

**PHOTOCATALYTIC ACTIVITY OF  
ZINC OXIDE (ZnO)/LOW DENSITY POLYETHYLENE (LDPE) COATED  
WITH SILVER UNDER VISIBLE LIGHT:  
THE EFFICIENCY OF DIPPING AND HAND LAY-UP TECHNIQUE**

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(Anis Amira Binti Badrol Hisham)

## ABSTRACT

### **PHOTOCATALYTIC ACTIVITY OF ZINC OXIDE (ZnO)/LOW DENSITY POLYETHYLENE (LDPE) COATED WITH SILVER UNDER VISIBLE LIGHT: THE EFFICIENCY OF DIPPING AND HAND LAY-UP TECHNIQUE**

Due to the significant global population growth and the demand for people to embrace better living conditions, the consumption of polymers has dramatically increased over the past few decades (especially plastics). According to recent data for Western Europe, the yearly total consumption of plastic products was estimated at 48.8 million tonnes in 2003, or 98 kg per person. One of the most common types of thermoplastic, low density polyethylene (LDPE), is used globally in products including bags, toys, containers, and pipes. As the consumption of plastic getting increase year by year, it would cause a pollution to the world. To overcome this issue, photo-degradation of LDPE have been investigated in this study by using methylene blue (MB) as a contaminant. ZnO was used as a photo-catalyst in order to increase the photo-degradation rate. ZnO has large direct band gap of 3.37 eV, high exciton binding energy of 60 m eV at 300 K, low toxicity, low cost, excellent stability, strong photosensitivity and high photocatalytic efficiency. However, ZnO has its own limitation. Thus, to overcome this limitaton, silver was chosen as a metal to enhance the photocatalytic activity. The adding of Ag particles on the surface of semiconductor photocatalysts can enhance the visible light absorption and increased the photocatalytic performance. Four samples were used in this study which are bare LDPE, and three samples of ZnO/LDPE. The fabrication process begin by compress and heat the raw LDPE in the square mold by using hot press with the temperature of 150 °C. For the sample contain ZnO, 1 g of ZnO powder was used. Two samples of ZnO/LDPE was coated with the silver by two different technique to observe the efficiency of both technique. The technique used was dipping and hand lay-up technique. The coated samples was let to be dried for few minutes at room temperature before being analysed with certain instruments. The dipping technique is more efficient in enhancing photocatalytic degradation of LDPE compared to hand lay-up technique according to the data obtained. However, the loading of silver only give a slightly increase in the photocatalytic performance compared to ZnO according to this research. The photo-degradation mechanism of MB was observe under visible light for 420 minutes. The instrument used to analyzed the samples are ATR-FTiR, Spectronic 20 and Optical Microscope. Photocatalytic kinetic degradation of MB can be obtain by Langmuir-Hinshel-wood model.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of study

Plastics are really well known nowadays due to its variety of functions. Common applications in the using of plastics including water bottles, car parts, clothes, food packaging, bicycle helmet, and construction equipment. Plastics have evolved into an important and adaptable material with a wide range of characteristics, chemical compositions, and applications over the previous six decades. Although most of the plastics are safe to be used but years by years, the abundance of plastic used have become problem to the environment (Okunola, 2019). It resulting to the increasing of plastic waste which later leads to plastic pollution, air pollution, water pollution and soil pollution.

Jambeck *et al.* (2015) stated that during 1930s and 1940s, plastics manufacture have been progressively prominent in the consumer marketplace, and they are now widespread in the 21st century. Plastics output has expanded from 15 to 311 million tons during the last five decades. Plastics manufacture is predicted to rise again during the next 20 years, nearly quadrupling in 2050, according to its expanding use in numerous areas of the industry. However, the main issue of the synthetic