
Trace metals accumulation in soil irrigated with polluted water and assessment of human health risk from vegetable consumption in Bangladesh

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Abstract

Based on the review of literature data trace metals (TMs) pollution of water, soil, sediment and vegetable originating mainly from industrial, municipal and agrochemicals pollution in several cities of Bangladesh was assessed. The quantitative data on TM concentrations, their contamination levels and their pollution sources have not been systematically gathered and studied. Thus, a comprehensive nationwide pollution assessment of areas in Bangladesh has become urgently needed. In this study, the concentrations, sources, contamination levels, sample collection and analytical tools of TMs were collected from the literature, compared and discussed. The USEPA recommended method for health risk assessment was used to assess human risk from vegetable consumption. The mean concentration of Cd, Cr, Cu and As in water was higher than the FAO irrigation water quality standard. The mean soil Cd, Cu, Pb, Zn and Ni concentrations are about 4.9, 2.2, 1.08, 1.3 and 3.9 times greater, respectively, than the national safe limit of Netherlands. Soils of Dhaka city are considered as highly contaminated based on geoaccumulation index (Igeo) values for Cd, As and Cu. The Igeo shows that the contamination of Cd, As, Cu, Ni, Pb and Cr is prevalent in agricultural soil and sediment of the cities all over the Bangladesh. The sources of TMs in agricultural soil are mainly polluted water irrigation and agro-chemicals. Vegetable contamination by TMs shows both non-carcinogenic and carcinogenic risks to the public. In order to provide key management targets for relevant government agencies based on the results of the pollution and health risk assessments, Cd, As, Cu, Ni, Pb and Cr are selected as the priority control TMs; and Dhaka city are selected as the priority control city. This study provides quantitative evidence demonstrating the critical need for strengthened wastewater discharge regulations in order to protect residents from TM discharges into the environment.

Keywords: wastewater discharge, agricultural soil, sediment, vegetable, health risk assessment, Bangladesh

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