Nanoparticles from construction wastes: A problem to health and the environment

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Abstract

The present study deals with the nano-mineralogy and geochemistry of ultrafine particles in construction waste from the Porto Alegre region in Southern Brazil. Uncontrolled construction waste dumps and poor management practices in formal disposal sites in the area may increase exposure risks to population. Whilst the physicochemical properties of construction wastes are well documented in the literature, the characteristics of nanoparticles in their formulations are not well known. Given that degradation of construction materials may unlock and enable further release of nano-particulates present, we focused on the <63 mm fraction to examine the geochemistry of inhalable nano-particulates that could cause adverse health impacts on local communities. A particular feature across the studied wastes are the numerous aerodynamically favourable, spherical-shaped nanoparticles of magnetite, rutile and anatase. The detected nanoparticles contained a number of elements including Al, As, Au, Ca, Cd, Co, Cr, Cu, Hg, Na, Fe, K, S, Sn, Si and. An enrichment in metals and metalloids such as As, Co, Cr, Cu, Hg, Fe, Sn or Ta in particles in the nano-scale range in relation to larger particles was observed. The presence of carbon nanotubes was also noted. The leaching tests showed that the construction wastes did not reach the limits for their disposal as hazardous waste according the European Directive. Whilst the majority of trace elements were highly immobile, the water extractability for oxyanionic-forming metalloids suggests possible migration to surface and groundwater bodies. This work seeks to bring awareness on the impacts of unsustainable construction waste management, and the relevance of improved regulations regarding their final disposal.

Keywords:

Nanoparticles, Hazardous elements, Environmental impacts, Civil construction waste