PHOTOBIODEGRADATION OF PHENOL USING MIXED MICROBIAL CULTURE AND N-S-TiO_2 UNDER VISIBLE LIGHT

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ABSTRACT

Photobiodegradation is a process of combining two methods of degradation which are photodegradation and biodegradation. In this project, it uses both the light and microorganism (mixed microbial culture) to degrade phenol compound. The kinetic of photodegradation of phenol using N-S TiO_2 catalyst under visible light at various dopant concentrations, catalyst loadings and initial phenol concentrations (during photo-biodegradation) were investigated. The biodegradation performance (during photo-biodegradation) was also evaluated. From the first experiment, the dopant concentration that offers the best result for first order reaction was 1.00% with the apparent rate concstant, k_{obs} of 0.226 h^{-1}. Meanwhile, the best catalyst loading was 2 g/l with k_{obs} of 0.564 h^{-1}. For photobiodegradation, the most promising result was obtained at the initial phenol concentration of 25 ppm where complete phenol degradation achieved within six hours of reaction.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Phenol (C_6H_6O); phenyl group ($-C_6H_5$) bonded to hydroxyl group (-OH) also known as carbolic acid. Phenol is the toxic substance regularly released as waste by the industries of textiles, leather, pharmaceutical, resin processing, oil plant (Azam Haddadi, 2013), coal conversion process, synthesis of organic chemicals, and also petroleum refining process (Hui Liu, 2011). The toxicity and carcinogenic properties that associate with phenol have makes it the dangerous chemical to the living organisms and ecosystem even with small quantity (I. Dobrosz-Gomez, 2015). Therefore, many actions taken to make sure phenolic compound release by those industries can be treated before exposure to environment take place.

Photobiodegradation is a process of combining two methods of degradation which are biodegradation and photodegradation. It uses both the microorganism and light to degrade chemical component. This process is a new process to be studied with a wish to have better result by utilizing two best known methods to degrade chemical components especially phenolic compound. The straight forward overview for this process is the chemical component will first undergo photodegradation by light with the help of catalyst before going to the second phase of the degradation by microorganism such as bacterial culture.

Photobiodegradation can be used to treat the phenolic compound available in the wastewater from various production plants such as from textile production and pharmaceutical plant. The phenol in the wastewater will be degraded into less or not