

Genotoxicity of copper oxide nanoparticles with different surface chemistry on rat bone marrow mesenchymal stem cells - DTU Orbit (09/11/2017)

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The surface chemistry of nanoparticles (NPs) is one of the critical factors determining their cellular responses. In this study, the cytotoxicity and genotoxicity of copper oxide (CuO) NPs with a similar size but different surface chemistry to rat bone marrow mesenchymal stem cells (MSCs) were investigated. The morphology, size and surface charge of four types of CuO NPs, i.e., CuO-core, CuO-COOH, CuO-NH₂ and CuO-PEG NPs, were characterized by TEM, dynamic light scattering (DLS) and zeta-potential measurement, respectively. All of the four CuO NPs had a negative surface charge around -10 mV and showed a similar tendency to form agglomerates with a size of ~200 nm in cell culture environment. The cytotoxicity of CuO NPs to MSCs at various concentrations and incubation periods were firstly evaluated. The CuO NPs showed dose-dependent and time-dependent toxicity to MSCs, and their surface chemistry had influence on the toxicity to some extent too. The intracellular reactive oxygen species (ROS) level of MSCs was then quantified. Finally, the genotoxicity of the CuO NPs was studied by comet assay. The results suggest that the genotoxicity of CuO NPs was mainly dependent on NPs concentration, and was only slightly influenced by their surface chemistry. The osteogenic and adipogenic differentiation abilities of the MSCs exposed to different CuO NPs were studied by Alizarin Res S and Oil Red O staining. The preliminary results showed that the exposure to 10 µg/mL CuO NPs will not lead to significant impact on the differentiation potential of the MSCs.

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