Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.22813

129 (2018) 244–254
October

Two-dimensional zeolitic imidazolate framework-8 for efficient removal of phosphate from water, process modeling, optimization, kinetic, and isotherm studies

Ali Akbar Mohammadi[a], Ahmad Zarei[b], Hossein Alidadi[c,d], Mojtaba Afsharnia[b], Mahmoud Shams[c,d,*]

[a]*Department of Environmental Health Engineering, Neyshabur University of Medical Sciences, Neyshabur, Iran, email: mohammadi.eng73@gmail.com (A.A. Mohammadi)*
[b]*Environmental Health Engineering, School of Health, Gonabad University of Medical Sciences, Gonabad, Iran, emails: a.zarei.tums@gmail.com (A. Zarei), mafsharnia2000@yahoo.com (M. Afsharnia)*
[c]*Social Determinants of Health research center, Mashhad University of Medical Sciences, Mashhad, Iran, emails: shamsmh@mums.ac.ir (M. Shams), alidadih@mums.ac.ir (H. Alidadi)*
[d]*Department of Environmental Health Engineering, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran*

Received 16 January 2018; Accepted 17 July 2018

ABSTRACT

Having unique properties, metal–organic frameworks are recognized as interesting materials for many applications. Leaf-shaped zeolitic imidazolate framework-8 (L-ZIF-8) with a 16.66 m^2/g Brunauer-Emmett-Teller (BET) surface area and total pore volume of 0.0572 cm^3/g was synthesized in aqueous medium and room temperature. L-ZIF-8 then used for P removal from aqueous solutions and a polynomial prediction model for phosphate (P) removal was developed by designing the experiments using central composite design. The model terms showed an increase in P removal with adsorbent dosage and contact time and also by decreasing pH. The highest P removal after model optimization determined to be at pH 4, L-ZIF-8 dosage 0.6 g/L, and 84 min contact time. The isotherm models indicated a monolayer adsorption of P onto L-ZIF-8 with a maximum 51.24 mg P/g of adsorbent. Study of P removal dynamic revealed that the process controlled by chemisorption.

Keywords: Metal organic frameworks; Zeolitic imidazolate framework-8; Adsorption; Phosphorus; Response surface methodology

* Corresponding author.