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Genotoxicity of chitosan nanoparticles with different compositions for use in food packaging

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Abstract – In this study we evaluate the genotoxicity of chitosan nanoparticles with different compositions (poly(methacrylic acid) or tripolyphosphate) using cytogenetic tests employing human lymphocyte cell cultures. Three concentrations were investigated (1.8, 18 and 180 mg/L). The results showed that the chitosan/poly(methacrylic acid) nanoparticles presented reduced mitotic index values at the highest concentration tested (180 mg/L). For chitosan/tripolyphosphate, no significant changes in mitotic index were observed. These results show promising potential of the materials for application in food packaging. Additional studies are in progress in order to obtain further information concerning the toxicity of these nanoparticles.

The use of nanoparticles in food packaging has been proposed on the basis that it could improve protection of foods by, for example, reducing permeation of gases, minimizing odor loss, and increasing mechanical strength and thermal stability. Consequently, the impacts of such nanoparticles on organisms and on the environment need to be investigated to ensure their safe use[1]. In this work, we have investigated the genotoxicity of the same size (110 nm) nanoparticles prepared with either chitosan (CS) and poly(methacrylic acid) (PMAA), or chitosan and tripolyphosphate (TPP), using cytogenetic tests employing human lymphocyte cultures. Test substrates were exposed to solutions containing nanoparticles at polymer mass concentrations of 1.8, 18 and 180 mg/L. Figure 1 shows no evidence of DNA damage caused by the nanoparticles (no significant numerical or structural changes were observed), however the CS/PMAA preparation reduced mitotic index values at the highest concentration tested (180 mg/L), indicating that the nanoparticles were toxic to the cells used, at this concentration. In the case of the CS/TPP nanoparticles, no significant changes in the mitotic index were observed at the concentration levels tested, indicating that these particles were not toxic according to the parameter evaluated. The assays used show promising potential for application in tests of nanoparticle safety, envisaging the future use of these materials in food packaging.

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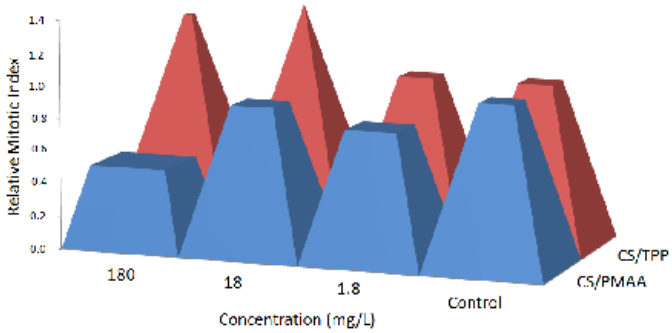

Figure 1. Mean mitotic index values obtained from cytogenetic analyses using human lymphocytes exposed to CS/PMAA and CS/TPP nanoparticles at different concentrations (1.8, 18 and 180 mg/L) (n=4).

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