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Research Article

NIST gold nanoparticle reference materials do not induce oxidative DNA damage

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Abstract

One primary challenge in nanotoxicology studies is the lack of well-characterised nanoparticle reference materials which could be used as positive or negative nanoparticle controls. The National Institute of Standards and Technology (NIST) has developed three gold nanoparticle (AuNP) reference materials (10, 30 and 60 nm). The genotoxicity of these nanoparticles was tested using HepG2 cells and calf-thymus DNA. DNA damage was assessed based on the specific and sensitive measurement of four oxidatively-modified DNA lesions (8-hydroxy-2´-deoxyguanosine, 8-hydroxy-2´-deoxyadenosine, (5´S)-8,5´-cyclo-2´-deoxyadenosine and (5´R)-8,5´-cyclo-2´-deoxyadenosine) using liquid chromatography/tandem mass spectrometry. Significantly elevated, dose-dependent DNA damage was not detected at concentrations up to 0.2 μg/ml, and free radicals were not detected using electron paramagnetic resonance

spectroscopy. These data suggest that the NIST AuNPs could potentially serve as suitable negative-control nanoparticle reference materials for in vitro and in vivo genotoxicity studies. NIST AuNPs thus hold substantial promise for improving the reproducibility and reliability of nanoparticle genotoxicity studies.

Keywords::

DNA damage | genotoxicity | gold nanoparticles | mass spectrometry | reference materials

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