Optimization of sono-nanocatalytic process using γ-Fe_2O_3 for Penicilin antibiotic removal by response surface methodology

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Abstract

Background & Aim*:* The pollution of water with pharmaceutical compounds can cause problems in the ecosystem. Antibiotics have special importance due to their inducing bacterial resistance. The aim of this study was to optimize the sono-nanocatalytic process using Fe_2O_3 for removal of Penicilin antibiotic by response surface methodology.

Methods**:** The study was based on the practical laboratory method in order to evaluate the effect of independent parameters such as pH, the dose of nanoparticles, reaction time, the initial concentration of the antibiotic and Frequency sound waves on the rate of penicillin removal. Chemical oxygen demand (COD) was selected to follow the performance for Penicilin antibiotic removal. In order to achieve the optimal experimental conditions, response surface methodology (RSM) model was designed and used.

Results**:** The results of data analysis showed that the catalyst dose and reaction time had greatest impact on the COD removal efficiency of Penicilin. Also, optimum removal conditions based on the analysis of variance (ANOVA) and model was achieved at pH, frequency of sono waves, initial concentration of the antibiotic, catalyst dose and reaction time equal 3, 35 KHz, 10 mg/l, 0.3 g/L and 53 min, respectively. Under these conditions, a COD removal efficiency equal to 95.51% was achieved.

Conclusion**:** The results of this study showed that the sono-nanocatalytic process in the presence γ- Fe_2O_3 nanoparticles has a high efficiency on the COD removal (Penicilin antibiotic) from aqueous environments.

Keywords**:** Fe_2O_3 nanoparticles, Penicilin antibiotic, Sonocatalytic process, Response Surface Methodology (RSM)