

TITLE: *Enterococcus faecium* MEDIATED BIOSYNTHESIS OF SILVER NANOPARTICLES WITH BACTERICIDAL EFFECT AGAINST VANCOMYCIN-RESISTANT *Enterococcus faecium*

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ABSTRACT:

The vancomycin-resistant *Enterococcus faecium* (VRE) has increased morbidity and mortality rates. In the face of this problem the development and characterization of antimicrobial compounds from green synthesis has been the focus of several studies. This study aimed to evaluate the bactericidal activity of biogenic silver nanoparticles (AgNP) against VRE planktonic cells. AgNP were obtained from the photoirradiation method employing cell-free supernatant (CFS-containing enterocin) from *E. faecium* (CFS-Efm22) with silver nitrate (10 mM). AgNP were characterized using UV-Vis spectroscopy, Fourier transform infrared spectrometry (FTIR) and scanning electron microscopy (SEM). The minimal bactericidal concentration (MBC) of AgNP was evaluated alone (broth microdilution) and in combination with vancomycin (Checkerboard method) against VRE (EF29 and EF34). The viability (propidium iodide-IP staining) and cell complexity (FSC x SSC) of VRE post-treated with MBC80 (concentration able of inhibiting 80% of the isolates) of AgNP was provided by flow cytometry. As AgNP surface plasmonic resonance dissipation of silver at 450 nm, spherical morphology with varying sizes at $\cong 100$ nm. An analysis of the FTIR spectra of the nanoparticles and the CFS revealed the occurrence of several characteristic absorption peaks of 3448.31, 2071.63, 1638.22, 607.69 and 531.97 cm^{-1} , identifying the presence of CFS components adsorbed on the surface of the nanoparticles, corresponding to clusters present into peptides. The MBC80 of AgNP against VRE results was 3.8 $\mu\text{g}/\text{mL}$ (Anova-Tukey Test, $P < 0.05$). There was synergistic effect of AgNP with vancomycin with FICI of 0.13. The MBC80 of AgNP was significantly reduced by $> 50\%$ when combined with vancomycin, from 3.8 $\mu\text{g}/\text{mL}$ to 1.5 $\mu\text{g}/\text{mL}$, as well as a reduction in the concentration of vancomycin, from 256 $\mu\text{g}/\text{mL}$ to up to 2 $\mu\text{g}/\text{mL}$. The mean percentage of non-viable cells after treatment with AgNP (3.8 $\mu\text{g}/\text{mL}$, MBC80) was 16%. AgNP synthesized from *E. durans* alone and in combination with vancomycin are promising for the control of VRE. Furthermore, green synthesis of AgNP attenuates the impact on the environment.

Keywords: resistance; nanotechnology; bacteriocin; antimicrobial peptide.

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