UNIVERSITI TEKNOLOGI MARA

PHOTOCATALYTIC ACTIVITY OF SILVER-DOPED TITANIUM DIOXIDE ON METHYL ORANGE DEGRADATION: EFFECT OF PH

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ABSTRACT

The photocatalytic activity of silver (Ag) deposited titanium dioxide (TiO_2) in the photodegradation of methyl orange (MO) was investigated. The bare TiO_2 and the Ag-doped TiO_2 was successfully synthesized by wet impregnation method. The photocatalysts were characterized using XRD, FESEM, BET, FTIR, BET, Malvern particle and EDX. The results show the crystal structure of bare TiO_2 and Ag doped TiO_2 to be an anatase structure. The FESEM image of both samples shows some square-like and spherical shapes in various sizes. In EDX analysis, the Ag nanoparticles are uniformly dispersed in the TiO_2 nanoparticles. In FTIR analysis, the peaks observed for both bare TiO_2 and Ag-doped TiO_2 powder were almost the same at 1737 and 3500 cm-1 respectively. The surface area of bare TiO_2 and 5wt% of Ag-doped TiO_2 were 9.71 and 9.32 m^2/g, respectively. UV-Vis spectrophotometer was used to determine the wavelength and band gap energy of bare TiO_2 and Ag-doped TiO_2. It founded that the wavelength for both photocatalyst samples giving the same results which is 374 nm although Ag was added into TiO_2 particle. The photocatalytic degradation on methyl orange under UV light irradiations was studied at different pH value of MO solution. The results show that the Ag-doped TiO_2 enhanced the photodegradation of MO dye in all the pH range studied. In addition, the optimum pH for both photocatalysts is at 2 with 98% removal efficiency for Ag-doped TiO_2. Therefore, it can be concluded that Ag-doped TiO_2 has a great potential for dye removal under favorable pH condition.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Recently, the wastewater from other industries, factories and laboratories has becomes the serious problem to the environment. Thus, various techniques was implemented by industrials to overcome these problems where are facing with ever increasing the people and decreasing in energy resources. Generally, the effectiveness of photocatalytic activity will be achieved by presence of semiconductors acts as catalyst to fix the wastewater field. The semiconductor has exposed with a good capability as a low cost and free from harm to the environment. Among the best semiconductors is titanium dioxide (TiO_2) due to high photocatalytic activity, very stable and free from toxic (Muthirulan et al., 2017). Moreover, many applications have been used to forms the TiO_2 particles. One of them is formed by simple sol gel process, wet impregnation and hydrothermal treatment. But, instead of their low specific surface area, the photocatalytic activity is limited (Akpan and Hameed, 2009).

In recent years, the new technology approach has been introduced for preparing the TiO_2 particles by using TiO_2 nanotubes arrays. This is because they can increase the surface area of particles; very fast in transferring the electrons as well as the efficiency of photocatalytic activity can be enhanced (Liao et al., 2011). Besides, the effectiveness of TiO_2 will be achieved by doping the TiO_2 with metal and non-metal into it.

For metal doped, the presence of metal ions from dopants reaction are obtained from light source irradiation for generates the electron-hole pairs shows the improving the interfacial electron transfer rates and charge carrier recombination rates which can increases the photocatalytic activity (Yang et al., 2015). There are several types of metal doped used which are copper, zinc, platinum silver and iron. For non-