TOXICITY OF CARBON NANOTUBES IN PACIFIC OYSTER

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Introduction. Carbon nanotubes (CNT) are one of the most widely used nanomaterials in industry and medicine generating the highest revenue in this industry (1). Its use raises questions about the possible effects of the release of nanocomposites to environmental and their biomagnification in aquatic ecosystems. Compared with cytotoxic studies in mammals, little is known about the toxic effects of CNT in invertebrates. It has been shown that most nanomaterials have a higher toxic effect on aquatic organisms since their dissolution in aqueous medium is favored. (2).
The aim of this work was to study the oxidative stress responses generated by CNT in Pacific Oyster (*Crassostrea gigas*).

Methods. Juvenile Pacific Oysters (6.44±.49 cm) were exposed to 20 ppm CNT. After 48 hours, gills, gonads, digestive gland, mantle and adductor muscle tissues were dissected. Oxidative stress was assessed as the oxidation of protein and lipid peroxidation following the protocols of Oberdörster (2004) (3) and Nourooz-Zadeh et al. (1993) (4), respectively. These values were normalized based on the total proteins quantified by Bradford.
Statistical analysis (one-way ANOVA (95%) and the Tukey test) was performed using Sigma Stat ® Version 3.5.

Results. Oxidative stress involves a cellular state in which reactive oxygen species production surpasses antioxidant cellular defenses (5).
CNT exposure did not cause any major disturbances in lipoperoxides production and values remained in the normal range for Pacific Oyster. There were no statiscally significant differences treatment-dependent effects on lipoperoxides production compared to controls, although there was statiscally difference in digestive gland and aductor muscle in 20 ppm CNT treatment (Fig. 1).

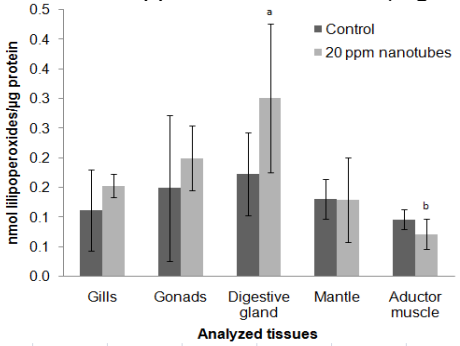

Fig.1 Lipoperoxides levels produced per microgram of total protein in five tissues. Different letters represent significant differences between tissues for treatment.

Protein oxidation was measured in tissues by carbonyl levels produced per microgram of total protein. There were no statiscally significant treatment-dependent effects on tissue. Only the digestive gland and mantle showed significative difference in 20 ppm CNT treatment (Fig. 2).

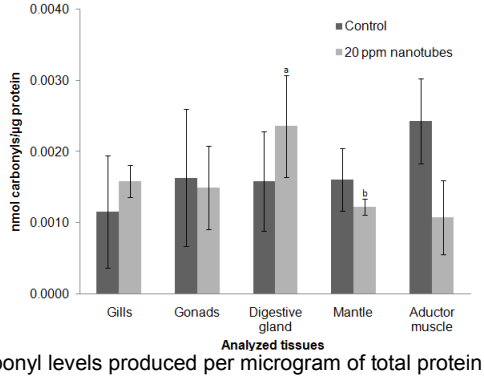

Fig.2 Carbonyl levels produced per microgram of total protein in tissues. Different letters represent significant differences between tissues for treatment.

The low production of lipoperoxides and carbonyls in control treatments is related with the antioxidant system of organism. In bivalve molluscs, catalase activity is higher in the digestive gland than in gills, while in these is glutathione peroxidase which is found in higher concentrations (6). This is consistent with results.
The low toxicity of CNT may be caused by the antioxidant mechanism of the organisms, however the opposite effect was seen in zebrafish and rainbow trout (7) where the CNT caused higher levels of toxicity.

Conclusions. The oysters are used as bioindicators of water pollution, especially of heavy metals. Because of their effective antioxidant system, oxidative stress cannot be used as biomarker for biomonitoring nanocomposites in water bodies. Their potent antioxidant system, mainly catalase, should focus of further research.

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