Iron oxide-impregnated dextrin nanocomposite: synthesis and its application for the biosorption of Cr(VI) ions from aqueous solution

Alok Mittal\textsuperscript{a,}\textsuperscript{*}, Rais Ahmad\textsuperscript{b}, Imran Hasan\textsuperscript{b}

\textsuperscript{a}Department of Chemistry, Maulana Azad National Institute of Technology, Bhopal 462003, India, Tel. +91 9425025427; Fax: +91 755 2670562; email: aljmittal@yahoo.co.in

\textsuperscript{b}Environmental Research Laboratory, Department of Applied Chemistry, Aligarh Muslim University, Aligarh 202002, India

Received 26 May 2015; Accepted 1 July 2015

**ABSTRACT**

In this paper, iron oxide impregnated with dextrin (Dex-Fe$_3$O$_4$) nanocomposite was synthesized by simple one-step hydrothermal chemical precipitation reaction. The nanocomposite was characterized by XRD, FT-IR, TGA, DTG, SEM with EDX and TEM techniques. The material was further explored as an adsorbent for the removal of Cr(VI) ions from its aqueous solution. The optimum removal of Cr(VI) ions with the highest adsorption capacity of 17.8 mg g$^{-1}$ was observed at pH 2. The equilibrium data were analysed with Langmuir, Freundlich, D–R and Temkin isotherms model and data were best followed by Langmuir model and Temkin model with a maximum monolayer adsorption capacity of 51.28, 54.64, and 71.43 mg g$^{-1}$ at 30, 40, and 50$^\circ$C, respectively. The activation energy calculated by D–R model reveals that the adsorption process is chemisorption in nature. The experimental data were best fitted with pseudo-second-order. The results of thermodynamic parameters ($\Delta G^\circ$, $\Delta H^\circ$, and $\Delta S^\circ$) showed that the adsorption of Cr(VI) on Dex-Fe$_3$O$_4$ is endothermic spontaneous in nature. The synthesized nanocomposite material is very promising for the removal of Cr(VI) from aqueous solution.

*Corresponding author.

1944-3994/1944-3986 © 2015 Balaban Desalination Publications. All rights reserved.