DNA damage induced by silver nanoparticles in three different human cell lines (BEAS-2B, CACO-2 and TK6)

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Nanotechnology is an emergent field and many products commercially available have engineered nanomaterials in their composition. Besides the increasing presence of these compounds, the same novel properties that make them interesting for industrial purposes had also raised some concerns about their toxicity. Therefore, the analysis of the genotoxic risk associated to nanomaterials exposure has become an expansive field.

Many different materials are used as additives, being the silver-based nanoparticles the most common material found in product description among the nanotechnology-based products. In this work we have carried out the genotoxic evaluation of silver nanoparticles in three different human cell lines (BEAS-2B, Caco-2 and TK6).

Exposure treatments for the three cell lines lasted for 3 hours and, in addition, TK6 cells were also treated for 24 hours. The dose range was up to 100 µg/mL, and the genetic damage was measured by means of the comet assay. The standard comet assay was complemented by using the formamidopyrimidine-DNA glycosylase (FPG) enzyme, to determine DNA oxidation as a possible mechanism for the genotoxic action of silver nanoparticles. In parallel, the apoptosis rate and the effect on the cell cycle was analyzed in the BEAS-2B and Caco-2 cell lines by flow cytometry.

The results showed that, although no significant increases in the levels of DNA damage were observed in the standard version of the comet assay, significant increases in the percentage of DNA in the comet tail were observed when FPG was used. Also, no effect on the apoptosis rate was seen neither in BEAS-2B nor in Caco-2 cells, although cell cycle arrest in Caco-2 was observed in 50 and 100 µg/mL.

With respect to the sensitivity of the cell lines to the oxidative effects of silver nanoparticles it was, Caco-2 > BEAS-2B > TK6. The results indicate that the selection of the cell line is an important factor to avoid positive/negative false results, when testing the toxicity of nanomaterials.