

Silver Nanoparticles as antimicrobial agent



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Silver ions have been shown to be an effective bactericide. These particles, as an antibacterial component, have been used in the formulation of dental resin composites and ion exchange fibers and in coatings of medical devices.

SITUATION

Resistance of bacteria to bactericides and antibiotics has increased in recent years due to the development of resistant strains. Some antimicrobial agents are extremely irritant and toxic and there is much interest in finding ways to formulate new types of safe and cost-effective biocidal materials.

APPROACH

It is well known that silver ions and silver-based compounds are highly toxic to microorganisms showing strong biocidal effects on as many as 16 species of bacteria including *E. coli*.

RESULTS

Antibacterial tests were performed against the Gram negative bacterium *E. coli*, strain B, on LB agar plates containing different concentrations of nanoparticles.

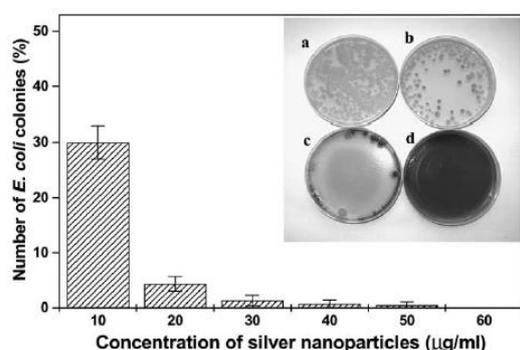


Figure 1_ Number of *E. coli* colonies as a function of the concentration of silver nanoparticles in LB agar plates expressed as a percentage of the number of colonies grown on silver-free control plates. The photograph inserted in the upper right corner shows LB plates containing different concentrations of silver nanoparticles: (a) 0, (b) 10, (c) 20, and (d) 50 $\mu\text{g cm}^{-3}$

SEM microscopy was used to evaluate the surface morphology of both the native (Fig. 2a) and the treated *E. coli* (Fig. 2b) in LB medium. The treated bacterial cells were significantly changed and showed major damage, which was characterized by the formation of "pits" in their cell walls.

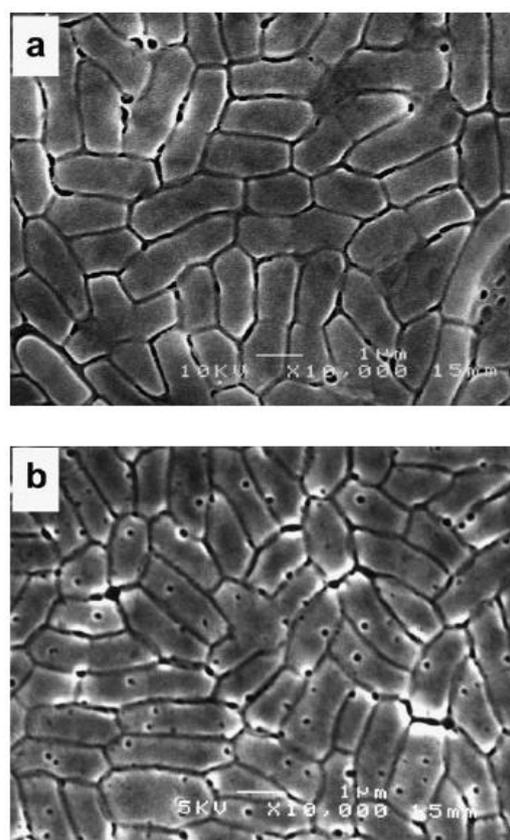


Figure 2_ Scanning electron micrographs of native *E. coli* cells (a) and cells treated with 50 $\mu\text{g cm}^{-3}$ of silver nanoparticles in liquid LB medium for 4 h (b).

The preparation, characterization, surface modification, and functionalization of nanosized inorganic particles opens the possibility of formulation of a **new generation of bactericidal materials.**