Effectiveness of Fenton Process on the Decolorization of Acid Orange 8 and Acid Red 44 from Aqueous Solution by On-line Spectrophotometric Method

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Synthetic dyes are used widely in various industries such as leather, paper and textile, because of their varieties and fastness. These dyes are the major industrial pollutants and water contaminants. Moreover, most of dye molecules are water soluble and their removal from wastewater by conventional treatment methods is not easy [1]. There are a lot of methods, including coagulation, adsorption, Fenton oxidation, photocatalytic oxidation, electrochemical degradation and membrane process, related with the removal of dyes from wastewater [1-3]. Among them, Fenton process which is one of the advanced oxidation processes is an attractive treatment for the effective decolorization and degradation of dyes due to its low cost and the lack of toxicity of Fenton’s reagents (i.e., Fe²⁺ and H₂O₂) [4].

In this study, on-line spectrophotometric method was used to follow the decolorization of Acid Orange 8 and Acid Red 44 by Fenton process. This method has many advantages compared with batch spectrophotometric method. The influences of H₂O₂, FeSO₄ and dye concentrations, pH and temperature on the decolorization of azo dyes including Acid Orange 8 and Acid Red 44 were investigated by Fenton process and examined the spectral changes during the oxidation process by on-line spectrophotometric method. In addition, the impacts of NaCl and Na₂SO₄ solutions on the decolorization process of Acid Orange 8 and Acid Red 44 were investigated in the optimum H₂O₂, Fe²⁺ and pH conditions.

The results showed that Fenton process was a powerful method for the decolorization of Acid Orange 8 and Acid Red 44. Based on the experimental results, it was found that the initial H₂O₂ concentration, the initial Fe²⁺ concentration, the initial pH value of solution, the initial dye concentration and the temperature had strong influences on the degradation of Acid Orange 8 and Acid Red 44 by Fenton oxidation process. Optimum H₂O₂:Fe²⁺ concentration ratios for the decolorization of AO8 and AR44 were found to be 30:1 and 15:1, respectively. Besides, optimum initial pH value was determined as 3.5. The addition of excess H₂O₂ solution into the azo dye solution caused the formation of less reactive radicals and reduced the decolorization rate of AO8 and AR44. The rate of dye decolorization showed an increase with increasing temperature. As the dye concentration increased and temperature decreased, the rate of dye decolorization decreased. The presence of NaCl within the solution led to a decrease in the extent of dye decolorization. On the other hand, the extent of dye decolorization did not change with Na₂SO₄.

KEYWORDS: azo dyes, Fenton process, decolorization, on-line spectrophotometric method

REFERENCES: