Antibacterial mechanisms of silver nanoparticles on *Pseudomonas aeruginosa*

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Silver nanoparticles (AgNPs) have been widely used due to their broad spectrum of antibacterial properties, effective sterilization and high safety. Studies had demonstrated that the antibiotic action of AgNPs is in a similar way to silver ions. However, the effectiv concentrations of AgNPs are three orders of mangitude lower than that of silver ions. The antibacterial mechanism of AgNPs has not been fully eluicidated from molecular level.

In our stury the mechanisms of antimicrobial activity of AgNPs in P. aeruginosa were investigated using metalloproteomics approach. The bacteria were cultured to stationary phase and exposed to 1.2 μg mL^{-1} of AgNPs at 37 ˚C for 24 h in dark. After incubation, the bacteria were harvested and washed by PBS. Then the resuspended cell pellets were lysed and prepared for iTRAQ and 2D-LC-MS/MS analysis. The analytical results suggested that interference with the cell-membrane function and generation of intracellular reactive oxygen species (ROS) were the main pathways for the antibacterial activity of AgNPs, for which both the nanoparticles themselves and the silver ions released from AgNPs play a crucial role. The metalloproteomics and bioinformatic analysis of silver-binding and silver-regulated proteins identified many preteins pivotal in function of membrane stabilization, ATP synthesis, phospholipid syntheis and antibiotic resistance.

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