Modulation mechanisms of the genotoxicity of organic pollutants by carbon nanotubes

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Carbon nanotubes (CNTs) represent a very important class of nanomaterials due to their many potential and current applications [1]. With the rapid growth of the number of CNT-based products, it is reasonable to expect an increase of the exposure of population and biota. Once in the environment, CNTs can interact with other compounds. Among those compounds is the important class of polycyclic aromatic hydrocarbons (PAHs) and nitro-PAHs which has been largely investigated due to its mutagenic and carcinogenic effects. These compounds are generated from fossil fuels combustion or burning of organic material [2]. Among nitro-PAHs, 1-nitropyrene (1-NP) is the most abundant in the environment [3].

This work aimed to study the modulation of the genotoxicity of 1-NP in the presence of CNTs in water. Multi-walled carbon nanotubes were produced by chemical vapour deposition process and characterized by LQES-UNICAMP. The mutagenicity of the 1-NP was evaluated after incubation with well characterized acid-treated multiwalled carbon nanotube samples. The Salmonella/microsome assay was performed with TA98 strain in dose-response experiments of 1-NP (10 - 1000 ng) exposed to different concentrations of carbon nanotubes (10, 50, and 100 µg) after different pre-incubation times. Reduction of the 1-NP mutagenicity was observed as the carbon nanotube concentration increased. The mutagenicity reduction is mainly attributed to non-covalent functionalization of carbon nanotubes by the 1-NP, expected to occur at free-defect regions. Atomistic calculations and transmission electron microscopy analysis suggested that this mechanism can lead to the capture of 1-NP molecules by the carbon nanotubes surfaces, reducing 1-NP availability for the bacteria cells and inhibiting its mutagenicity. The understanding of the pollutant-carbon nanotubes interactions can help in the development of new environmental applications as well as in the determination of the possible impacts of carbon nanotubes when released into the environment.

References

[1] R. H. Baughman, A. A. Zakhidov and W. A. de Heer, Science **297**, (2002) 787.

[2] G. A. Umbuzeiro, *et al.,* Environmental and Molecular Mutagenesis **49**, (2008) 249.

[3] K. El-Bayoumy *et al.*, Cancer Research **48**, (1988) 4256.