Optimization of 4- chlorophenol Oxidation by Manganese Ferrite Nanocatalyst with Response Surface Methodology

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In this study, manganese ferrite (MnFe_2O_4) was prepared by a co-precipitation method and used as a magnetic catalyst for the degradation of 4-chlorophenol in Advanced Oxidation Process (AOP). In order to find the best operating condition in 4-Chlorophenol degradation in Fenton process, adopted response surface methodology (RSM) and Central composite factorial design (CCD) were used to investigate the effective parameters such as pH, catalyst and H_2O_2 dosage, 4-Chlorophenol concentration, and process time. Characterization of synthesized manganese ferrite by field emission scanning electron microscopy (FESEM), energy dispersive spectroscopy (EDS), and Vibrating Sample Magnetometer (VSM) explained the porous structure of super-para magnetic MnFe_2O_4 and showed that Fe, O and Mn are the dominant elements in the composite with weight percentages of 47.20, 28.40 and 24.40%, respectively; and also, the result of powder X-ray diffractometer (XRD) confirmed the presence of single phase MnFe_2O_4 with a face-centered cubic structure. Degradation efficiency was observed through an oxidation process indicated that 4-Chlorophenol could be 93% reduced by MnFe_2O_4 within 60min. Furthermore, optimum pH, H_2O_2 , and catalyst were 4.24, 0.07 mol. L^{-1} , and 0.72 g. L^{-1} , respectively. Second-order polynomial equation for the degradation efficiency of 4-chlorophenol expressed the relation between response variable and the test variables. P-Value of the model (<0.0001) showed that the model was suitable for this experiment.

Keywords: manganese ferrite; Advanced Oxidation Process; 4-chlorophenol; central composite; ElectroFenton

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