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Preliminary investigations on presence of arsenic in Sri Lankan soils & plants

Arsenic is well recognized as an element of public concern due to its high toxicity and carcinogenic properties. Occurrence of chronic arsenic poisoning symptoms in patients of chronic kidney disease of unknown etiology (CKDu) from Padaviya area led to the hypothesis that chronic accumulation of arsenic may be the potential cause of CKDu. The most likely means of ingestion of arsenic may be groundwater as all CKDu patients have been consuming groundwater, and not surface water for the last few decades. Presence of inorganic and organic arsenic is evidently the result of presence of it in groundwater and interstitial (soil) water from which it can enter plants.

The present study therefore, was carried out with the objective of determining arsenic content in soil profiles as well as selected aquatic and terrestrial plants in Padaviya area with a view to understanding the vertical and horizontal (spatial) distribution of arsenic in the environment.

Soil samples were taken at 1 foot depths down to 12 feet from paddy fields, homesteads and areas of Padaviya reservoir using a spiral auger. Soil was also collected from Deniyaya (Pasgama), a non-CKDu endemic area, as control samples. Three samples were taken from every one-foot depth in the soil profile and collected into polythene bags. The auger was cleaned thoroughly to remove all soil and washed with de-ionized water prior to taking samples. Samples of roots, leaves, flowers and bark of common trees, shrubs and herbaceous plants in the study area were collected in plastic bags and brought to the laboratory to test for the presence of arsenic. Control plant samples were collected from non-CKDu areas.

Soil particle sizes and cation exchange capacity were determined using standard methods; organic matter was measured using weight loss on ignition. Soil and plant samples were acid digested using nitric (4): suphuric (1): perchloric acid (1) mixture until a clear solution was obtained and the digested samples were used to detect arsenic in them using the hydride generator and atomic absorption spectrometer. Distribution of Fe and Al in soil that affects bioavailability of arsenic in soil and groundwater was determined using oxalate-extraction method.

All surface soil samples contained total arsenic contents greater than those in the bottom horizons of the soil profiles. Surface layers of soil in paddy fields of Padaviya area were detected to have relatively high levels when compared to that of the deep layers. On the contrary the As level in the deep layers of soil in the control area in the wet zone recorded higher values than that of the surface which could be attributed to the greater incidence of leaching that is possible in wet zone soils. No As arsenic was detected below 7 feet depth in Padaviya reservoir. Relationship between distribution of oxalate-extractable Fe with presence of As in soil will be discussed.

Bark of *Azadirachta indica* (Kohomba) was found to accumulate the greatest amount of total As while it was observed that roots and leaves of *Terminalia arjuna* too accumulate As more than the other tree species. *Eichhornia crassipes*, the aquatic floating plant and flowers of *Nelumbo sp.* (rooted aquatic plant) were found to contain excessive amounts of As, indicating their capacity to hyper-accumulate As and thus their potential to be used as candidate species in arsenic phytoremediation.