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Fluorescence investigation on the interaction of phyto-synthesized ZnO NPs with bovine serum albumin

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Abstract

The environmentally friendly synthesis of nanoparticles has garnered significant interest due to the increasing need for safe, cost-effective, and sustainable technologies in nanomaterial production [1]. This study presents a novel and eco-conscious method for synthesizing zinc oxide nanoparticles (ZnO NPs) utilizing *Ficus religiosa* leaf extract as a renewable, non-toxic, and effective stabilizer. The successful formation of the biosynthesized ZnO NPs was confirmed through UV–Vis spectroscopy, X-ray diffraction (XRD), and field emission scanning electron microscopy (FE-SEM). Furthermore, a fluorescence-based technique was developed for the rapid and straightforward assessment of the interaction between the phyto-synthesized ZnO NPs and bovine serum albumin (BSA), a crucial carrier protein, under simulated physiological conditions at pH 7.4. This method is characterized by its ease of use, reliability, and practicality [2]. The experimental findings demonstrated that the intrinsic fluorescence of BSA could be quenched by the phyto-synthesized ZnO NPs. The Stern-Volmer plot exhibited a nonlinear trend with an initial upward curvature, likely resulting from a combination of static and dynamic quenching mechanisms [3]. The quenching constants and binding parameters, including binding constants and the number of binding sites, were determined using the fluorescence quenching data. Additionally, synchronous fluorescence spectroscopy indicated slight alterations in the local polarity surrounding the tryptophan and tyrosine residues during their interaction with the ZnO NPs [4]. The biological implications of this research are significant, as albumin functions as a carrier for various ligands. Consequently, this study could offer a new approach to investigate the biological toxicity of green synthesized ZnO NPs at the protein level.

Key words: Green synthesis, ZnO nanoparticles, Bovine serum albumin, Fluorescence spectroscopy.

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