The effect of modification of activated carbon WG-12 on lead adsorption from water

Joanna Lach* *, Longina Stępniak a, Agnieszka Ociepa-Kubicka b

a Institute of Environmental Engineering, Czestochowa University of Technology, Brzeźnicka Street 60a, Częstochowa, Poland, emails: jlach@is.pcz.czest.pl (J. Lach), stepniak@is.pcz.czest.pl (L. Stępniak)
b The Faculty of Management, Czestochowa University of Technology, Armii Krajowej Street 19b, Częstochowa, Poland, email: agnieszkaociepa22@wp.pl (A. Ociepa-Kubicka)

Received 30 December 2017; Accepted 2 June 2018

ABSTRACT

The presented work aimed at comparing two types of gaseous modification: the conventional method using an external source of energy (heat) and an originally developed method utilizing Joule heat generated during the flow of electric current through a carbon bed. The conventional modification of the WG-12 activated carbon was conducted in a rotary furnace at a temperature of 400°C and 800°C, respectively. Modification of activated carbon in an experimental electric heating system (referred to as the SEOW) occurred in a process whereby activated carbon was heated up to 400°C during the flow of electric current through the carbon bed, followed by cooling down with air or carbon dioxide. Both activated carbon modification methods enhanced the adsorption capacity toward Pb(II) ions. The monolayer capacity, as calculated from the Langmuir isotherm for the initial carbon, was \( q_m = 44.05 \) mmol/kg, while for carbon modified in the rotary furnace, \( q_m = 112.36 \) mmol/kg, and for carbon modified on the SEOW stand, \( q_m = 76.92 \) mmol/kg. The modification resulted in an increase in the specific surface area of activated carbon and the number of acid (mainly hydroxyl) functional groups. The advantage of activated carbon heating using the SEOW required much (up to several times) less energy, compared with the conventional method.

Keywords: Adsorption; Activated carbon; Lead; Modification

* Corresponding author.

Presented at the 13th Conference on Microcontaminants in Human Environment, 4–6 December 2017, Częstochowa, Poland.

1944-3994/1944-3986 © 2018 Desalination Publications. All rights reserved.