ANTIBACTERIAL POTENTIAL OF DIAMOND NANOPARTICLES

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Abstract

Several types of nanoparticles were found to possess potent antimicrobial properties. However diamond nanoparticles (DNPs) have only been little studied so far. The mechanism of their interaction with bacteria is completely unknown. In our work we focused on investigation of antibacterial activity of DNPs and the mechanism of their action against Eschericha coli (model gram negative bacterium) and Bacillus subtilis (model gram positive bacterium). We tested different sizes (5 - 50 nm) and forms (non-oxidized/oxidized) of DNPs for their activity against both model bacteria. In general, E. coli cell were more sensitive to DNPs than B. subtilis cells. Antibacterial activity was influenced not only by DNP concentration but also by DNP size and form. Whereas untreated 5-nm DNPs exhibited higher effectivity against E. coli, the antibacterial activity of 18-50-nm DNPs was more pronounced against B. subtilis. Interestingly, in the presence of all the DNPs tested, the B. subtilis colonies exhibited altered size and morphology. Transmission electron microscopy showed that DNPs interact with the bacterial surface, which may impair vital cell functions. We propose that DNPs interfere with the permeability of the bacterial cell wall and/or membrane.

Keywords: Diamond nanoparticles, antibacterial properties, Escherichia coli, Bacillus subtilis, DLS, XPS

ACKNOWLEDGEMENTS

Financial support: research project P108/12/0910 (GAČR).

Author did not supply full text of the paper/poster.