**Abstract**

In this work, ZnO nanoparticles were prepared by in situ chemical precipitation method in the presence of Agar [biopolymer](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/biopolymer). The influences of Agar concentrations on the structural, morphological and optical properties of ZnO have been investigated. The XRD pattern of Pure ZnO and Agar/ZnO nanocomposites indicates the hexagonal [wurtzite](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/wurtzite" \o "Learn more about Wurtzite from ScienceDirect's AI-generated Topic Pages) phase of ZnO. The crystallite size of pure ZnO and Agar/ZnO nanocomposites was found to be in the range of 35.5 to 19.73 nm. Pure ZnO and Agar/ZnO nanocomposites showed nanospheroid and nanopaddy shaped morphology from FESEM studies. The interplanar distance observed from the [HRTEM](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/high-resolution-transmission-electron-microscopy) image confirms the plane of the prepared material. The elemental compositions of the samples were characterized by EDX. The optical properties of Pure ZnO and Agar/ZnO nanocomposites were characterized by UV, FTIR and PL. The band gap of Agar/ZnO nanocomposites were varied with the Agar concentration. Oxygen vacancy induced [photoluminescence](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/photoluminescence) of ZnO are observed and its intensity is found to be increased linearly with the Agar concentration. The [antibacterial activity](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/antibacterial-activity) of ZnO and Agar/ZnO nanocomposites was evaluated by [disc diffusion](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/disk-diffusion) method against Gram-positive (B.subtilis) and Gram-negative ([*P. aeruginosa*](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/pseudomonas-aeruginosa)) bacteria. The cytotoxicity of Agar/ZnO nanocomposites was studied against Normal (L929) and Breast cancer cell line (MB231). The result of this investigation reveals that the Agar/ZnO nanocomposites deliver a dose dependent toxicity in normal and cancer cell line.