Multicomponent Study of Nanoparticles of TiO_2, SiO_2, CuO and Zn in Soil Columns.

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In the last decade the use of new products aimed at nanotechnology has increased exponentially offering multiple benefits to society, which has boosted its application in a wide range of products and processes. Their reduced size may facilitate bioaccumulation and their large surface area may allow the nanomaterials to behave as carriers of the contaminants in them adsorbed. Therefore knowledge of the influence of nanoparticles or how they can modify the ecosystem is extremely relevant. It is therefore of extreme importance to understand the fate and transport of nanoparticulate materials in the environment in order to identify possible routes of exposure to humans and the ecosystem, as well as the processes and phenomena that occur during soil contamination. The objective of this research were to understand the behavior and the transport of TiO_2 nanoparticles and their interaction with nanoparticles of SiO_2, ZnO and CuO through soils. Experiments were carried out in the laboratory using Volta Redonda-RJ controlled landfill soils and computational simulations in conjunction with mathematical modeling to obtain information about processes and phenomena involved in the potential contamination of soils. For this purpose, the multi-component Langmuir adsorption isotherms were considered, since it considers the ion exchange as a competitive adsorption process. Continuing, the Wagner Interaction Model was used to calculate the activity coefficient. It was observed in the column assays that the TiO_2 concentration showed a marked peak in the first 120 minutes of Assay, attributed to the leaching phenomenon, followed by adsorption and complexation after the incubation time. It was observed that the solutions of SiO_2 nanoparticles had a high zeta potential, which in turn kept the other particles in suspension. A similar effect was observed for CuO solutions with lower intensity.

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