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Electrochemical Oxidation Approach towards the Treatment of Acetamiprid Pesticide from Polluted Water

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ABSTRACT

Introduction: Acetamiprid (AP) is one of the most widely used pesticides in the neonicotinoid class. AP residues in the environment have received considerable due to their potential toxicity to humans. Therefore, it is important to remove AP from the aqueous solution.

Materials and Methods: In the current study, response surface methodology (RSM) was used as an efficient approach to optimize the removal of AP using the electro-Fenton (EF) process. The effects of the main variables, including reaction time, AP concentration, current density, and H_2O_2 dosage were investigated and optimized. ANOVA technique was also used to identify the Fisher's value (F-value) and P-value of the model.

Results: The predicted AP removal efficiency by the model was in good agreement with the obtained experimental results with correlation regression of 0.98. The ANOVA test proved that the developed quadratic model was significant with very low P-values less than 0.05, the high F-value of 240.1, and regression coefficients close to 1 at a 95% confidence level. The optimum condition for AP removal efficiency of 99.02% was attained at the reaction time of 12 min, AP concentration of 3.5 mg L^{-1}, the current density of 12 mA cm^{-2}, and H_2O_2 dosage of 86 µL.

Conclusion: RSM was employed as a suitable method to optimize the operating condition and maximize the AP removal. Herein, the EF process as an eco-friendly electrochemical advanced oxidation process (EAOP) successfully applied to remove AP from the water and wastewater.

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Introduction

The lives of all biota, including humans, animals, and plants, are affected by the quantity and quality of water. Also, health, agricultural, industrial, and welfare activities are affected by water resources.

Due to the importance of water in the life of organisms, in recent decades, emerging pollutants (Eps) (even in low concentrations) have been detected in water resources, which have caused a decrease in water quality and subsequent occurrence of diseases and environmental hazards [1-3]. Eps include surfactants, personal care products, pharmaceutical compounds, and pesticides [4-6].