Surface-area-dependent effects of carbon nanotubes on soil enzyme activity and microbial biomass

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Commercial development of single-walled carbon nanotubes (SWCNTs) may lead to the discharge of SWCNTs to the soil environment with unknown consequences. We evaluated the impacts of powder and suspended forms of SWCNTs at 0, 30, 100, 300, 600, and 1000 µg g\textsuperscript{-1} soil on soil enzyme activity and microbial biomass through a 3-week soil incubation experiment. The activities of cellulohydrolase, \(\beta\)-1,4-xylosidase, \(\beta\)-1,4-N-acetylglucosaminidase, L-leucine aminopeptidase, and acid phosphatase which are involved in decomposition of key compounds in terrestrial ecosystems, and microbial biomass were measured. SWCNTs of concentrations at 300-1000 µg g\textsuperscript{-1} soil significantly lowered the activities of most enzymes and microbial biomass. We found that SWCNTs showed comparable negative effects on soil enzyme activity and biomass at lower concentrations than those of multi-walled carbon nanotubes [1]. Our results also showed that CNT surface area has significant negative relationship with relative enzyme activity and biomass. Thus, we suggest that greater microorganism-CNT interactions could increase the negative effect of CNTs on soil microorganisms [2].