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Gold nanoparticle supported on mesoporous vanadium oxide for photo-oxidation of 2-naphthol with hydrogen peroxide and aerobic oxidation of benzyl alcohols



Biraj Das^a, Mukesh Sharma^a, Manash J. Baruah^a, Bedanta P. Mounash^a, Galla V. Karunakar^b, Kusum K. Bania^{a,*}

^a Department of Chemical Sciences, Tezpur University, Assam, 784028, India

^b Division of Fluro and Agro Chemicals, CSIR- Indian Institute of Chemical Technology, Hyderabad, Telangana, 500007, India

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ABSTRACT

Vanadium oxide supported gold nanocatalysts designated as AuVO_x was found to be highly efficient for photocatalytic oxidation of benzyl alcohol and 2-naphthol. The photocatalytic ability of the AuVO_x catalyst towards the selective oxidation of 2-naphthol to BINOL was found to be dependent on the nature of the support. The selectivity of the reaction was found to be significantly altered on hybridization with multi-walled carbon nanotubes (AuVO_x-MWCNTs). The well-resolved surface plasmon resonance (SPR) band originated from the gold nanoparticles (Au-NPs) on the vanadium oxides support helped in stimulating the photo-oxidation of benzyl alcohol to benzaldehyde and 2-naphthol to BINOL with almost 100% selectivity. The most notable achievement using the AuVO_x and AuVO_x-MWCNTs catalyst was in the successful photo-oxidation of 2-naphthol to BINOL in presence of hydrogen peroxide (H₂O₂). The photo-activity of the material and the creation of oxygen defect sites participated in the photochemical processes were estimated from photoluminescence analysis and ESR study. The photochemical reaction was supposed to proceed via superoxide radical generation favored by the oxygen defect sites.