Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2015.1054311

57 (2016) 11820–11834
May

Taylor & Francis
Taylor & Francis Group

Adsorptive removal of phenol from aqueous solutions by copper (cu)-modified scoria powder: process modeling and kinetic evaluation

Masoud Moradi[a,b], Amir Mohammad Mansouri[a,c], Nahid Azizi[d], Jila Amini[d], Kaveh Karimi[d], Kiomars Sharafi[d,e,*]

[a]*Research Center for Environmental Determination of Health (RCEDH), Kermanshah University of Medical Sciences, Kermanshah, Iran, emails: Mahfooz60@gmail.com (M. Moradi), amansouri.mansouri84@gmail.com (A.M. Mansouri)*
[b]*Environmental Health Engineering, Iran University of Medical Sciences, Tehran, Iran*
[c]*Faculty of Chemistry, Department of Analytical Chemistry, Razi University, Kermanshah, Iran*
[d]*Department of Environmental Health Engineering, Kermanshah University of Medical Sciences, Kermanshah, Iran, emails: azizi_nahid92@yahoo.com (N. Azizi), jilaamini1@gmail.com (J. Amini), karimik6@gmail.com (K. Karimi), Kio.sharafi@gmail.com (K. Sharafi)*
[e]*Department of Environmental Health Engineering, Tehran University of Medical Sciences, Tehran, Iran*

Received 15 June 2014; Accepted 20 April 2015

ABSTRACT

Phenol compounds are regarded as hazardous pollutants due to their toxicity and carcinogenic properties to human health at low concentrations. So, this study was aimed to investigate the phenol adsorption by copper (Cu)-modified scoria powder, which is a low-cost adsorbent for the removal of organic compounds. All the experiments were performed based on the full face-centered central composite design experimental plan and analyzed using response surface methodology. The samples were analyzed using various conditions including adsorbent dose (0.1–1 g/l), phenol concentration (50–250 mg/l), and contact time (5–100 min). Three-dimensional plots reveal the relationship between the phenol removal efficiency and the paired factors, which describe the behavior of scoria powder in the removal of phenol from aqueous solution. The models showed that phenol removal efficiency in aqueous solution affected by four studied factors. A maximum removal efficiency of phenol achieved was more than 96% at the optimum conditions (scoria dosage of 1 g/l, phenol concentration of 50 mg/l, and contact time of 100 min). Process of kinetic parameters were also evaluated and modeled using five kinetic models including pseudo-first-order equation, second-order equation, modified Freundlich, pore diffusion, and Elovich. The best fit of experimental adsorption data was calculated by means of the pseudo-second-order model. Equilibrium data obeyed the Freundlich and Langmuir isotherms, and found that the equilibrium data well obeyed the Langmuir isotherm.

Keywords: Adsorptive removal; Phenol; Aqueous solutions; Scoria powder

*Corresponding author.