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Processes and Mineralogy of Arsenic in Soils: An Overview

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Abstract

Arsenic, although a non-metal, is very often referred to as a heavy metal. Its provenance and contents in recently formed or least weathered soils depend on the type of rocks and intensity of geochemical processes. The variation is exemplified in shale, where As content varies from 1 to 900 mg kg⁻¹. In highly weathered soils, where pedochemical processes exceed geochemical processes, the content is generally below the levels that are toxic to life forms. In the Bengal basin, As content is low in soils, but high in the ground water (beneath the vadose zone). This suggests that As has been sufficiently leached from soils. The solubility of most of the As-bearing soil minerals is high, and it occurs as anions (AsO₃³⁻, or AsO₄³⁻) in soil solution. The soils of the Bengal basin are alkaline in reaction, mostly fine textured with almost even distribution of particle size fractions, and moderately drained. Minerals like micas and feldspars dominate their coarse fractions, whereas illite (40-47 %) and smectite (24-30 %) are dominant in clay fractions. Both inorganic and organic colloids are negatively charged that cannot retain anions. In many soils in the world, leaching of As is well documented. Therefore, it appears that the problem of As in human food and drink chains in the Bengal basin arises, because leached As is recycled back through lifting of ground water for drinking and irrigation. There could be other sources like deposition from atmospheric emission, pesticide, and mine wastes, but the accretions might be very small. One root of the problem of As toxicity in the Bengal basin is that population and anthropogenic biotic pressure exceed the supporting capacity of natural resources. This may be tackled by surface storing of rainwater, which is abundant in the region during monsoon, for off-season use. Arsenic is known