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Synthesis and Characterization of a Composite Polymeric Material Including Chelating Agent for Adsorption of Uranyl Ions

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Highlights

- A new adsorbent including a powerful chelating was developed for effective uranyl.
- Characterization was carried out by FTIR, EDX, SEM, UV-VIS-NIR, and PZC technical.
- As we know, this is the first application for grafting of CCA to a polymeric matrix.
- CCA-g-PAA can be used as potential adsorbent for removal or pre-concentration of uranyl.

Abstract

In this study, a versatile polymeric material was synthezed by grafting Calcon Carboxylic Acid (CCA), which is known as a chelating agent for some metal ions, to polyacrylamide (PAA) structure. Thus, the adsorptive properties of inert PAA polymer were significantly improved owing to this procedure. The obtained new material, CCA-g-PAA, was characterized by point zero charge (PZC), FTIR, SEM, and UV-VIS-NIR analysis. The adsorption properties of new material were investigated comprehensively and experimental variables were optimized such as pH, temperature, time, and concentration. Experimental data were evaluated by using therotical adsorption models. The maximum adsorption capacity of material was calculated as 0.079 mol kg^{-1} by considering Langmuir equation. The constants calculated from Freundlich and DR model were found as 6.98 and 0.441, respectively. Adsorption kinetic was also explained with pseudo second order and intra particular diffusion models. Experimental studies were showed that adsorption was endothermic and occured spontaneously. The developed material has important advantages such as reusability, cost-effective synthesis procedure, high adsorption capacity, and selectivity.

Keywords: Uranyl; adsorption; polyacrylamide; calcon carbocylic acid

1. Introduction

Needs for new energy sources have a vital importance in the developing countries since industrial evaluation. Conventional energy sources including crude oil cause seriously