Journal of Applied Microbiology

Journal of Applied Microbiology ISSN 1364-5072

ORIGINAL ARTICLE

Investigation of the antibacterial activity of Ag-NPs conjugated with a specific antibody against *Staphylococcus aureus* after photoactivation

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Keywords
cell wall conjugating, Gram-positive bacteria, light irradiation, Silver nanoparticles, *Staphylococcus aureus*.

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2019/0585: received 4 May 2019, revised 11 September 2019 and accepted 26 September 2019

doi:10.1111/jam.14471

Abstract

Aim: This work reports a new method for the use of lasers for the selective killing of bacteria targeted using light-absorbing Silver nanoparticles (Ag-NPs) conjugated with a specific antibody against the Gram-positive bacterium *Staphylococcus aureus* (*S. aureus*).

Methods and Results: Ag-NPs were synthesized using a chemical reduction method and characterized with respect to their surface plasmon resonance, surface morphology via transmission electron microscopy (TEM) and dynamic light scattering (DLS). The bacterial surface was targeted using 20 nm Ag-NPs conjugated with an anti-protein A antibody. Labelled bacteria were irradiated with blue visible laser at 2·04 W/cm^2. The antibacterial activity of functionalized Ag-NPs was investigated by fluorescence microscopy after irradiation, and morphological changes in *S. aureus* after laser treatment were assessed using scanning electron microscopy (SEM). The laser-irradiated, functionalized Ag-NPs exhibited significant bactericidal activity, and laser-induced bacterial damage was observed after 10 min of laser irradiation against *S. aureus*. The fluorescence microscopic analysis results supported that bacterial cell death occurred in the presence of the functionalized Ag-NPs.

Conclusions: The results of this study suggest that a novel method for the preparation of functionalized nanoparticles has potential as a potent antibacterial agent for the selective killing of resistant disease-causing bacteria.

Significance and Impact of the Study: This study shows that Ag-NPs functionalized with a specific antibody, could be used in combination with laser radiation as a novel treatment to target resistant bacterial and fungal pathogens with minimal impact on normal microflora.