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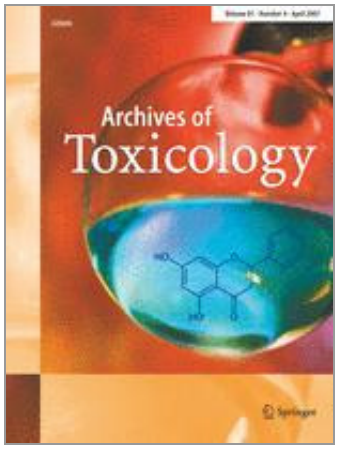
Cytotoxicity and genotoxicity of silver nanoparticles in the human lung cancer cell line, A549

Abstract

Nanomaterials, especially silver nanoparticles (Ag NPs), are used in a rapidly increasing number of commercial products. Accordingly, the hazards associated with human exposure to nanomaterials should be investigated to facilitate the risk assessment process. A potential route of exposure to NPs is through the respiratory system. In the present study, we investigated the effects of well-characterized PVP-coated Ag NPs and silver ions (Ag+) in the human, alveolar cell line, A549. Dose-dependent cellular toxicity caused by Ag NPs and Ag+ was demonstrated by the MTT and annexin V/propidium iodide assays, and evidence of Ag NP uptake could be measured indirectly by atomic absorption spectroscopy and flow cytometry. The cytotoxicity of both silver compounds was greatly decreased by pretreatment with the antioxidant, *N*-acetyl-cysteine, and a strong correlation between the levels of reactive oxygen species (ROS) and mitochondrial damage ($r_s = -0.8810$; $p = 0.0039$) or early apoptosis ($r_s = 0.8857$; $p = 0.0188$) was observed. DNA damage induced by ROS was detected as an increase in bulky DNA adducts by ^{32}P postlabeling after Ag NP exposure. The level of bulky DNA adducts was strongly correlated with the cellular ROS levels ($r_s = 0.8810$, $p = 0.0039$) and could be inhibited by antioxidant pretreatment, suggesting Ag NPs as a mediator of ROS-induced genotoxicity.



Within this Article:

2. Materials and methods
3. Results
4. Discussion
5. References
6. References

Related Content

References (32)

About this Article

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