

Evidence of mercury sequestration by carbon nanotubes and nanominerals present in agricultural soils from a coal fired power plant exhaust

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Abstract

Mercury (Hg) in agricultural soils could have negative effects on the environment and the human health. The exposure to high level of Hg through different absorption pathways, such as ingestion and diet through soil-plant system could permanently damage developing foetus of animals and humans.

With the aim to assess the potential environmental and health risk and to study the behaviour and fate of Hg from agricultural soils to the environment, 47 soil samples were collected around a thermoelectric power plant in the Santa Catarina (Brazil). The Hg concentration measured by inductively coupled plasma mass spectrometry (ICP-MS) ranged from 0.16 to 0.56 mg kg⁻¹. The distribution obtained by kriging interpolation allowed the identification of the main pollution sources. To see the morphology and composition of soil samples, field emission scanning electron microscopy (FE-SEM) and high resolution transmission electron microscopy (HR-TEM) were used combined with energy dispersive X-ray spectroscopy (EDS), showing that the carbon nanotubes and magnetite as nanomineral contributed to Hg retention. The mentioned molecular characterization, and the low Contamination Factors (CF) values obtained, suggested that there is low risk to the food security of the agro-ecosystems area near to the CFPP in the terms of Hg inputs and contamination.

Keywords: Mercury, Agricultural soils, Coal fly ash, Environmental risk, Human health, Carcinogenic risk