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IMPACT OF Ag, CeO_2, Fe_3O_4, SnO_2 NANOPARTICLES ON SOIL MICROBIAL COMMUNITY

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Abstract

The production of engineered nanoparticles (NPs) is growing day by day; thanks to their physical and chemical properties, NPs are used in different sectors. However, manufacture, use and potential release of these particles have preceded the evaluation of the environmental risks. The aim of this work was to assess the impact of Ag, CeO_2, Fe_3O_4, SnO_2 NPs on the soil microbial community. To evaluate if NPs can affect the soil quality, 500 mg of NPs / kg of soil were mixed to an A1 horizon of Epileptic Cambisols (sandy clay loam texture; subacid pH) and incubated at constant temperature and controlled moisture (e.g. 25°C and 60% WHC). Aliquots of soil samples were taken at 30, 60 and 90 days and transferred to the laboratory for the following analysis: viable bacterial and moulds/yeasts counts, total soil microbial biomass, estimation of soil respiration, DNA extraction and PCR-DGGE. Preliminary results of the biological assays shows an increment of the basal respiration and a decrease in the amount of carbon soil microbial biomass. The relation between these parameters determine a higher metabolic quotient (qCO_2) compared to the control test, that identifies a stressful situation, most evident in the thesis with Ag-NPs. Regarding microbial plate counts, no significant differences among the four treatments and the soil control was observed, except for the Ag at 60 days of incubation (Ag-60), where 2 log decrease was evidenced for the viable bacterial count. Conversely, the quantification of the extracted genomic DNA showed a gradual and evident decrease in Ag treatment as incubation proceeded. PCR-DGGE, that was performed to evaluate NPs impact on microbial soil community, clearly highlighted a different microbial profile in Ag treatment between control and Ag-30. Moreover, the profile gave rise to a different banding in Ag-60 with no variation in Ag-90, but some bands showed an increased intensity as the incubation with Ag NPs proceeded. On the other hand, the general banding profile corresponding to the control was mainly conserved in CeO_2, Fe_3O_4 and SnO_2 treated soil. Therefore, results obtained so far show an important influence of the Ag NPs on the microbial community in soil by decreasing richness and diversity. Studies are in progress to characterize the member of the microbial community that are positively/negatively selected in the presence of Ag NPs.