THE EFFECT OF TREATMENT SEQUENCE IN COMBINED PHOTOCATALYTIC-BIODEGRADATION OF PHENOL

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This report is submitted in partial fulfillment of the requirements needed for the award of Bachelor in Chemical Engineering (Hons)

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JULY 2016

ACKNOWLEDGMENT

Firstly, I wish to thank God for giving me the opportunity to embark on my degree and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Sir Mohamad Sufian bin So'aib. Thank you for the support, patience and ideas in assisting me with this project.

My appreciation goes to the entire laboratory assistant who provided the facilities and assistance during my experiment. Special thanks to my friends for helping me with this project.

Finally, this thesis is dedicated to my loving father and mother for the vision and determination to educate me. This piece of victory is dedicated to both of you.

Alhamdulilah.

ABSTRACT

As phenol is a hazardous pollutant even at low concentration, it needs to be removed from the wastewater. This study focusing on the degradation of phenol by photocatalytic treatment where the effect of initial concentration and catalyst loading was investigated and also the effect of combine treatment sequence of phenol. One of the main objectives of this study is to investigate the effect of treatment sequence of combined photocatalytic- biodegradation on phenol degradation. Degradation of phenol was studied using two different combine treatment sequences which are biodegradation-photocatalytic and photocatalytic-biodegradation. Besides, phenol degradation performance using N-doped TiO_2/ZnO and TiO_2/ZnO as photocatalysts were studied and compared. These photocatalysts were used to degrade phenol in presence of visible light from a Tornado lamp with light intensity of 24 Watt. Mixed culture collected from effluent treatment plant in Shah Alam has been studied for its phenol degrading potential. Photocatalytic degradation of phenol was studied using initial concentration of 10 ppm, 25 ppm and 50 ppm while the amount of catalyst used are 1 g/L, 2 g/L and 3 g/L. The highest degradation efficiency obtained is 49.092% for TiO_2/ZnO and 69.811% for N-doped TiO_2/ZnO both at initial phenol concentration of 10 ppm. The optimum catalyst loading obtained based on the experiment is 3 g/L for N-doped TiO_2/ZnO which gives efficiency 72% of and 2 g/L for TiO_2/ZnO which efficiency of 55.102%. The degradation efficiencies for both combine sequence were determined and the highest efficiency obtained is 80.86% using biodegradation-photocatalytic degradation of phenol. From the result obtained, combine biodegradation-photocatalytic of phenol is more effective treatment compared to photocatalytic-biodegradation based on the degradation efficiencies obtained.

TABLE OF CONTENTS

CHAPTER ONE

INTRODUCTION

1.0 Research Background

Nowadays, many industries generated a very wide variety of pollutants that cause negative impacts on our environment. Besides, high numbers of organic contaminants become resistant to conventional chemical and biological treatments. Their toxicity and bad impacts to society and environment has led many developments of alternative treatment technologies to handle water pollutants in water.

Phenol which is also known as carbolic acid is one of the most highly discharged pollutants that are dangerous to environment. It has been detected in surface waters, rainwater, sediments, drinking water, groundwater, urban runoff and industrial effluents. This bio recalcitrant organic pollutant normally found in many industrial effluents such as wastewater from coal processing plants, pulp and paper manufacturing plant, steel industries, textile units etc. Phenol is an irritating and corrosive substance at high concentration hence can cause musical membranes targets of toxicity in humans according to (McCall, Betanzos, & Weber, 2009). Besides, phenol can give negative impacts to environment as well.

From years to years, researches developed many alternatives to eliminate phenol from water. For example, advanced oxidation process such as ultrasonic (Jasim & Engineer, 2014), photolysis and photocatalysis has been used for phenol treatment. Another existing method for phenol degradation includes adsorption using activated carbon and biological method such as biodegradation of phenol has been widely used for phenol