Synthesis and application of functionalized nano silica for Ag(II) ions sequestration

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ABSTRACT

This paper communicates the synthesis of a new functionalized adsorbent and its applications as an efficient extractant for economically important Ag(II) metal. The functionalized adsorbent is synthesized through covalent attachment of a chelating compound thiosemicarbazide to the silica surface through modification route. Various characterization techniques such as Fourier transform infrared spectroscopy, Thermogravimetric analysis and Energy-dispersive X-ray spectroscopy confirmed that the ligand is successfully attached to the silica surface. The performance of the synthesized adsorbent is evaluated in batch adsorption experiments using radiotracer procedure. Rate transfer and thermodynamic factors are studied to ensure the practical use of the adsorbent for Ag(II) ions removal. The adsorption of Ag(II) followed first-order rate equation and is controlled by surface and intraparticle diffusions. Thermodynamic studies revealed that the Ag(II) adsorption is spontaneous (ΔG = −5,639.32 J/mol) and favorable (ΔS = 85.08 J/mol K). The equilibrium adsorption data followed Langmuir, Freundlich and D–R equations and from these models ion-exchange parameters are computed. The sorbent can be easily regenerated and used several times for Ag(II) ions adsorption.

Keywords: Thiosemicarbazide; Covalent modification; Nano silica; Radiotracer; Adsorption models