



*Research article*

**Study of the antibacterial effects of the starch-based zinc oxide nanoparticles on methicillin resistance *Staphylococcus aureus* isolates from different clinical specimens of patients from Basrah, Iraq**

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**Abstract:** This study aimed to assess the efficacy of starch-based zinc oxide nanoparticles (ZnO-NPs) against methicillin-resistant *Staphylococcus aureus* (MRSA) isolates from clinical specimens in Basrah, Iraq. In this cross-sectional study, 61 MRSA were collected from different clinical specimens of patients in Basrah city, Iraq. MRSA isolates were identified using standard microbiology tests, cefoxitin disc diffusion and oxacillin salt agar. ZnO-NPs were synthesized in three different concentrations (0.1 M, 0.05 M, 0.02 M) by the chemical method using starch as the stabilizer. Starch-based ZnO-NPs were characterized using ultraviolet-visible spectroscopy (UV-Vis), X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDS), and transmission electron microscopy (TEM). The antibacterial effects of particles were investigated by the disc diffusion method. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the most effective starch-based ZnO-NPs were determined using a broth microdilution assay. The UV-Vis of all concentrations of starch-based ZnO-NPs exhibited a strong absorption band at 360 nm which was characteristic of the ZnO-NPs. XRD assay confirmed the representative hexagonal wurtzite phase of the starch-based ZnO-NPs, and their purity and high crystallinity. The spherical shape with a diameter of  $21.56 \pm 3.42$  and  $22.87 \pm 3.91$  was revealed for the particles by FE-SEM and TEM, respectively. EDS analysis confirmed the presence of zinc (Zn) ( $61.4 \pm 0.54\%$ ) and oxygen (O) ( $36 \pm 0.14\%$ ). The 0.1 M concentration had the highest antibacterial effects (mean  $\pm$  SD of inhibition zone =  $17.62 \pm 2.65$  mm) followed by the 0.05 M