



Decolorization performance of TiO_2/Zr catalysts supported on Nanostructured material including Carbon

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ABSTRACT

A composite of Zr-doped TiO_2 and carboxylic multiwall carbon nano tube (MWCNT-COOH) as a support was successfully synthesized by using Sol-Gel method. Increasing specific surface area of TiO_2/Zr nano photocatalyst (NPC), perform by padding the catalyst on substrate of (MWCNT-COOH). The porous structure of catalyst with high specific surface area obtained via calcination phase by removed carbonaceous structure. TiO_2 with Zr as dopant lead to high photo catalyst activity and decreasing BG energy. Decolorization ability of NPCs monitored by using UV-Vis spectrophotometer. Padding of TiO_2 on MWCNT-COOH as substrate cause high specific area and the best photocatalytic activity. Properties of support and catalyst were characterized by SEM, TEM, XRD, FT-IR and BET. For photocatalytic applications, the band gap of the synthesized semiconductors was determined. The TOC analysis has perform for proving the Decolorization of Acid Red 88 as a Azo dye. $\text{TiO}_2/\text{Zr}/\text{MWCNT-COOH}$ was the best performance.

Keywords: Zr-Doped TiO_2 , MWCNT-COOH, spectroscopic techniques, Sol-Gel, decolorization.

1. INTRODUCTION

Industrial wastewaters are one of the most significant causes of environmental pollution [1]. Dyes are color organic compounds which can colorize other substances [2]. The complex aromatic structures of dyes make them more stable and more difficult to remove from the effluents discharged into water bodies [3]. Effluent from the dyeing industry contain highly colored species; such highly colored wastes are not only aesthetically displeasing but also hinder light penetration and may in consequence disturb biological processes in water-bodies [4]. In addition, dyes are toxic to some organisms and hence harmful to aquatic animals. Furthermore, the expanded uses of dyes have shown that some of them and their reaction products such as aromatic amines are highly carcinogenic [5]. Therefore, removal of dyes before disposal of the wastewater is necessary. Most of the used dyes are stable to photodegradation, biodegradation and oxidizing agents. Currently, several physical or chemical processes are used to treat dye wastewaters [6-7]. Adsorption has been found to be superior to other techniques for treating wastewater: it is low-cost, highly efficient, simple, easy to perform and insensitive to toxic substances [8]. Heterogeneous photocatalysis is an emerging technique for environmental remediation where semiconductor materials are used as photocatalysts. When organic pollutants are decomposed by heterogeneous catalytic reactions, the pollutant molecules adsorb on the surface of the catalysts, where chemical bonds are broken and formed on the surface and eventually small organic molecules are released as products. [9-10]. Multi Wall Carbon nanotubes (MWCNTs) have been the worldwide hotspot of study since their discovery because of their unique morphologies and various potential applications. Because of their relatively large specific surface areas and easily modified surfaces, much attention has been paid to the adsorption by MWCNTs.

The aim of this research was to achieve to high activity photocatalyst based on TiO_2 . Effect of incorporation of trace amount of Zr as dopant in photocatalyst activity of TiO_2 lattices investigated. For increasing specific surface area of TiO_2 , partial amount of MWCNT-COOH added as a substrate to sol-gel. After sedimentation of TiO_2 on