



Hybrid circonia sol-gel filmes modified with silver nanoparticles and silver complexes: Antimicrobial activity comparison

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Abstract – In this study we evaluate the bactericidal and bacteriostatic properties of hybrid circonia sol-gel modified with silver nanoparticles and silver complexes. Antimicrobial activity against *Escherichia coli*, *Salmonella sp.* and *Listeria monocytogenes* were tested in agar plates. The silver nanoparticles were synthesized by inverse micelles using AOT and their presence was studied by UV-Visible Spectroscopy and transmission electron microscopy (TEM). From TEM examinations, silver nanoparticles of spherical shapes of 10-12 nm in diameter were revealed. Silver complexes were synthesized using nicotinic acid derivatives. The differently modified hybrid films revealed in all cases a high bactericidal property for *Listeria monocytogenes* and a reduced effect for *Escherichia coli* and *Salmonella sp.*

In the last years, silver nanoparticles and its salts have been used in application associated with medicine and the food and textile industries, because of their high bactericidal activity (1-5). Thus, the use of diluted solution of silver salts in the prophylactic treatment of newborn eye infection and in the treatment of burns wounds have been reported (1, 2). Currently, silver sulfadiazine is used in clinical wound dressing as well as in the coating of medical material (silver impregnated catheters). Other studies have evaluated the in vitro antibacterial and biological of silver-incorporated in bioactive glass system (SiO₂-CaO-P₂O₅-Ag₂O). The bacteriostatic and the bactericidal properties in *E. Coli* of this new quaternary glass system make it a promising material for dental applications. The antibacterial action of Ag-bioglass was exclusively attributed to the leaching of Ag⁺ ions from the glass matrix (3). In relation to applications of silver salts in textiles fibres, Tomisic *et.al* studied the antimicrobial activity of AgCl embedded in a silica matrix on cotton fabric. From this study, the antibacterial activity of the silver salts was higher than their antifungal activity. According to the authors AgCl solutions of concentration of ca. 290 ppm could provide long lasting antibacterial activity of cotton fabrics even after 10 repetitive washing (4).

Based on the previous information, in this work we compare the bacteriostatic and bactericidal properties of a series of silver complexes with that of silver nanoparticles incorporated in hybrid type circonia sol-gel films. To determine the antibacterial effect for the differently doped films, the antimicrobial activities for *Listeria monocytogenes* and *Escherichia coli* and *Salmonella sp.* were tested. In general silver nanoparticles presented higher bactericidal and bacteriostatic properties than silver complexes, which may be the result of the chemical affinity between the organic part of silver complexes and the organic chains in the polymer.

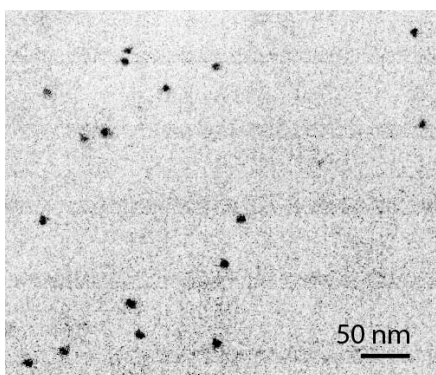


Figure 1: TEM image of silver nanoparticles synthesized in AOT reverse micelles.

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