Bio-inspired synthesis of Y_2O_3:Eu^{3+} red nanophosphor for eco-friendly photocatalysis

J.B. Prasanna kumar [1, 2], G. Ramgopal [3], Y.S. Vidya[4], K.S. Anantharaju[5*], B. Daruka Prasad[6], S.C. Sharma[7], S.C. Prashantha[5], H.B. Premkumar[8], H. Nagabhushana[9*]

[1]*Department of Physics, GFGC Tumkur, Tumkur-572 102, Karnataka, India*
[2.] *Department of Physics, Sathyabama University, Jeppiaar Nagar, Chennai-600 119, Tamilmadu, India*
[3]*Department of Physics, Maharani's science college, Palace Road, Bangalore-560 001, Karnataka, India*
[4]*Department of Physics, Lal Bahadur Shastry Government First Grade College, Bangalore 560 032, India*
[5]*Research Center, Department of Science, East West Institute of Technology, Bangalore 560 091, India.*
[6]*Department of Physics, B M S Institute of Technology, Yelahanka, Bangalore-560064, India.*
[7] *Vice chancellor, Chattisgarh Swami Vivekananda Technical University, Bhilai (CG)-493441, India.*
[8]*Department of Physics, Acharya Institute of Technology, Bangalore-560 090, India*
[9]*Prof. CNR Rao Centre for Advanced Materials, Tumkur University, Tumkur-572103, India*

Abstract

We report the synthesis of Y_2O_3: Eu^{3+} (1-11 mol %) nanoparticles (NPs) with different morphologies *via* eco– friendly, inexpensive and simple low temperature solution combustion method using *Aloe Vera* gel as fuel. The formation of different morphologies of Y_2O_3: Eu^{3+} NPs were characterized by PXRD, SEM, TEM, HRTEM, UV-Visible and PL techniques. The PXRD data and Rietveld analysis confirms the formation of single phase Y_2O_3 with cubic crystal structure. The influence of Eu^{3+} ion concentration on the morphology, UV absorption, PL emission and photocatalytic activity of Y_2O_3: Eu^{3+} nanostructures were investigated. Y_2O_3: Eu^{3+} NPs exhibit intense red emission with CIE chromaticity coordinates (0.50, 0.47) and correlated color temperature values at different excitation ranges from 1868 to 2600 K. The control of Eu^{3+} ion on Y_2O_3 matrix influences the photocatalytic decolorization of methylene blue (MB) as a model compound was evaluated under UVA light. Enhanced photocatalytic activity of conical shaped Y_2O_3:Eu^{3+} (1 mol %) was attributed to dopant concentration, crystallite size, textural properties and capability of reducing the electron-hole pair recombination. The trend of inhibitory effect in the presence of different radical scavengers followed the order SO_4^{2-} > Cl^- > C_2H_5OH > HCO_3^- > CO_3^{2-}. These findings show great promise of Y_2O_3: Eu^{3+} NPs as a red phosphor in warm white LEDs as well as eco-friendly heterogeneous photocatalysis.

Key words: Bio-inspired; *Aloe Vera* gel; Y_2O_3; Eu^{3+}; Nanophosphors; Photocatalysis
*Corresponding Author: E-mail address: bhushanvlc@gmail.com, ananth.che@gmail.com, vidyays.phy@gmail.com