

**SYNTHESIS OF MAGNETITE ZnO/Fe<sub>3</sub>O<sub>4</sub> AS  
COMPOSITE CATALYST USING SOL-GEL  
METHOD FOR SONOCATALYTIC  
DEGRADATION IN WASTEWATER TREATMENT**

**MOHAMMAD TAUFIK BIN YUSUB**

**BACHELOR OF CHEMICAL ENGINEERING  
(ENVIRONMENT) WITH HONOURS**

**UNIVERSITI TEKNOLOGI MARA**

**2017**

## AUTHOR'S DECLARATION

I declare that the work in the thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the results of my own, unless otherwise indicated or acknowledge as reference work.

I, hereby acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

Signed :  .....

Date : 11/7/2017 .....

**Mohammad Taufik bin Yusub**

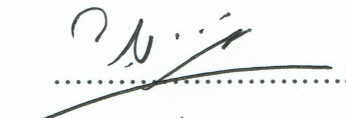
Student ID: 2014666224

## SUPERVISOR'S CERTIFICATION

We declared that we read this thesis and in our point of view this thesis is qualified in terms of scope and quality for the purpose of awarding the Bachelor of Chemical Engineering (Environment) with Honours.

Signed :

Date :

  
.....  
11/7/2017  
.....

Main Supervisor  
**Pn Nur Fadzeelah binti Abu Kassim**  
Faculty of Chemical Engineering  
Universiti Teknologi MARA  
Cawangan Pulau Pinang  
13500 Permatang Pauh  
Pulau Pinang

**NUR FADZEELAH ABU KASSIM**  
*Pensyarah Kanan*  
Fakulti Kejuruteraan Kimia  
UiTM Caw. Pulau Pinang

Signed :

Date :



.....  
Nor Aida Zubir (Dr)

Koordinator Program

Fakulti Kejuruteraan Kimia

Universiti Teknologi MARA (Pulau Pinang)

Co-Supervisor

**Dr. Nor Aida binti Zubir**  
Faculty of Chemical Engineering  
Universiti Teknologi MARA  
Cawangan Pulau Pinang  
13500 Permatang Pauh  
Pulau Pinang

## ACKNOWLEDGEMENT

I pray to Almighty ALLAH Subhanahu wa Ta'ala who give me the thoughts, the will, and guided me to complete this work. I pray that ALLAH will bless this work and make it useful for mankind, and that He will forgive us.

This work would not have been possible but for the assistance and encouragement of a number of people who not only stimulated impetus, but also offered their support spiritually.

My unalloyed gratitude to my project supervisor, Madam Nur Fadzeelah binti Abu Kassim for her guidance, encouragement, patience and continuous follow up during the course of this study. My appreciation and gratitude is also extended to my co-supervisor and coordinator of this project, Dr Aida Zubir and Madam Noorzalila who also guide me in finishing this study.

My gratitude is also due to all the staff of the Faculty of Chemical Engineering, UiTM for their cooperation.

Finally, I must express my deepest gratitude to my parents continuously encouraged me

## ABSTRACT

Over the past decades, advanced oxidation processes (AOPs) for wastewater treatment drawn a great deal of attention of the researchers. Among the AOPs method available, sonocatalysis is chosen in this study as a method to degrade phenol in wastewater. The objective of this study were to prepare ZnO/Fe<sub>3</sub>O<sub>4</sub> composite catalyst by using sol gel method and also to determine the feasibility of the prepared catalyst. In this study, magnetite (Fe<sub>3</sub>O<sub>4</sub>) nanoparticles were first prepared from ferric nitrate(Fe(NO<sub>3</sub>)<sub>3</sub> 9H<sub>2</sub>O) and ethylene glycol (C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>) using the sol-gel method. In the next stage, ZnO/Fe<sub>3</sub>O<sub>4</sub> composite were obtained from zinc acetate and diethanolamine via the sol–gel method. The result of magnetic properties analysis from Vibrating Sample Magnetometer (VSM) showed the saturation magnetization values, M<sub>s</sub> of ZnO/Fe<sub>3</sub>O<sub>4</sub> composite obtained was at 3.8 emu/g while the coercivity, H<sub>c</sub> value obtained was 26 kOe. Based from the VSM result also, ferromagnetic nanoparticles were produced in this study. The result obtained from Fourier Transform Infrared Spectrum (FTIR) analysis of the prepared nanocomposites showed the characteristic absorption of Zn–O bond is at 423.57 cm<sup>-1</sup> and of Fe–O bond is at 661.14 cm<sup>-1</sup>. Sonocatalytic degradation of phenol solution experiment was conducted at three different conditions in this study. The first condition where the phenol solution was irradiated with ultrasound showed only 1.5% degradation throughout 120 min reaction. The second condition when Fe<sub>3</sub>O<sub>4</sub> nanoparticle was added into the solution showed no degradation occur while the degradation was enhanced to 21.2% in the third condition when ZnO/Fe<sub>3</sub>O<sub>4</sub> composite was added into the solution show that the presence of ZnO acted as a calayst during the reaction.