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Greenhouse Gases Degradation by Dye Sensitized Nano *ZnO* under Visible Light irradiation

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Abstract

In this study, dye sensitized commercial and prepared nano ZnO were used in photocatalytic degradation of two main greenhouse gases, methane and carbon dioxide in a batch reactor under visible light. ZnO nanoparticles were produced by sonochemical method in high frequency. In order to activate nanoparticles in visible region, copper phthalocyanine was used. Calcinated commercial and prepared nano ZnO, after immobilizing the dye were analyzed by FTIR, SEM and UV-vis. SEM images showed that the dye sensitized nanoparticles were more smooth and uniform than the dye sensitized commercial ZnO particles. UV-vis spectra indicated the expansion of absorption band of photocatalysts to visible area after sensitization by CuPc. Conversions of CO_2 and CH_4, using dye sensitized nano ZnO, were 11.3 and 12.2%. These percentages in comparison with dye sensitized commercial ZnO were more about double.

Key words: Photocatalyst, Nano ZnO, Dye, Greenhouse gases, Visible light.

1. Introduction

The main greenhouse gases; methane, carbon dioxide and chlorofluorocarbons (CFCs) are the most important gases in creation of global warming, because of their greenhouse effects. Among greenhouse gases, CO_2 and CH_4 have high dispersion in atmosphere and the highest contamination rate belongs to CO_2 [1-3]. These gases are mainly increasing due to human activities and using natural sources of hydrocarbons [1]. As monitoring, this temperature increasing gets more attention recently, it needs a method to remove, decrease or convert CO_2 to useful materials. An effective procedure to decrease CO_2 from atmosphere is replacing carbon fuels with non-fossil fuels like H_2 and renewable energy sources. Since the use of carbon dioxide fuel sources is continued, there must be a procedure to trap, transport and store available CO_2, and find a way to use that [4]. Recently, photocatalysts have been widely used to remove greenhouse gases like CO_2 and CH_4 [1-3]. Among different photocatalysts, ZnO has been used widely, because of some advantages like; normal reaction conditions, being harmless, low price, stability, use of sun energy, high chemical activity in the presence of light, and low environmental contamination [5]. It has been reported that to obtain better ZnO performance, smaller particles will act better than larger ones, by influencing on the band gap energy and surface of photocatalyst [6, 7]. There are different methods to produce different shapes of