

**REACTIVE BLACK 5 DYE DECOLORIZATION BY HETEROGENEOUS FENTON-
LIKE REACTION USING FE-CLAMSHELL CATALYST**



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1. Letter of Report Submission

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**FINAL RESEARCH REPORT "REACTIVE BLACK 5 DYE DECOLORIZATION BY
HETEROGENEOUS FENTON-LIKE REACTION USING FE-CLAMSHELL
CATALYST"**

Referring to the above matter, attached herewith is the 4 copies of the final research reports and a CD entitled "Reactive Black 5 Dye Decolorization by Heterogeneous Fenton-like Reaction Using Fe-clamshell Catalyst" by our group of researcher from Faculty of Chemical Engineering, UiTM Cawangan Pulau Pinang for your kind attention.

Thank you.

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5. Report

5.1 Proposed Executive Summary

(Original proposal)

Fenton reaction wastewater treatment process is known to be very effective in the removal of many hazardous organic pollutants and dyestuff from water. The Fenton reaction causes dissociation of the oxidant with the formation of highly reactive hydroxyl radicals that attack and destroy the organic pollutants. However, the homogeneous Fenton process has significant disadvantages such as the generation of iron hydroxide sludge and limited range of pH. Heterogeneous Fenton is an alternative solution to overcome these limitations. Selection of catalyst support is important during the preparation of heterogeneous Fenton-like catalyst. At present, the catalyst supports include organic (such as C-Nafion and resin) and inorganic materials (such as HY zeolite, C fabrics and pillared clays). In heterogeneous solid catalyst, the iron species is "immobilized" on the solid supports or within the structure and in the pore/interlayer of the catalyst. The clam is a bi-valve mollusk of the clams family that digs in the sand. Salt-water clams are widely popular for eating purposes but the shells are considered as waste. Being inexpensive and abundant, the clam shell represents an attractive supports for iron immobilization. Therefore this study focuses on the development of heterogeneous catalysts from the low cost material, which is the clam shell. The efficiency of the heterogeneous catalyst will be tested on decolorization of model real textile wastewater that is Reactive Black 5 (RB5) by making use of a Fenton-like process. This catalyst (Fe-clamshell) will be prepared by impregnation method in which iron ion act as catalyst is attached on the supported catalyst (clamshell). The prepared catalyst is characterized by using Fourier Transform Infrared (FTIR). The effect of different reaction parameters such as different ion loading on supported catalyst, catalyst dosage, initial pH, and initial concentration of hydrogen peroxide and dye on the decolorization of RB5 will be assessed. It is expected that Fe-clamshell catalyst possess a potential to treat RB5 solution and this could give an added value since it is natural, abundant, low cost and environmentally friendly.

5.3 Introduction

Colored effluents from textile industries have been the major problems concerning textile wastewaters. It is estimated the total dye consumption of the textile industry worldwide is in excess of 107 kg/year, for which 90% of this ends up on fabrics. More than 10% of dyes are discharged into waste streams without treatment by the textile industry worldwide. Azo dyes have been identified as the most environmental problematic compounds in textile dye effluents. This kind of dyes is resistant to biological degradation due to the complex and steady molecular structures of the dyes. Therefore, it is necessary to find an effective treatment technology that leads to complete destruction of the dye molecules. Fenton's reagent is particularly attractive because of the low costs, the lack of toxicity of the reagents, the absence of mass transfer limitation due to its homogeneous catalytic nature and the simplicity of the technology. However, homogeneously catalyzed reactions need up to 50–80ppm of Fe ions in solution, which is well above the Malaysian Regulation of Environmental Quality Act 1974 that allows only below than 5ppm of Fe ions in treated water to be dumped directly into the environment. It also have other drawbacks such as limited pH range, the production of iron-contained sludge and the catalyst deactivation by iron complexing agents. To overcome the disadvantages of the homogeneous Fenton process, some attempts have been made to develop heterogeneous catalysts, prepared by loading iron (III) oxide onto a porous support. The aim of this research is to study the applicability of Fe-contained solid materials on supported catalyst as heterogeneous Fenton-like catalyst in the model real textile wastewater containing reactive azo dye. Fe-clamshell and Reactive Black 5 (RB5) are chosen as the heterogeneous catalyst and the real textile wastewater, respectively.