Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.21922

119 (2018) 53–63
July

Optimizing laccase-mediated amoxicillin removal by the use of Box–Behnken design in an aqueous solution

Reza Shokoohi[a], Mohammad Taghi Samadi[a], Mojtaba Amani[b], Yousef Poureshgh[a,*]

[a]*Department of Environmental Health Engineering & Research Centre for Health Sciences, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran, Tel. +989148092356; Fax: +984533512004; email: yusef.poureshg@gmail.com (Y. Poureshgh); Tel. +989188129962; email: Reza.shokohi@umsha.ac.ir (R. Shokoohi), Tel. +989188129968; email: Samadi@umsha.ac.ir (M.T. Samadi)*
[b]*Faculty of pharmacy, Ardabil University of Medical Sciences, Ardabil, Iran, Tel. +989125104239; email: m.amani@pharmacy.arums.ac.ir*

Received 16 August 2017; Accepted 4 January 2018

ABSTRACT

Abnormal use of antibiotics and discharging them into the sewage systems bring about serious and dangerous harms to the environment. The present study aims at the feasibility evaluation of amoxicillin removal from the aqueous solutions by means of enzymatic oxidation by taking advantage of response surface method based on Box–Behnken model. The present study is a library research. Therefore, the experiments are carried out in a laboratory for discontinuously evaluating the effects of independent variables such as temperature, pH, contact time, enzyme activity, hydroxybenzotriazole mediator concentration and the antibiotic concentration. The remaining amoxicillin's concentration has been determined by HPLC device. To implement the experiments, Box–Behnken model was used for measuring the variables' mutual effects. One-way analysis of variance was used for data analysis. The results showed that enzymatic oxidation output increases with the increase in contact time and enzymatic activity as well as with a decrease in the antibiotic's concentration. The highest and the lowest removal percentages were 91.5% and 5.36%, respectively. According to the high amounts of R^2 (0.974) and R^2adj (0.955), it can be said that the selected model is appropriate for data analyses. Finally, a quadratic polynomial model was applied as the best model of choice for figuring out the relationships between the main variables and amoxicillin elimination output. Response surface method can be effective in amoxicillin oxidation optimization and laccase can be used for amoxicillin elimination.

Keywords: Enzymatic degradation; Laccase; Amoxicillin; Box–Behnken design

* Corresponding author.