МЕЖДИСЦИПЛИНАРНЫЕ ИССЛЕДОВАНИЯ

STUDY OF THE PHOTOCATALYTIC DEGRADATION AND THE ENHANCED ANTI-BACTERIAL ACTIVITY AGAINST SEPTICEMIA OF Sm-DOPED ZnO NANOPARTICLES

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The present work reported the preparation of Sm-doped zinc oxide (ZnO:Sm) nanoparticles using a chemical precipitation method. Particle size, morphology, luminescence and optical properties are studied. The role of doping concentration on the antibacterial and photocatalytic properties is explored. The atomic doping concentration of Sm is chosen as 0*,* 1*,* 3 *and* 5*%. The uniformity and grain sizes of the prepared nanoparticles are effectively controlled by doping. Violet, blue and greenish yellow emissions are observed in the photoluminescence spectrum...*

Keywords: nanoparticles, precipitation, photoluminescence, septicemia.

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1. Introduction. The incorporation of rare earth elements (REE) in ZnO nanoparticles is one of the important and developing research in physics due to various applications, including dye degradation [1], anti-microbial agents [2], gas sensors [3], solar cells [4] and red-emitting phosphor material [5]. Though ZnO has many notable properties, such as a wide band gap, being non-toxic, and being abundant in nature, the surface modification of ZnO is needed to reduce the electron-hole recombination rate. This can be done by the addition of metal as a dopant, including REE. Since the ionic radii of REE are higher than the ionic radii of Zn, it creates more distortion and enhances the f-f transitions in the emission band. Moreover, it reduces the electron-hole recombination rate, which is favorable for its enhanced photocatalytic and anti-microbial properties [6, 7]. Recently, various REE-doped ZnO nanoparticles and their properties have been reported by various research teams [6–11].

M. Faraz et al. prepared the Sm-doped ZnO nanoparticles by the gel-combustion method. The addition of the dopant enhances the visible light absorption and the red-shifted band gap is observed. These nanoparticles are used for the degradation of Malachite green dye [12]. The red-shifted band gap is also observed by J. Sahu et al. In addition, with the red-shifted band gap, the fluctuating lattice parameters and the enhanced oxygen vacancies are also reported in their work [13]. The wet chemical synthetic route is used by H. E. Okur et al. to prepare the Sm-doped ZnO nanoparticles. The shifting of the maximum intensity plane to the higher Bragg's angle and the fluctuating lattice parameters are some of their important findings [11]. The effective degradation of methylene blue (MB), methyl orange (MO), and fast orange-red (FOR) dye is also reported in the literature [14, 15]. Recently, green-synthesized Sm-doped ZnO nanoparticles were prepared using Syzygium Cumini fruit extract. This semiconducting material has an 88% degradation efficiency of FOR with a half-life of 9.19 min. The enhanced zone of inhibition on gram-positive and gram-negative bacteria as well as the excellent cyclic voltammetry (CV) performance was also reported [15]. Inspired by the above-mentioned research works, we prepared Sm-doped ZnO nanoparticles by the chemical precipitation method...

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