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Antibacterial Metallopharmaceuticals: Into the Nanoscale Regime of Silver

Joon Myong Song

College of Pharmacy, Seoul National University, Seoul, South Korea

Bacterial resistance towards to common antibiotics, results development of antibacterial metallopharmaceuticals (silver nanoparticles) (AgNP). AgNPs of different shapes were synthesized by solution phase routes, and their interactions with *E.coli* were studied. The antibacterial activity of silver compounds loaded on porous host matrices are evaluated under short contact time where in the bacterial load was exposed not directly to the metal-loaded material but to distilled water pretreated with them, was mainly attributed to generation of reactive oxygen species (ROS). In this work we first investigated the shape dependence of the antibacterial activity of silver nanoparticles. We also developed highly antibacterial porous carbon matrices supporting nano-silver by simple and cost effective way. EFTEM micrographs of the bacterial cells showed considerable changes in the cell membranes upon AgNP-treatment.

Truncated triangular silver nanoplates with a {111} lattice plane as the basal plane displayed the strongest biocidal action compared with spherical, rod shaped nanoparticles or with silver ions. Nanocrystalline silver-supported carbon composite was fabricated by directly loading AgNPs into the porous host matrix from a preformed nanosilver hydrosol. The method eliminates the high temperature decomposition step, thereby minimizing the possibilities of formation of larger silver particles. XRD calculation indicated the presence of Ag crystallites in nanometer range; silver nanoparticle hydrosol-treated composite having the finest crystallite size (<14.4 nm). Ag crystals coalesced significantly with increasing temperature resulting in much larger particle size in thermally impregnated silver-carbon composites. The results demonstrate for the first time that silver nanoparticles undergo a shape dependent interaction with bacteria.