Chapter 1

Introduction

1.1 Rational

The textile industry involves in the manufacture of fabrics from both natural and man-made fibers. The textile industry makes great benefit but it consumes a large quantity of water and consequently produces a large amount of wastewater containing various pollutants such organic matter, solid, oil and grease and dyes. There are various types of manufacturing processes depending on the raw materials and textile products. There are many kinds of dyes on the market for various applications. Effluents from the textile industry commonly contain inorganic chemicals and are characterized by very high COD and TOC values as well as strong color. Dye residue in drainage water can accumulate and consequently, the ecosystem of the streams can be seriously affected. Approximately 10,000 different dyes and pigments are used industrially, and over $7x10^5$ tons are produced annually worldwide. It is estimated that 10-15% of dyes used in textile industry are released with the effluent (Spadaro et al., 1994). Most of the studies, such as chemical precipitation, adsorption by activated carbon and some natural absorbent, photocatalytic oxidation, ozonation , Fenton's oxidation processes have been used extensively to treat textile wastewaters.

There are several method practiced to decolorize dye wastewater but they cannot be effectively used individually to deal with the wastewater containing soluble and insoluble dyes. For example, the coagulation process can effectively decolorize the wastewater containing insoluble dyes such as disperse dyes. However it does not work well for soluble dyes such as reactive dyes. Soluble dyes can be effectively decolorized by oxidation process such as ozonation (Perkins et al., cited in Hsueh et al., 2005:1409-1414). It, however, can not decolorize insoluble dyes. The interest in advanced oxidation methods results from their potential. The mechanism of chain reactions which involves hydroxyl and hydroperoxy radicals (due to their high reactivity and low selectivity), enables the application of the process to a large number of compounds present in the wastewater, especially for decoloration.

Advanced oxidation processes (AOPs) provide an effective mean of rapidly treating biorefractory compounds with efficient process control. Fenton reaction is an AOPs that has been studied for the treatment of biorefractory organic contaminants in aqueous waste streams, soils, and groundwater. In Fenton reaction, hydroxyl radical (OH·) is easily produced by iron (II) catalyst and hydrogen peroxide. The reaction is performed under acidic conditions to keep the iron soluble and to enhance the oxidative character of the hydroxyl radicals. The process includes a neutralization step to allow the elimination of ferric ions by precipitation as hydroxide. Fenton sludge creates subsequent disposal problems and constitutes the mainly limitation of the process. The major drawback of Fenton reaction is the production of substantial amount of sludge that requires further disposal. One of such alternatives is the fluidized-bed reactor in which the carriers can initiate iron precipitate via ferric crystallization (Chou et al., 2004). A modification of Fenton process, the process with Fe^{2+} addition in named fluidized-bed Fenton method, in which Fe^{2+} is the homogeneous catalyst and supported carriers is the heterogeneous catalyst of H_2O_2 to oxidize organic contaminants. The Fe (III) hydrolysis product of Fenton's reaction can crystallize and grow on the surface of this carrier to reduce the precipitation of $Fe(OH)_3$ (Chou et al., 2003).

1.2 Objectives of Investigation

1. To study the feasibility of using fluidized-bed Fenton process to remove color and COD of dyeing wastewater.
2. To determine the effects of initial ferrous and hydrogen peroxide concentration in fluidized-bed Fenton process.
3. To determine the kinetic information of synthetic dyeing wastewater by varying the conditions including Fe^{2+} concentration and initial H_2O_2 dosage.
4. To determine the optimum condition of color and COD removal for wastewater from textile factory by varying the conditions including initial pH, Fe^{2+} concentration and H_2O_2 dosage.

1.3 Scope of Investigation

1. Using lab scale reactor of 1.35 liters.
2. Using synthetic dyeing wastewater and wastewater from textile factory.
3. For the fluidized-bed Fenton process, the carrier is the SiO_2.
4. Working at room temperature.
5. Operating in batch mode.
6. Working at laboratory of Chia Nan University of Pharmacy and Science, Tainan, Taiwan