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Sorption profile of uranium (VI) from aqueous medium onto 3-*O*-acetyl-(*S*)-1,2-*O*-trichloroethylidene-5,6,8-trideoxy-α-D-*xylo*-oct-5(*E*)-eno-1,4-furano-7-ulose (OASOTCETDOXDXOEEFU)

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HIGHLIGHTS

- Monoen based organic adsorbent was used for removal of U(VI).
- The adsorbent material was characterized by SEM and FTIR.
- The experimental isotherm data of U(VI) sorption were examined using several models.
- The adsorbent can be used as economic and low-risk sorbent material.

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ABSTRACT

Adsorption of uranyl ions onto 3-*O*-asetil-(S)-1,2-*O*-trikloroetiliden-5,6,8-trideoksi-α-D-*ksilo*-okt-5(E)-eno-1,4-furano-7-uloz (OASOTCETDOXDXOEEFU) from aqueous solutions was investigated in batch adsorption experiments. The study has been conducted to investigate the effects of the pH of solution, contact time, initial concentration and temperature for adsorption process. The maximum removal of U(VI) was found to be about 55% at pH 4.0 and initial U(VI) concentration of 50 mg L^{-1}. The organic adsorbent material was characterized by Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). The experimental isotherm data of uranium sorption were examined using several adsorption models. Adsorption process fitted to Freundlich and Halsey isotherm models. Thermodynamic results showed that the adsorption process was exothermic and spontaneous.

1. Introduction

Removal of heavy metal ions from environmental aqueous samples is a crucial subject and challenge to all, who are interested in environment, arising from a greater appreciation of their toxicity and longevity in soil and groundwater. Uranium is one of the most hazardous heavy metals due to its high toxicity as well as its radioactivity [1]. The toxic nature of uranium (VI) ion, even at trace level, has been a public health problem for many years. Therefore, research on separation of uranium from wastewater is important [2].

Many conventional techniques such as chemical precipitation, membrane filtration, electrolysis, ion exchange and co-precipitation/adsorption are used for the removal of heavy metals during wastewater treatment [3]. Among these methods, adsorption has been shown to be an economically feasible alternative method for removing heavy metals from wastewater and water supplies [4]. Adsorption enables the separation of selected compounds from dilute solutions. Compared to alternative technologies, adsorption is attractive for its relative simplicity of design, operation and scale up, high capacity and favorable rate, insensitivity to toxic substances, ease of regeneration and low cost. Additionally, it avoids using toxic solvents and minimizes degradation [5]. Uranium adsorption by various inorganic and organic adsorbents has also been explored. Adsorbents like activated carbon [6,7], zeolite [8,9], talc [10], goethite [11,12], akaganeite [13], MOADDTCEXHEFU [14], diatomite [1], coir biomass [15], silk fibroin [16] and various biomasses [17,18] have been investigated.

As we mentioned elsewhere [14], solid organic compounds are able to bind metals due to their reactive terminals. Therefore, they can be alternatively used as an adsorbent material for adsorption of metals in separation techniques. The monoen structures of unsaturated carbohydrate skeletons and their derivatives are very useful molecules for the synthesis of complex and derivative sugars (disaccharides, antibiotics and amino sugars), natural products (such as prostanoids and sex phores), and carboxylic systems in

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