Basal citotoxicity of single wall carbon nanotubes on a human endothelial cell line (HUVEC)

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Carbon nanotubes (CNTs) are among the nanoparticles with higher potential for biomedical uses. They consist on carbon atoms arranged in a series of condensed benzene rings rolled-up into a tubular structure. CNTs can be classified in two general categories: single-walled nanotubes (SWNT) which have diameters from 0.4 to 2.0 nm and lengths in the range of 20-1000 nm, and multi-walled nanotubes (MWNT) that are bigger objects with diameters in the range of 1.4-100 nm and lengths from 1 to several μm.

CNTs have interesting physicochemical properties which make CNTs a unique material with the potential for diverse applications, including biomedical [1]. Therefore, it is necessary to know the toxic effects that they can induce, even more when the human exposure will increase in the near future.

CNTs toxicity has been previously studied mainly in pulmonary and dermal cells due to the importance of these exposure ways. But nanoparticles can translocate from the uptake sites to the blood circulation or the lymphatic system, resulting in distribution throughout the body [2]. Thus, the vascular endothelium is going to be in contact with them and can suffer from their toxic effects.

In this sense, in the present study the vascular endothelium cell line (HUVEC) was used to explore the basal cytotoxicity involved in SWCNT pathogenicity. Cells were exposed to concentrations between 0 and 800 μg/mL SWCNT for 24h and 48h. The basal cytotoxicity biomarkers studied were protein content (PT), neutral red uptake (NR), a tetrazolium salt metabolization (MTS) and Trypan Blue Exclusion Test (TBET).

NR assay, MTS assay, and PT results all showed a decrease in a time and concentration-dependent manner. TBET also showed a decreased in the viability of the cells. The most sensitive biomarker was the MTS reduction with a mean effective concentration (EC50) of 81.25 μg/ml after 48h exposure, indicating impairment of mitochondrial dehydrogenases activity. The results obtained indicate that SWCNT can induce citotoxicity in HUVEC cells.

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References:

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Figures:

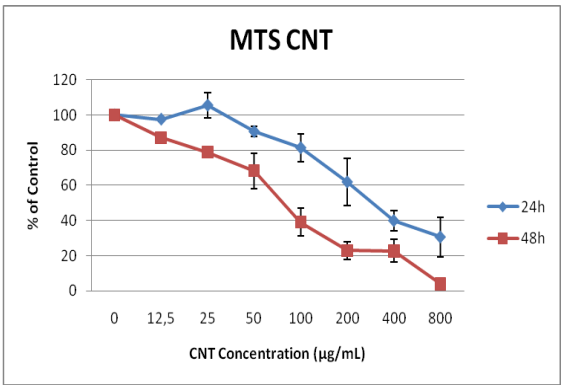

Figure 1. MTS reduction in Huvec cells exposed to SWCNT for 24 and 48h.

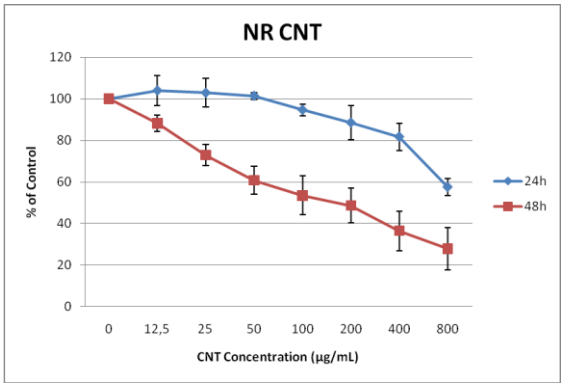

Figure 2. NR uptake in Huvec cells exposed to SWCNT for 24 and 48h.

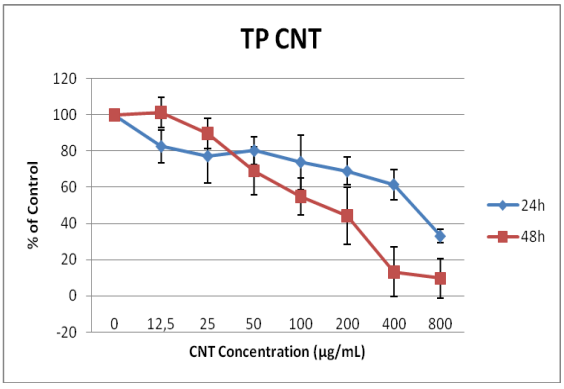

Figure 3. Total Protein content in Huvec cells exposed to SWCNT for 24 and 48h.

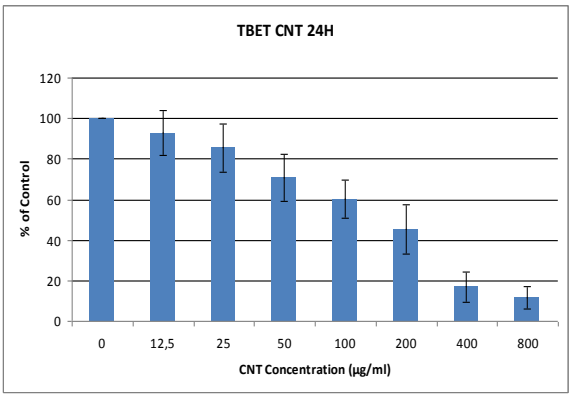

Figure 4. TBET in Huvec cells exposed to SWCNT for 24h.