

Comparison of the Toxicity of Silver and Gold Nanoparticles in Murine Fibroblasts

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Abstract : Nanotechnologies are considered the most promising fields with high added value, brings new possibilities in various sectors from industry to medicine. With the growing of interest in nanomaterials and their applications, increasing nanoparticle production leads to increased exposure of people and environment with 'human made' nanoparticles. Nanoparticles (NPs) are clusters of atoms in the size range of 1-100 nm. Metal nanoparticles represent one of the most important and frequently used types of NPs due to their unique physical, chemical and biological properties, which significantly differ from those of bulk material. Biological properties including toxicity of metal nanoparticles are generally determined by their size, size distribution, shape, surface area, surface charge, surface chemistry, stability in the environment and ability to release metal ions. Therefore, the biological behavior of NPs and their possible adverse effect cannot be derived from the bulk form of material because nanoparticles show unique properties and interactions with biological systems just due to their nanodimensions. Silver and gold NPs are intensively studied and used. Both can be used for instance in surface enhanced Raman spectroscopy, a considerable number of applications of silver NPs is associated with antibacterial effects, while gold NPs are associated with cancer treatment and bio imaging. Antibacterial effects of silver ions are known for centuries. Silver ions and silver-based compounds are highly toxic to microorganisms. Toxic properties of silver NPs are intensively studied, but the mechanism of cytotoxicity is not fully understood. While silver NPs are considered toxic, gold NPs are referred to as toxic but also innocuous for eukaryotic cells. Therefore, gold NPs are used in various biological applications without a risk of cell damaging, even when we want to suppress the growth of cancer cells. Thus, gold NPs are toxic or harmless. Because most studies comparing particles of various sizes prepared in various ways, and testing is performed on different cell lines, it is very difficult to generalize. The novelty and significance of our research is focused to the complex biological effects of silver and gold NPs prepared by the same method, have the same parameters and the same stabilizer. That is why we can compare the biological effects of pure nanometals themselves based on their chemical nature without the influence of other variable. Aim of our study therefore is to compare the cytotoxic effect of two types of noble metal NPs focusing on the mechanisms that contribute to cytotoxicity. The study was conducted on murine fibroblasts by selected common used tests. Each of these tests monitors the selected area related to toxicity and together provides a comprehensive view on the issue of interactions of nanoparticles and living cells.

Keywords : cytotoxicity, gold nanoparticles, mechanism of cytotoxicity, silver nanoparticles

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