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Evaluation of effective process for oxidation and coagulation by ferrous ion and hydrogen peroxide

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1. INTRODUCTION

Many industrial processes to use water generate pollutants such as by-products and original compounds, resulting in high pollution loadings to the treatment plant. It has been recognized that hydroxyl radical generated by Fenton's reagent might tremendously effective work to reduce the intensity of high pollution loads or to remove refractory organic compounds. Other advanced oxidation processes can be applied for the reduction of toxicity and pollution loads. Therefore, they are usually used as pre-treatment can be enhanced (Lee *et al.*, 1992).

This paper tries to evaluate the effective process operation and the really effective mechanisms of the Fenton process to remove pollutants for the dyeing wastewater. Fenton process as AOP was not exactly evaluate as oxidation and/or coagulation for the highly loaded pollutants. This research herewas carried out to evaluate the removal efficiency for the colour and COD involving oxidation and/or coagulation and to investigate the mechanisms by comparing the results using ferrous ion, ferric ion and Fenton's reagent.

2. MATERIALS AND METHODS

Fenton's reagent was applied to investigate the exact mechanism to enhance the removal efficiencies of colour and COD for the textile dyeing wastewater. A treatment plant with the capacity of 80,000 m^3/day for dyeing wastewater is operating, in which the pre-treated dyeing wastewater by biological treatment in the pure oxygen aeration tank without settling tank inflows into the Fenton process. For the elucidating the exact mechanisms to remove COD and colour three different experiments, that is, Fenton oxidation, ferrous ion coagulation and ferric ion coagulation were performed. The initial COD concentration of wastewater was 380 mg/L. Hydrogen peroxide of 116 mg/L and iron of 197 mg/L were applied to the Fenton process for both experimental conditions. The iron concentration was same for the ferrous coagulation, ferric coagulation and Fenton oxidation. Hydrogen peroxide

was applied only to the reactor of Fenton oxidation at 12 minutes and sodium hydroxide was applied at 29 minutes to adjust at pH 5.5 for settling out the ferric sludge.

3. RESULTS AND DISCUSSIONS

The experiment was performed in order to investigate the effective reaction with ferrous ion coagulation, ferric ion coagulation and Fenton's reagent that are hydrogen peroxide and ferrous solution.

The removal profiles of COD were close to each other for the ferrous coagulation and Fenton oxidation through 12 minutes, however its profile of COD for the ferric coagulation was quite different from them. The removal profile of COD with ferric ion was rapidly dropped from the initial step of reaction. However the values of COD by ferric ion coagulation were sustained consistently through the reaction hour after the abrupt drop at the beginning of the reaction.

4. CONCLUSIONS

The results of this research indicate that the removal efficiencies of COD and colour are strongly dependent on the initial concentration of ferrous solution in Fenton process for textile dyeing wastewater treatment. The higher removal efficiency from Fenton oxidation than from the sole ferric coagulation can be explained by the reason of chain reactions of ferrous solution and hydrogen peroxide. The efficiency of coagulation and oxidation by Fenton oxidation exceeded the efficiency of the sole coagulation by ferric ion to remove COD and colour for the textile dyeing wastewater.

5. ABSTRACT

This research was carried out to evaluate the removal efficiencies of CODcr and colour for the dyeing wastewater by ferrous solution in Fenton process. The results showed that COD was mainly removed by Fenton coagulation, where the ferric ions are formed in the initial step of Fenton reaction. On the other hand colour was removed by Fenton oxidation rather than Fenton coagulation. The removal mechanism of CODcr and colour was mainly coagulation by ferrous ion, ferric ion and Fenton oxidation. The removal efficiencies were dependent on the ferric ion amount at the beginning of the reaction. However the final removal efficiency of COD and colour was in the order of Fenton oxidation, ferric ion coagulation and ferrous ion coagulation. The reason of the highest removal efficiency by Fenton oxidation can be explained by the chain reactions with ferrous solution, ferric ion

and hydrogen peroxide.

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