

POTENTIAL APPLICATION OF SILVER NANOPARTICLES COATINGS AS ANTIMICROBIALS

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World is heading towards post-antibiotic era and bacterial resistance to antibiotics present a growing concern as a „Major global threat“ to public health. New strategies to combat multy drug resistant microorganisms (MDR) are urgently needed and nanomaterials looks very promising.

Extremelly small size (1-100 nm) enables nanoparticles to enter the human body through cell membranes or cross the blood-brain barrier. Metal nanomaterials (silver, gold, copper, titanium, zinc, magnesium, cadmium, and alumina) possess unique antimicrobial activities. Silver ions showed strongest bactericidal effect, cooper and gold weaker one.

Ionic silver is water soluble while metallic silver is not. Inside the human body ionic silver cannot survive, because quickly combines with chloride to form an insoluble silver chloride which is far less reactive than metallic silver nanoparticles which can survive inside the body beacuse they are unaffected by chloride. Silver ions are non-toxic to human cells in low concentrations.

Theories and hypothesis about mechanism of antimicrobial action of silver ions includes:

- Interaction of electrostatic forces between bacterial cells (negative charge) and silver ions (positively charged),
- Oxidation and destruction of bacterial cytoplasm,
- Direct influence on DNA, increasing quantity of intracellular free radicals,
- Inhibition of the transmembrane transport of Na⁺ and Ca⁺⁺
- Inhibition of enzymes of the respiratory chain,
- Reaction with Peptidoglycans blocking transfer of oxygen into bacterial cells

In our preliminary study of several different compositions of nanoparticle coatings (titanium, inox and silver), we found antimicrobial activity of silver and double composition of titanium and silver against *Staphylococcus aureus* and *Staphylococcus epidermidis*, but not against *E. coli*, *Pseudomonas aeruginosa*, *Listeria monocytogenes* and *Candida albicans*. More extensive studies will follow.

Key words: Nanoparticles, silver, ions, antimicrobial, antibiotic, resistance.