A novel type of silver nanoparticles and their advantages in toxicity testing in cell culture systems

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Silver nanoparticles (SNPs) are among the most commercialized nanoparticles worldwide. Often SNP are used because of their antibacterial properties. Besides that they possess unique optic and catalytic features, making them highly interesting for the creation of novel and advanced functional materials. Despite its widespread use only little data exist in terms of possible adverse effects of SNP on human health. Conventional synthesis routes usually yield products of varying quality and property. It thus may become puzzling to compare biological data from different studies due to the great variety in sizes, coatings or shapes of the particles applied. Here, we applied a novel synthesis approach to obtain SNP of well-defined colloidal and structural properties. Being stabilized by a covalently linked small peptide, these particles are nicely homogenous, with narrow size distribution, and form monodisperse suspensions in aqueous solutions. We applied these peptide-coated SNP in two different sizes of 20 or 40 nm (Ag20Pep and Ag40Pep) and analyzed responses of THP-1-derived human macrophages while being exposed against these particles. Gold nanoparticles of similar size and coating (Au20Pep) were used for comparison. The cytotoxicity of particles was assessed by WST-1 and LDH assays, and the uptake into the cells was confirmed via transmission electron microscopy. In summary, our data demonstrate that this novel type of SNP is well suited to serve as model system for nanoparticles to be tested in toxicological studies in vitro.
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