PREPARATION OF HYBRID CuO/TiO_2 PHOTOCATALYST RESPONSIVE TOWARDS UV-LIGHT (EFFECT OF COPPER CONCENTRATION)

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ABSTRACT

Titanium dioxide (TiO_2) is often used in wastewater treatment plant. However, the photocatalytic activity is limited due to the degradation of dye using TiO_2 only occur in UV range. Therefore, to enhance the performance of photocatalytic activity, doping TiO_2 with metal will enhance the degradation activity under UV and visible light. The objectives of this research is to prepare hybrid CuO/TiO_2 using wet impregnation method by varying copper concentration, to characterize the photocatalyst using XRD, EDX, FESEM and BET and to evaluate the photocatalytic removal of methyl orange by hybrid CuO/TiO_2 photocatalyst. To investigate the removal efficiency of methyl orange by using hybrid CuO/TiO_2, the copper concentration was varied from 0.3 wt%, to 1.0 wt% at 90 ^{o}C incubation temperature and 2 hours incubation time. From XRD result, the present of copper cannot be detected because the copper concentration is too low (<1 wt%), only titanium and oxygen element was detected. In the other analyser, EDX, the present of copper element was detected along with titanium and oxygen element. The mappings of the elements were shown by EDX and FESEM images. A homogenous distribution of copper on titanium dioxide surface was observed. As for BET, it shows the surface area, pores width and pores volume of the Cu doped TiO_2 photocatalyst were 9.17 m2/g 7.86 m2/g and 0.04 cm3/g. The photodegradation results showed that 0.5 wt% CuO/TiO_2 performance was the highest with 46% removal of methyl orange. The kinetic data studies were fitted into pseudo-first, pseudo-second and intraparticle diffusion model. The kinetic of adsorption model was found to follow pseudo-first order model as the highest regression value at 0.5 wt% copper loading was 91%.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

In textile industries, the major problem faced was on the wastewater sources in corresponding to the high level of dye stuff waste and floating solid materials. Wastewaters generated by the textile industries are known to contain significant amounts of non-fixed dyes, especially azo-dyes, and a huge amount of inorganic salts. According to Pirkarami and Olya (2014), about 5000 tons of dye material waste was discharge by the factory to the environment every year. The oxygen in water was absorbed by the toxic material from the discharge and threatens human life and ecosystem.

From the total production of dye in the world, more than 15% of it contributes to orange ll azo-dyes that has been used in textile manufacturing industries (Riaz et al., 2012). Orange ll is resistance to light degradation and it does not undergo biological degradation. Although the stability of orange ll is very useful in textile industrial but it causes difficulty in handling its effluent.

There are several ways to treat the dye effluent from the industries. Firstly, the treatment is by physical technique such as coagulation, precipitation and membrane separation. Secondly, is by chemical treatment. The dye is break down into simpler