Application of nanoscale iron oxide-hydroxide-impregnated activated carbon (Fe-AC) as an adsorbent for vanadium recovery from aqueous solutions

Hakimeh Sharififard, Mansooreh Soleimani*, Farzin Zokaee Ashtiani

Department of Chemical Engineering, Amirkabir University of Technology, No. 424, Hafez Ave, P.O. Box 15875-4413, Tehran, Iran, email: h.sharififard@aut.ac.ir (M. Soleimani), Tel. +98 21 64543152; Fax: +98 21 66405847; emails: Soleimanim@aut.ac.ir (H. Sharififard), zokaee@aut.ac.ir (F. Zokaee Ashtiani)

Received 23 April 2015; Accepted 10 October 2015

ABSTRACT

In this study, iron oxide-hydroxide-impregnated activated carbon (Fe-AC) nanocomposites were prepared as new adsorbents for vanadium recovery from aqueous solutions. The commercial activated carbon was modified via a permanganate/ferrous iron synthesis method. The influences of main synthesis parameters, such as temperature (35–85°C), time (5–24 h), and FeSO₄ concentration (0.2–0.6 mol L⁻¹), were investigated to obtain the best adsorbent for vanadium recovery. The effects of these parameters were optimized by Taguchi method. The optimal conditions for the synthesis of the best adsorbent were FeSO₄ concentration = 0.4 M, time = 24 h, and temperature = 55°C. The characterization tests showed that the nature of iron nanoparticles on AC surfaces is iron oxide-hydroxide (FeOOH). The results showed that Fe-AC nanocomposite exhibited a reasonable capacity for vanadium recovery from aqueous solutions. According to Langmuir isotherm, maximum adsorption capacities were 37.87 and 119.01 mg g⁻¹ for activated carbon and Fe-AC, respectively.

Keywords: Nanoscale iron oxide-hydroxide; Activated carbon; Vanadium recovery

*Corresponding author.

Presented at the 3rd International Conference on Water, Energy and Environment (ICWEE)
24–26 March 2015, Sharjah, United Arab Emirates

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