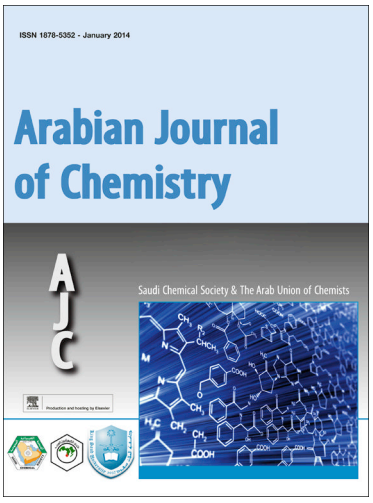

Original article

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Broad spectral inhibitory effects of pale green zinc oxide nanophosphor on bacterial and fungal pathogens

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Abstract

Nd^{3+} doped zinc oxide nanophosphor were prepared by a modified sonochemical route. Adsorption of *aloe vera* (*A.V.*) gel by the precursors made the final product with controlled the morphology, that is *A.V.* gel acted as surfactant. Characterization studies confirmed the pure hexagonal phase with nanostructure, wide-bandgap was reported. Major electronic transitions in the prepared samples were due to 4f shell electrons of Nd^{3+}ions. Emission peaks attributed to $^2P_{3/2} \rightarrow {}^4I_{13/2}$, $^2P_{3/2} \rightarrow {}^4I_{15/2}$, $^1I_6 \rightarrow {}^3H_4$, $^2P_{1/2} \rightarrow {}^4I_{9/2}$ and $^4G_{7/2} \rightarrow {}^4I_{9/2}$ transitions under the excitation wavelength of 421 nm. The emitted wavelengths showed the redshift from blue to pale green region. Further, the prepared samples showed very good control over the growth of microbial pathogens such as Staphylococcus aureus, Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Alternaria alternata and Fusarium oxysporum. The proposed mechanism is that the ZnO:Nd^{3+} intertwinds the bacteria and fungal pores with a heterogeneous range of superstructues, resulting in the local perturbation at cell membrane of fungal cells. This induces the decrease the potential energy at bacterial membrane and the leakage of electrolytes of fungal spores. There is a mechanical wrapping interaction between pathogens and the nanoparticles which locally damages the cell membrane and causes cell lysis. Biocompatible, ZnO:Nd^{3+} nanostructures possesses antibacterial activity against more multi-resistant bacterial and fungal phytopathogens. This additional information provides useful scientific information to prevent the various crop diseases.

Keyword: Superstructures; Sonochemical; Photoluminescence; Crop diseases;

Phytopathogens.