Ain Shams University
Faculty of science
Chemistry department

Treatment of hazardous refractory wastewater from natural gas and carpet industries

A Thesis
Thesis Submitted for Partial fulfillment ofrequirement for the degree of Master of Science

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2017

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For the degree of master of science

To

Department of chemistry
Faculty of science
Ain Shams University

2018

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Acknowledgement

Many deep and sincere thanks are to ***Prof. Dr. Mohamed Mahmoud Abo-Aly****, Chemistry Department, Faculty of Science, Ain Shams University, for his kind contribution, advice and complete revision of the thesis.*

Also, I am deeply indebted to ***Prof. Dr. Fayza Aly Nasr,*** *Water Pollution Research Department, National Research Center, for her supervision of work, her valuable and enlightened guidance, as well as her fruitful discussion all along the course of work.*

Moreover, I would like to express my great and sincere gratitude to ***Ass. Prof. Ibrahim Abdel-Aliem****, Water Pollution Research Department, National Research Center, for his great support to the progress of this work, his valuable advice and kind supervision.*

To my family, especially my mother's soul, my father for love, support, and inspiration they gave me.

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Abstract

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Degree: (M.Sc), Chemistry Department, Faculty of science, Ain Shams University (2017).

Title of thesis: Treatment of hazardous refractory wastewater from natural gas and carpet industries.

In this study, the efficiency of the treatment processes for removal of hazardous refractory wastewater from natural gas and carpet industries wastewater was investigated. The wastewater generated from subject industries is characterized by high concentration of COD and low BOD values. The BOD/COD is less than 0.3 which indicates that this wastewater inhibits the metabolic activity of bacterial seed due to their refractory properties causing biodegradability to be difficult. Therefore, either an effective wastewater pretreatment to increase the BOD/COD ratio followed by biological treatment, or coagulation-flocculation has to be carried out. In the case of gas industry wastewater, due to the low TSS concentration, conventional coagulation precipitation method is not considered adequate. A Fenton reagent [Fe^{2+} /H_2O_2] is proposed for degradation of existing soluble organics in the wastewater. Optimum operating conditions were: H_2O_2 concentration of 1.6 M/L (one stoichiometry with COD), 60 mM/L of Fe^{2+} ions, at pH around 3 and optimal reaction time of 30 minutes. Results proved that, Fenton reagent is found suitable to improve the biodegradability of the raw gas processing wastewater, BOD/COD increased from 0.17 to 0.36 and a complete removal of phenols was achieved, making it feasible

to be treated biologically in an effective manner. The subsequent anaerobic treatment using UASB reactor at optimum HRT (18h) qualifies the treated wastewater for discharge into the sewerage system. The subsequent aerobic treatment using the Continuous-Flow Activated Sludge at 12h HRT qualifies the treated wastewater for discharge into the sea.

In the case of carpet industry wastewater which contains high concentration of suspended solids, coagulation-precipitation was selected as feasible solution for the treatment. Chemical coagulation process using ferric chloride (1.8g/l), flocculent (3 mg/l) at pH 8 achieved COD removal efficiencies of 99.1 whereas using ferrous sulfate (3 g/l), flocculent (2 mg/l) at pH 7 achieved 98.8% COD removal. Corresponding TSS removal values were 98.5 and 97.8%, respectively. Characteristics of the treated wastewater using both ferric chloride and ferrous sulfate were found to be complying with the permissible limits for wastewater discharge into public sewerage system. However, the treated effluent by ferric chloride was found to be more favorable for economic advantage.

Keywords: Refractory, Industrial, Wastewater, treatment, Fenton, Biological.

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