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# Removal of cephalexin from artificial wastewater by mesoporous silica materials using Box-Behnken response surface methodology

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**ABSTRACT**

Mesoporous silica such as MCM-41 was used as an adsorbent for the removal of cephalexin antibiotic from synthetic wastewater. In this study, MCM-41 adsorbent was synthesised and was characterised by FE-SEM, XRD, FTIR and isotherms of adsorption/desorption of $N_2$. The effects of initial pH, adsorbent dose, initial adsorbate concentration, contact time and temperature on process efficiency were evaluated using Box-Behnken statistical experiment design (RSM). FTIR analysis revealed the Si-OH, H-O-H and Si-O-Si bonds are formed. According to BET surface area, MCM-41 had pores with a diameter of more than 2.0 nm and surface area of 1,097 $m^2g^{-1}$ and also XRD spectra showed the mean crystallite size of MCM-41 was 75 nm. The statistical results show that pH, adsorbent dose, initial antibiotic concentration, temperature and quadratic pH were significant and presented with probability <0.05. The optimum removal condition based on analysis of variance and the quadratic model was the initial pH of adsorbate solution fixed at 3.00, adsorbent dose 800 mg $L^{-1}$, the initial concentration of antibiotic at 50.0 mg $L^{-1}$, a temperature of 40.0°C, and at the adsorption time of 30.0 min. Under these conditions, the percentage removal of cephalexin antibiotic was 90.3%. Therefore, according to the obtained results, the mesoporous silica can be used to adsorb cephalexin antibiotic in optimal conditions designed by response surface methodology.

*Keywords:* Adsorption; Cephalexin; Mesoporous silica; Box-Behnken response surface methodology

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