Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.23073

126 (2018) 350–360
September

Synthesis of UiO-66 based on benzoic acid and chloroform with highly efficient adsorption of Congo red dye

Sheng Feng[a,*], Runbai Wang[a], Shanshan Feng[a], Zhihui Zhang[b], Shuguang Liu[a]

[a]*School of Environmental and Safety Engineering, Changzhou University, Jiangsu 213164, China, Tel. +86 519 86330080; emails: shfeng@cczu.edu.cn (S. Feng), ruibaiwang@163.com (R. Wang), fss728@163.com (S. Feng), shguangliu@163.com (S. Liu)*
[b]*Jiangsu Key Laboratory of Advanced Catalytic Materials and Technology, Changzhou University, Jiangsu 213164, China, email: zhangzh@cczu.edu.cn*

Received 8 March 2018; Accepted 28 August 2018

ABSTRACT

In this study, a perfect UiO-66 was synthesized by adding benzoic acid in the precursor solution and activating it with chloroform after synthesis. The crystal morphology and material properties of the synthesized materials were investigated by X-ray powder diffraction, Fourier-transform infrared spectroscopy, scanning electron microscopy, N_2 adsorption–desorption analysis, zeta potential, and thermogravimetric analyses. A typical anionic organic dye, Congo red (CR), was used as the target contaminant to examine the adsorption properties of a series of UiO-66. The acid-promoted and activated UiO-66 had a more regular octahedral structure, high-surface area of 905–1,230 m^2/g, and more positive zeta potential (hydrogen ion), which might explained the greatly enhanced adsorption of CR dye. The effect of several influential parameters such as adsorbent dosage, solution pH, initial dye concentration, temperature, and contact time was well studied and optimized by using batch adsorption study. Moreover, mechanisms with kinetic, isotherm, and thermodynamics were researched in detail. The acid-promoted and activated UiO-66 could be regenerated by a simple N, N-dimethylformamide -washing method and exhibited stable and high reusability over five cycles. Overall, the acid-promoted and activated UiO-66 was an excellent candidate for wastewater treatment due to a simple synthesis procedure, high efficiency, reusability, and stability in the aqueous phase.

Keywords: UiO-66; Acid promotion; Activation; Congo red (CR); Adsorption; Regeneration

* Corresponding author.