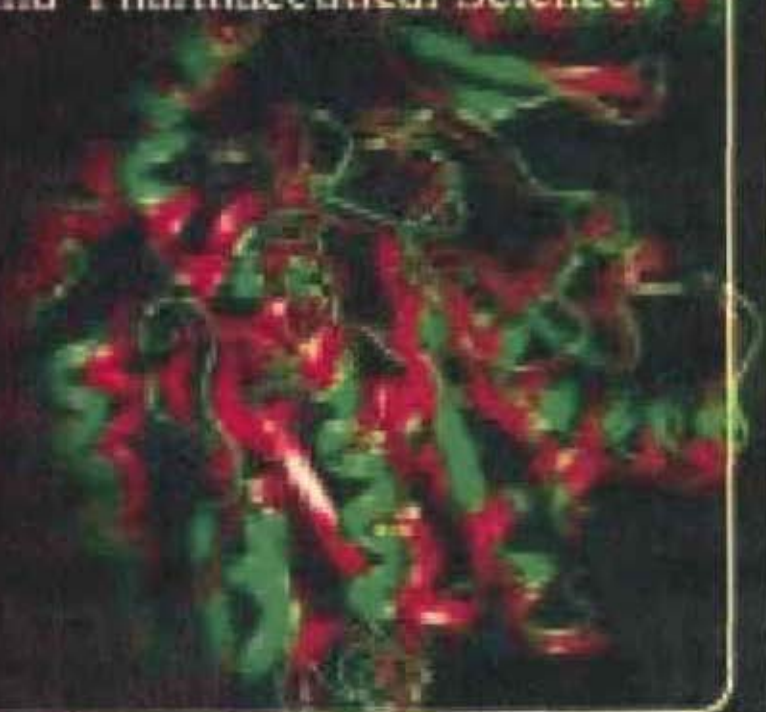




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The effect of the calcinations temperature during synthesis of $\text{TiO}_2\text{-Fe}_3\text{O}_4$ -bentonite as photocatalyst material

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ABSTRACT

The $\text{TiO}_2\text{-Fe}_3\text{O}_4$ supported bentonite has been synthesized. The syntheses of the $\text{TiO}_2\text{-Fe}_3\text{O}_4$ based photocatalyst have been carried out by sol-gel method. The bentonite used for porous support was obtained from Pacitan, Indonesia. The mol ratio of Ti and Fe in this experiment was 1:1. The syntheses of the photocatalyst material were followed by calcinations. This experiment was focused on the effect of temperature calcinations toward Ti and Fe crystal phase, which was affected to the capability of the materials in photocatalysis of phenol degradation. The variation of the calcinations temperature was 500, 600 and 700°C. The physicochemical properties of $\text{TiO}_2\text{-Fe}_3\text{O}_4$ bentonite samples were characterized by X-ray diffraction. Photocatalytic activity of the materials was evaluated by phenol photodegradation using UV light. The calcinations temperature was significantly influenced in the forming of anatase phase of TiO_2 which was affected in the catalytic activity.

Keywords: bentonite; calcination; $\text{TiO}_2\text{-Fe}_3\text{O}_4$; phenol degradation; photocatalyst

INTRODUCTION

Photocatalytic technology has various applications in degradation of organic and inorganic pollutants. Some of photocatalysts that have been used were TiO_2 , Fe_2O_3 and other substances. TiO_2 has been widely used as photocatalysts because of its relatively high photocatalytic activity, biological and chemical stability, low cost, non-toxicity, and long term stability against photocorrosion and chemical corrosion [1,2]. However, TiO_2 has limitation on the aspect of the photocatalytic activity in the UV region and also the difficulty to be separated from the system. Some methods has been developed by the researchers to solve this limitations, such as doping transition metals [3,4,5,6], doping non-metallic elements [7,8,9,10,11], etc. Its purposes to enhance the photocatalytic activity of TiO_2 and also to improve the utilization of visible light. The researches resulted that the composite photocatalysts had higher photocatalytic activity than single ones. Therefore, iron oxide / iron ore (Fe_2O_3) can be added to TiO_2 as a stabilizer in the application of TiO_2 . The existence of magnetite (Fe_3O_4) as a doping oxide in this composite also serves as a crystal formation controller of anatase phase. Anatase phase of TiO_2 photocatalyst give greater photocatalytic ability than the rutile phase of it [12]. In this study, it also used bentonite as a support catalyst. Bentonite generally is used as adsorbents and catalysts because of the pore number. The utilization of bentonite as solid support will facilitate and accelerate the mass transfer of adsorbate into the bentonite so that the contact between metal oxide of photocatalyst with organic compounds will more easily occur and react.