

Potential Link between Ground Water Hardness, Arsenic Content and Prevalence of CKDu

Priyani A Paranagama

Senior Professor and Chair, Department of Chemistry, University of Kelaniya

The highest prevalence of CKDu occurs in the largest rice farming areas in Sri Lanka and approximately 99% of CKDu patients are farmers. Our preliminary investigations revealed that the percentage of CKDu patients who manifest chronic As poisoning symptoms were greater than that among the control group. Degree of hardness in groundwater resources of Sri Lanka appears to have a strong positive correlation with the distribution of CKDu patients in Sri Lanka. The results revealed that water hardness varies among areas, i.e. Padavi-Sripura (270 – 820 mg L⁻¹), Anuradhapura urban area (108 – 312 mg L⁻¹), Polpithigama (90 – 615 mg L⁻¹), Nikawewa (115 - 612 mg L⁻¹), Mahawa-Siyambangamuwa (60 - 410 mg L⁻¹), Medawachchiya (60– 685 mg L⁻¹), Matale (60 - 460 mg L⁻¹), Gonameriyawa water spring (6 - 9 mg L⁻¹) and Pasgoda (28- 54 mg L⁻¹).

Levels of arsenic in water used by CKDu patients ranged from 1.1 - 12.3 µg L⁻¹. Inhabitants who consume water from Gonamariyawa spring in Kebithigollawa area were not affected with CKDu. It was also revealed that the water samples contained iron (0.14 - 0.46 µg L⁻¹), phosphates (61.1 - 80.25 µg L⁻¹), nitrates (0.30 – 5.82 µg L⁻¹) and sulphates (0.11 – 21.02 µg L⁻¹) in addition to very high contents of calcium and magnesium. The analysis of soil revealed that all surface soil samples contained total arsenic greater than those at the bottom horizons of the soil profiles. Surface layers of soil in paddy fields of Padaviya area were found to have relatively high levels of arsenic (1.5 mg kg⁻¹) when compared with that of deeper layers (0.61 mg kg⁻¹). No arsenic was detected below 7 feet depth in Padaviya reservoir.

Rice samples (n=75) collected from various parts of the country were shown to contain 3.6 - 183 µg kg⁻¹ of arsenic. Well over 60% of the rice samples tested contained more than 50 µg kg⁻¹ of arsenic. Analysis of parts of selected plant species in the CKDu endemic areas revealed that they contained arsenic, e.g. *Azadirachta indica* (Kohomba) bark (753 ± 4.2 µg kg⁻¹), *Terminalia arjuna* (Kumbuk) root (815 ± 2.4 µg kg⁻¹) and bark (115 ± 2.4 µg kg⁻¹). The aquatic floating plant, *Eichhornia crassipes* (553.5 ± 2.4 µg kg⁻¹) as well as flowers and roots of *Nelumbo sp.* (Lotus) (1101 ± 10.2 µg kg⁻¹) contained excessive amounts of arsenic.

In order to investigate the source of arsenic in the environment, agrochemicals available in the retail market of CKDu prevalent areas were analyzed. The highest arsenic content was observed in phosphate containing chemical fertilizers used in rice cultivation. The highest total arsenic content, 25.49 to 37.86 mg kg⁻¹, was in Triple Super Phosphate (TSP) which is heavily used in rice cultivation. Moderate