SYNTHESIS OF MAGNETITE ZnO/Fe_3O_4 AS COMPOSITE CATALYST USING SOL-GEL METHOD FOR SONOCATALYTIC DEGRADATION IN WASTEWATER TREATMENT

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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.

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SUPERVISOR'S CERTIFICATION

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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_3O_4 composite catalyst by using sol gel method and also to determine the feasibility of the prepared catalyst. In this study, magnetite (Fe_3O_4) nanoparticles were first prepared from ferric nitrate($Fe(NO_3)_3$ $9H_2O$) and ethylene glycol ($C_2H_6O_2$) using the sol-gel method. In the next stage, ZnO/Fe_3O_4 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, Ms of ZnO/Fe_3O_4 composite obtained was at 3.8 emu/g while the coercivity, Hc 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^{-1} and of Fe–O bond is at 661.14 cm^{-1}. 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_3O_4 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_3O_4 composite was added into the solution show that the presence of ZnO acted as a calayst during the reaction.