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Visible Light Induced Photocatalytic Degradation of Victoria Blue by using ZnS and Co Doped ZnS Nano Catalyst

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Abstract: **ZnS and Co doped ZnS were synthesized by chemical precipitation method. Structure and morphology of synthesized Co doped ZnS nano catalyst was investigated using scanning election microscopy (SEM), Electron dispersive X-ray spectroscopy (EDS) and X-ray diffraction (XRD). The photocatalytic activity of Co doped ZnS nano catalyst was investigated by degradation of Victoria blue solution under visible light radiation. The effects of various parameters such as the Victoria blue concentration, catalyst dose, effect of pH on the photocatalytic degradation were examined. The kinetics study shows that the reaction follows pseudo first order kinetics. Among the different amounts of dopant like 1, 2, and 5 wt% Co-doped ZnS nanocatalyst, it was observed that 5 wt % Co doped ZnS shows highest degradation rate for Victoria blue. The particle size, surface morphology and photo induced electron–hole pair generation are the key factors which has impact on photocatalytic activity.**

Keywords: Victoria blue, ZnS and Co doped ZnS, photocatalysis.

I. INTRODUCTION

Now-a-days environmental pollution becomes major area of concern worldwide. Nanotechnology could be the possible solution to this problem. The rapid development in the field of nanotechnology with time have gain attentions considerable attentions on the synthesis and manufacturing of ZnS (Xianfu W., et al.,2013; Gang-Juan L.et al.,2017; Sheshtawy H.et al.,2018). The ZnS has been extensively studied because of its potential applications in flat-panel display, light-emitting diodes (LEDs), infrared windows, electroluminescence, sensors, lasers and photocatalysis due to its diverse range of possible structures and morphologies, and superior chemical and thermal stabilities (Rao R., et al.,2005; Leary R. et al., 2011). Due to the stability of present dyes, conventional treatment methods for industrial wastewater are ineffectual, causing frequently in an intensively discharge of colored pollutants from the effluent treatment plants into the nearby water streams. In recent times, a number of researchers are focusing on heterogeneous photocatalytic degradation of variety of dyes (Augugliaro V., et al.,2002; Datta R., et al.,2002; Sarteep Z., et al.,2016). ZnS nanostructures are interesting entities for catalytic activities because of their notable chemical stability against oxidation and hydrolysis. Besides, ZnS is available in abundance and is nontoxic. Therefore, ZnS can play an important role as catalyst in environmental protection through the removal of organic and toxic water pollutants. ZnS is a wide band gap semiconductor with band gap of 3.77 eV which can be used as photocatalyst. It has a good photocatalytic property of generating rapid electron-hole pair by photo excitation (Langjam M., et al.,2015). Therefore, ZnS can play an important role as catalyst in environmental protection through the removal of organic and toxic water pollutants (Xiaosheng F., et al.,2011). However, for such application it would be desirable to extend the band gap excitations towards the visible region, and also to prolong the lifetime of photo generated charge carriers. Doping of Zinc sulphide with transition metal ions provides a relatively well-studied and convenient way of solving both problems described above. Zinc sulphide doped with transition metal ions can demonstrate extended band gaps and significantly higher photocatalytic efficiencies (Rathore P., et al.,2015; Pricilla A., et al.,2017). In such case dopant proportion is an important parameter to be considered, as the amount of dopant influences the processes of charge carrier trapping, separation and recombination (Nayereh S.,et al.,2012).Thus, the amount of

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