that the sorption of As(V) ions is spontaneous. The kinetics study shows that the As(V) sorption follows second order kinetic model. The free energy (E) was 12.91 kJ mol⁻¹ which shows the sorption is an ion-exchange process. The As(V) sorption by SnZP was not affected by the presence sulphate, chloride, nitrate and carbonate but was significantly reduced by phosphate.

Keyword: Stannum-exchanged zeolite P; Arsenic removal; Kinetic; Thermodynamic