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iXRD

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TEM SEM iXRD

2xMIC / ZnO pH<sub>ZPC</sub>

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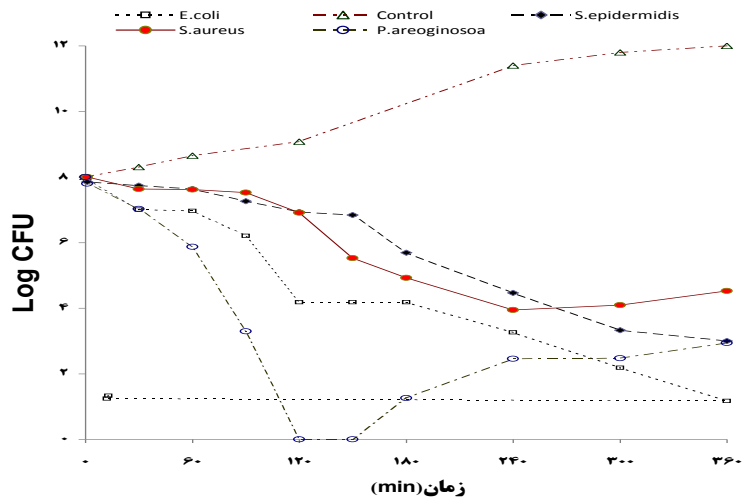
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SEM

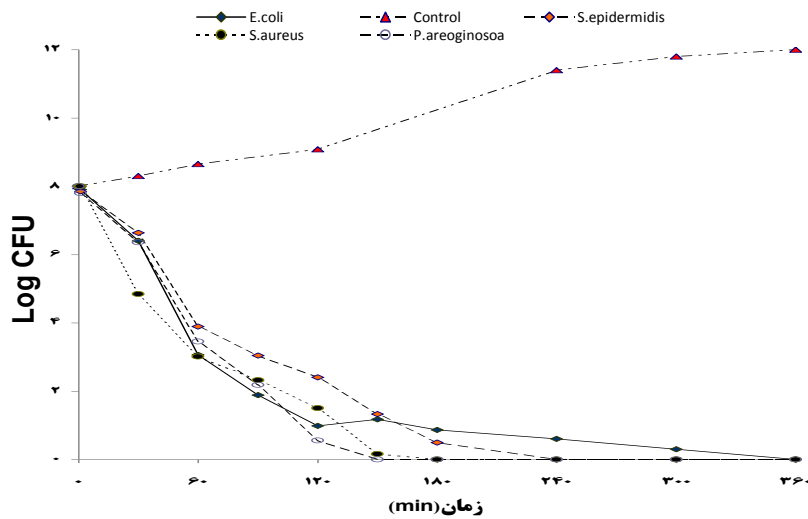
SEM

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## **Antimicrobial Efficacy of Zinc Oxide Nanoparticles Suspension Against Gram Negative and Gram Positive Bacteria**

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### **ABSTRACT**

**Background and Objectives:** Along with the rapid development of human life, controlling harmful effects of microorganisms would be unavoidable. The objective of this study was to evaluate antibacterial efficacy of zinc oxide nanoparticles on different microbial strains.

**Material and Methods:** This experimental study was done using gram negative and gram positive bacteria in nutrient media. Nanoparticle characterization was determined using X-ray diffraction (XRD), scanning and transmission electron microscopy (SEM and TEM). Bacterial sensitivity to nanoparticles was tested using a disk diffusion test and minimum inhibitory concentration (MIC). Time-kill studies and other tests were carried out using 10<sup>8</sup> CFU/mL of bacteria at baseline. A point of zero charge, pHzpc, of nanoparticle was investigated using the batch equilibration method. Obtained data were managed by SPSS Ver.16 and were analyzed through the Pearson, analysis of variance (ANOVA) and Student's independent t-tests. 0.05 was selected as significant level for all tests.

**Results:** Characterization results from XRD, SEM, and TEM showed that particles are in nano range and they do not contain any discernible crystalline impurity. The average ZnO nanoparticles diameter was 20 nm. The pHzPC for ZnO was found to be 7.51. The *P. aeruginosa* strain exhibited larger diameter inhibition zone (DIZ) to ZnO nanoparticle compared with other strains. Population of *P. aeruginosa* for 2 x MIC concentration was reduced to zero in the presence of nano ZnO within 150 min. The bacterial CFU had significant difference with contact time, nanoparticles loading, and bacterial strain ( $P < 0.001$ ).

**Conclusion:** This study demonstrated that antibacterial activity of ZnO can be a candidates for the elimination of gram negative and gram positive bacteria, particularly in nasocomial infection agent control.

**Keyword:** Gram negative bacteria, Gram positive bacteria, Antimicrobial effect, ZnO

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