



Sol-gel prepared vanadium oxide for photocatalytic degradation of Methylene Blue dye

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ABSTRACT

In the present work vanadium oxide (V_2O_5) was prepared by simple and direct sol-gel method by using ammonium metavanadate as precursor in the presence of ammonia as complexing agent. For structural and morphological analysis of V_2O_5 different characterization techniques were used. X-Ray Diffraction and Fourier Transform Spectroscopy were used for structural identification and functional group detection. The morphology of prepared material was studied by Scanning Electron microscopy technique. For band gap measurement (optical study) of V_2O_5 , the UV-Visible Spectrophotometer techniques were used. Finally the Photocatalytic activity of the calcinated product for Methylene Blue (MB) dye was studied. The percentage of degradation and rate constant also calculated. The present work shows the good photocatalytic activity of V_2O_5 for hazardous MB dye and degradation take place in this case is about 75%. Thus V_2O_5 is promising material for photocatalytic activity.

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1. Introduction

Environmental pollution is the major problem in front of the world. The level of pollutant in environment increases every day, which creates major issues like atmospheric imbalance, diseases, etc. Due to industrialization, lots of hazardous pollutants were mixed in water which causes irremediable damage to health as well as an environment. Discharge from textile industries is a major source of various organic dyes such as methylene blue, methyl orange, and rhodamine-6 G (Rh-6 G) dye in usable water [1]. Organic dyes are carcinogenic and cause serious damage to everyone's life. There are various dye removal processes reported such as precipitation, adsorption by activated carbon, coagulation, and ultra-filtration. The major problems of these processes are they simply transform pollutant from one phase to another phase and form secondary pollutants [2]. The photo catalysis process has astonished results such as it shows degradation of dyes, can pro-

duce hydrogen, it shows antibacterial activity. The photo catalytic degradation of such hazardous and non-biodegradable pollutants under visible light irradiation is a simple treatment to waste water. The photo catalytic degradation process has several advantages such as a low temperature process, complete mineralization, fast, simple and inexpensive.

The metal oxides have good photo catalytic property because it has large surface area; can produce at room temperature, low cost, etc. Metal oxide semiconductors such as TiO_2 , ZnO , WO_3 , V_2O_5 , Fe_2O_3 , etc show good photo catalytic property. Because of more promising properties, V_2O_5 received more attention towards it. The most promising property of vanadium oxide is, it has variable oxidation states. Several oxidation states such as VO , VO_2 , V_2O_5 , V_3O_7 , and etc. have been reported. Among all vanadium oxide phases, V_2O_5 is more stable and most useful for the energy storage application due to its electrochemical property [3], gas sensor application [4,5]. The V_2O_5 is n-type semiconductor material and it has a low band gap (about 2.2 eV) [6]. Also V_2O_5 is non-toxic, shows chemical as well as photo stability and it has a high absorption in the visible region [1]. Because of its non-stoichiometry it is

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