## Indigo Dye Wastewater Treatment by Fenton Oxidation

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Abstract : Indigo is a well-known natural blue dye that is used hither to even though synthetic ones are commercially available. The removal of indigo from effluents is difficult due to its resistance towards biodegradation which causes an aquatic environment effect. Fenton process is a reaction between hydrogen peroxide H2O2 and Fe2+ to generate •OH (highly reactive oxidant ( $E \circ = 2.8$  V)). Additionally, •OH is non-selective oxidant which is capable of destroying wide range of organic pollutants in water and wastewater. The aims of this research were to investigate the effect of H2O2, Fe2+ and pH on indigo wastewater oxidation by Fenton process. A liter reactor was operated in all experiments. The batch reactor was prepared by filling 1 liter of indigo wastewater. The pH was adjusted to the desired value; then, FeSO4 at predetermined amount was added. Finally, H2O2 was immediately added to start the Fenton's reaction. The Fenton oxidation of indigo wastewater was operated for 60 minutes. Residual H2O2 was analyzed using titanium oxalate method. The Fe2+ concentration was determined by phenanthroline method. COD was determined using closed-reflux titrimetric method to indicate the removal efficiency. The results showed that at pH 2 increasing the initial ferrous concentration from 0.1 mM to 1 mM enhanced the indigo removal from 36% to 59%. Fenton reaction was rapidly due to the high generation rate of •OH. The degradation of indigo increased with increasing pH up to pH 3. This can be explained that the scavenging effect of the •OH by H+ in the condition of low pH is severe to form an oxonium ion, resulting in decrease the production of •OH and lower the decolorization efficiency of indigo. Increasing the initial H2O2 concentration from 5 mM to 20 mM could enhance the decolorization. The COD removal was increased from 35% to 65% with increasing H2O2 concentration from 5 mM to 20 mM. The generations of •OH were promoted by the increase of initial H2O2 concentration. However, the higher concentration of H2O2 resulted in the reduction of COD removal efficiency. The initial ferrous concentrations were studied in the range of 0.05-15.0 mM. The results found that the COD removals increased with increasing ferrous concentrations. The COD removals were increased from 32% to 65% when increase the ferrous concentration from 0.5 mM to 10.0 mM. However, the COD removal did not significantly change at higher 10.0 mM. This is because •OH yielding was lower level of oxidation, therefore, the COD removals were not improved. According to the studies, the Fenton's reagents were important factors for COD removal by Fenton process. The optimum condition for COD removal of indigo dye wastewater was 10.0 mM of ferrous, 20 mM of H2O2 and at pH 3.

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Keywords : indigo dye, fenton oxidation, wastewater treatment, advanced oxidation processes

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