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BIOTRANSFORMATION OF CARBON-BASED NANOMATERIALS BY HORSERADISH PEROXIDASE

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Abstract

Due to the steady increase in the use and mass production of carbon-based nanomaterials (CBN), such as fullerenes and carbon nanotubes (CNTs), the presence of these materials in the environment is an eventuality. However, there is very little information regarding the fate and transport of CBNs, and almost no information regarding the possible biotransformation pathways that CBNs might undergo once released into the environment. Without this information assessing the possible human and ecological health effects of CBNs remains a challenge for the scientific community. To this end, we are developing analytical methods for the proper characterization, identification, and quantification of selected fullerenes and CNTs and their possible biotransformation products. Here we present the results from an initial set of experiments where different types of CBNs in aqueous suspensions were subjected to enzymatic oxidation with horseradish peroxidase. No substantial differences were observed in SEM images of the CBN suspensions tested before and after the proposed enzymatic degradation. Nevertheless, changes were observed in the agglomerate size, the particulate and dissolved organic carbon concentrations, and the CO₂ concentration in the headspace of the experimental vials during the same treatment. However, this far we are not able to assess the degree of degradation, as the current proposed methodology is not sensitive enough. The use of more sensitive quantitative analysis, e.g. ¹⁴C labeling of CBNs and HPLC-MS of the CBN suspension after degradation, will provide more insightful and more conclusive information.
