Arsenic in Bangladesh Environment and its Impact on Food Chain through Crop Transfer

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Abstract

Arsenic contamination of ground water in Bangladesh and the incidence of Arsenicosis patients do not go hand in hand. People living in the same household and drinking from the same source of As-affected water are not equally affected. Moreover, the manifestation of Arsenicosis also varies from region to region in the country. This has raised the question about the sole contribution of As-contaminated drinking water as to the cause of Arsenicosis. Many efforts have been directed towards ensuring supply of As-free drinking water with varying successes. Even if As-safe drinking water is assured, the question of irrigating soils with As-laden ground water will continue for years to come. The possibility of As accumulation in soils through irrigation water and its subsequent entry into the food chain through various food materials cannot be overlooked. The average background concentration of arsenic in Bangladesh is much below 10 mg kg^{-1} soil. However, in some areas where soils receive As-contaminated ground water irrigation, the concentration has been found to be as high as 80 mg kg^{-1} soil. The soil As varies both spatially and vertically. The spatial variation is controlled by the soil formation and the aquifer characters, while the vertical distribution is controlled by the clay contents. The surface 0-150 mm soil contain more As than the sub-surface 150-300 mm soil. The maximum As concentration in irrigation water was found to be 0.55 mg L^{-1}; irrigating a rice field with this water when the requirement is 1000 mm of water, it has been calculated that the As load will come to 5kg As ha^{-1} yr^{-1}. Many crops receiving As contaminated water as irrigation have been found to accumulate As at levels that exceed the minimum allowable daily limit (MADL) of 0.2 mg per kg dry weight. Some vegetables crops like Arum (*Colocassia antiquorum*), Kalmi (*Ipomea aquatica*), Amaranthus (*Amaranthus* spp.) etc. were found to be As accumulators. In arum, the concentration of As have been found to be as high as more than 150 mg kg^{-1} dry weight. Rice and wheat receiving As-contaminated irrigation water have been found to sequester the toxic metalloid into roots and stems. However,

the quantity of rice consumed per person per day with the content of As in the grain may in many instances, surpass the MADL. Study with animals has shown that the As in rice is more bio-available than that in vegetables. Irrigated rice fields, on the other hand, allow the growth of green and blue-green algae that has been considered as helpful in auto-renewal of nutrient status of paddy soils, more particularly with nitrogen, phosphorus and other minerals. It has been observed that these algae accumulate high amount of As along with other heavy metals. The algae, besides being consumed by the fish, release the As for the subsequent crop on mineralization, thus intensifying the vicious cycle of As contamination of the food chain. However, the growth of green and blue-green algae in the irrigated rice fields could be used as a measure for phytoremediation of As contamination.