Environmental Engineering and Management Journal xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu

"Gheorghe Asachi" Technical University of Iasi, Romania

FORECASTING OF CHLOROPHENOLS REMOVING WITH ADVANCED OXIDATION PROCESSES: AN ARTIFICIAL NEURAL NETWORKS APPLICATION

Aysun Altikat[1*], Zeynep Ceylan[2], Alper Gulbe[3]

[1]Iğdır University Engineering Faculty Department of Environmental Engineering, Iğdır, 76000, Turkey
[2]Atatürk University Engineering Faculty Department of Environmental Engineering, Erzurum, 25240, Turkey
[3]Iğdır University, Technical Sciences Vocational School, Department of Computer Programming, Iğdır, 76000, Turkey

Abstract

Advanced oxidation processes (AOPs) are used with high efficiency in wastewater treatment due to the formation of hydroxyl radicals with high oxidation capacity. However, there exists many different variables which affect the efficiency of theses processes as it affects the amount of hydroxyl radicals formed; such as reaction time, pH, temperature, reactant concentrations and catalyst amount. In this study, removal of 2-chlorophenol (2-CP) and 2,4-dihlorophenol (2,4-DCP), which are highly toxic organic pollutants, with Fenton oxidation was investigated. This research has two aims. The first is modelling of substituted phenols removing with AOPs utilizing artificial neural networks (ANN), and the second is determination of the relative important among the input parameters for removing. In the research, 18 different ANN structures were used. The best ANN model for prediction of 2-CP and chemical oxygen demand from 2-CP ($COD_{2\text{-}CP}$) were determined at the ANN10 structure. In this structure, 15 neurons, Levenberg-Marquardt and logarithmic sigmoid-symmetric sigmoid were used as learning and transfer functions, respectively. In addition, at the ANN16 and ANN2 structures, which were used for the prediction of removing efficiency for 2,4-DCP and $COD_{2,4\text{-}DCP}$, have obtained better results. In both models, Levenberg-Marquardt learning function was used. In ANN16 transfer functions were logarithmic sigmoid-symmetric sigmoid with 20 neurons and in ANN2 symmetric sigmoid-symmetric sigmoid transfer functions with 10 neurons. When examined the sensitivity analysis results, all the input parameters have a significant effect on the substituted phenols removing with AOPs.

Key words: artificial neural network, 2-chlorophenol, 2,4-dichlorophenol, fenton oxidation, modeling

Received: November, 2019; Revised final: March, 2020; Accepted: April, 2020

[*] Author to whom all correspondence should be addressed: e-mail: aysun.altikat@igdir.edu.tr, Phone +90 476 223001, 4453