Titanium nanoparticles in sedimented dust aggregates from urban children's parks around coal ashes wastes

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Abstract
Recently, an increased interest in nanoscience applications can be observed in various fields. Soils around coal power plants may contain potentially hazardous elements (PHEs) and nanoparticles (NPs), which can be neo-produced pollutants or can be a product of industrial coal utilization. While titanium (Ti)-NPs contact is a worldwide concern, transference of Ti-NPs to infants as well as their human health impact is still imprecise. In general, the toxicity and the human health risk assessment associated with the presence of some Ti-NPs, needs to be determined with a robust and fast analytical methodology. The mode of occurrences of Ti-NPs in children's playgrounds were evaluated by advanced electron microscopy techniques (field emission scanning electron microscope-FE-SEM and high resolution transmission electron microscope-HR-TEM) coupled with an energy dispersive X-ray microanalysis system (EDS); Raman Spectroscopy (RS); and X-Ray Diffractions (XRD). The reported data showed that when the size of the NPs reduced, the ability of sedimented dust aggregates to transport PHEs increased. Carbonaceous matter and amorphous silica were the main factors that influenced the distribution of PHEs among the studied Ti-NPs aggregates. Together, the data indicate that the proportions of PHEs in sedimented urban dust in the urban area around coal power plants are mainly due to emissions related to vehicle traffic and the coal industry, representing immediate environmental risks and long-term health risks. Therefore, actions are required to monitor and mitigate the impact of Ti-NPs aggregates in the urban area and nearby ecosystems. Such pollutants are necessary to be observed as children represent a susceptible cluster likened to adults. The currently estimated risk can be influenced by factors such as absorption, form of Ti-NPs, particle fraction, particle size, and physico-geochemical properties in relation to toxicity, among others. Analysis of actual particle concentrations in human organs, as well as organ concentrations and effects in liver and the reproductive system after chronic exposure to well-characterized Ti-NPs in animals are recommended to refine this assessment.

Keywords
Nanoparticles; Hazardous elements; Environmental impacts; Infant parks