Effect of Fenton’s Reagent Concentration for COD Removal of Reactive Black 5 Dye

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ABSTRACT

Textile wastewater contains high concentrations of recalcitrant organic contaminants, characterized by high COD, BOD, turbidity, pH and high color content. Fenton oxidation is an effective method for degradation of recalcitrant organic contaminants because of the involvement of oxidative hydroxyl radical (‘OH) with high redox potential of 2.80eV. However, in Fenton oxidation reaction, maintaining optimum H$_2$O$_2$/Fe$^{+2}$ ratios is important to obtain high efficiencies. Keeping this in view, this work aimed at investigating the effectiveness of Fenton’s reagent H$_2$O$_2$/Fe$^{+2}$ under different operating conditions such as [Dye]$_{ini}$, Dye:Fe$^{+2}$ and pH for dye degradation. For this purpose, Reactive Black 5 dye was chosen as model dye and optimization of aforementioned operating parameters was performed by using Response Surface Methodology by selecting COD removal as response variable. The results showed that optimum H$_2$O$_2$/Fe$^{+2}$ ratios is important to maintain as high values resulted in an approximately 95.87% increase in COD value from original one. However, under optimized conditions of H$_2$O$_2$ : Fe$^{+2}$ =15, Dye: Fe$^{+2}$ =30 and pH=5.5, maximum COD removal efficiency of 87.33% was achieved for 200mg/L of dye concentration. Therefore, it can be concluded that at higher concentrations of H$_2$O$_2$ complex formation of ‘OH radical with dye molecule takes place which results in high COD value of treated dye. This also implies the importance of dye concentration and initial COD value used for Fenton oxidation.

Keywords: Fenton oxidation, Ferrous ions, Optimization, Surface Response technique, Textile wastewater

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