"The 3rd International and 21st
national Conference on environmental Health"
February 26-28, 2019
Zanjan, Iran

Optimization of Adsorption conditions of dye on low-cost adsorbent using Response Surface Methodology

Shirin Afshin[1,2], Mohsen Haghighi[3], Yousef Rashtbari[1,2], S.Ahmad Mokhtari[1,*]

1 Department of Environmental Health Engineering, School of Health, Ardabil University of Medical science/Ardabil, Iran; shirinafshin1990@gmail.com, u3f.rashtbari@gmail.com
2 Students Research Committee, Faculty of Health, Ardabil University of Medical Sciences, Ardabil, Iran
3 Department of Environmental Health Engineering, Faculty of Health, Kashan University of Medical Sciences/Kashan, Iran; mohsenhaghighi087@gmail.com
* Corresponding Author; S.Ahmad Mokhtari; S.a.mokhtari@gmail.com

Abstract

Aim of study: The main environmental pollutants that are found in many different industries, such as textiles are dyes. These dyes by entering the waters can cause toxicity, carcinogenicity and mutagenesis in humans and aquatic species. Therefore, in this study Response Surface Method (RSM) was used to investigate the operational parameters and determine the optimum conditions for removal of acid blue 113 in the presence of bentonite.

Methodology: To evaluate the removal of acid blue 113 using the bentonite, the surface response method (RSM) was used based on the central composite design (CCD). The structure and morphology of bentonite adsorbent were determined by XRD, FESEM and XRF techniques. The effective parameters in the process such as: reaction time, initial pH, adsorbent dosage and initial concentration of dye were measured at three levels. Isotherm (Langmuir and Freundlich) and kinetic (pseudo first and second order) adsorption models were used for the analysis of this process.

Results: The results of Physico chemical analysis confirmed the structure of bentonite. The proposed model (Quadratic) with high correlation coefficient (R^2=0.9729 and R^2_{Adj}=0.92497) indicated that the experimental and predicted results were very consistent with the model. Finally, under optimal conditions (initial dye concentration=32.31 mg/L, absorbent dose=0.53 g/L, reaction time= 82.98 min and pH=3.6) the removal efficiency was 98.62% with a desirability of 0.945 for acid blue 113. The results indicated adsorption process follows Freundlich isotherm (0.9216) and pseudo-second-order kinetic model (0.9985).

Conclusion: The present study demonstrated that natural bentonite adsorbent has high ability in removal of acid blue 113. In addition, the central composite design can be used as an effective method to optimize dye adsorption from industrial wastewater containing high concentrations of dye.

Keywords: Adsorption, Bentonite Mineral clay, Acid blue 113, Response Surface Methodology, Isotherm and Kinetic