Available online at **www.joac.info**

ISSN: 2278-1862

Journal of Applicable Chemistry

2019, 8 (4): 1657-1664

(International Peer Reviewed Journal)

Electrochemical Synthesis and Factors Affecting the Photocatalytic Behaviour of ZnO-V_2O_5 Nanostructures

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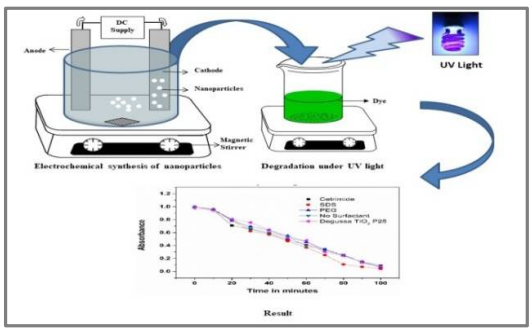
Accepted on 9th June, 2019

ABSTRACT

An attempt is made to establish the role of electrochemically generated nanostructures of Zinc-Vanadium oxides as photocatalysts by investigating 2 commonly used dyes Methylene Blue (MB) and Eriochrome Black-T (EBT) under UV light. Mixed metal oxides of Zinc and Vanadium (ZnO and V_2O_5) nanostructures (ZVO) were synthesized using a facile electrochemical-thermal method by electrolyzing an aqueous solution of sodium bicarbonate and sodium vanadate using sacrificial Zinc electrodes in an undivided pyrex cell under potentiostatic conditions at room temperature. The resulting particles were calcined at different temperatures. The role of 3 different surfactants-Cetyltrimethyl ammonium bromide (Cetrimide), Sodium dodecyl sulphate (SDS) and Polyethylene glycol (PEG) during synthesis was also investigated to enhance their photocatalytic action. Characterization of these nanoparticles was carried out using powder XRD, SEM, TEM, FTIR, TGA and UV-Visible spectra. Photocatalytic behavior of the prepared and pulverized samples was investigated using different dyes like MB and EBT. The effect of operating parameters like temperature and initial dye concentration on the rate of dye degradation was studied. High degree of decolorization was achieved under optimum experimental conditions suggesting photochemical degradation of dyes by nanostructures of ZnO-V_2O_5. The photodegradation results indicate high degree of decolorization and resultant mineralization of the organic dyes. It indicates that this technique could be envisaged for treatment of effluents mainly from textile industries.

Graphical Abstract



Keywords: Electrochemical, Zinc, Vanadium, Nanostructures, Photocatalyst, Surfactant.