

ID 99

## Determination of quality and the geochemistry of soil in a chronic kidney disease of unknown etiology (CKDu) hotspot, Rideemaliyadda, Sri Lanka

J.A.S. Sewwandi\*<sup>1</sup>, M.D.N.R. Dayananda<sup>2,3</sup> and J.A. Liyanage<sup>2</sup>

<sup>1</sup>Institute of Chemistry Ceylon

<sup>2</sup>Department of Indigenous Medical Resources, Gampaha Wickckramarachchi University of Indigenous Medicine, Sri Lanka,

<sup>3</sup>Department of Chemistry, University of Kelaniya, Sri Lanka

### Abstract

CKDu appeared mainly in North Central province in Sri Lanka, and recently, it materialized in Uva province. Soil can be gripped as a main environmental source for the phenomenon of this kidney failure, as it is a material that is frequently used by people in the areas with CKDu generality, and soil has a direct correlation between food crops and water sources. Therefore, the present study explores the potentially toxic levels and soil quality in Rideemaliyadda-South Grama Niladari Division (a CKDu hotspot), Badulla district, Uva province, Sri Lanka, to explore the risk factors associated with the phenomenon of CKDu. Triplicated thirty soil samples were collected using the random stratified sampling method (Thirteen home gardens, nine cultivated areas, five forested areas, and three tank sediment samples) under the land use patterns in this area and evaluated using ArcMap 10.2.2 software. Cation concentrations including Cr, Mn, Cu, Zn, Cd, Pb, and As in collected soil and sediment samples were analyzed using inductively coupled plasma-mass spectrometry (ICP-MS) followed by Microwave digestion using concentrated nitric acid. The average concentration of selected heavy metals including Chromium (Cr), Manganese (Mn), Copper (Cu), Zinc (Zn), Cadmium (Cd), Lead (Pb), and Arsenic (As) in soil (in mg/kg) were  $43.62 \pm 6.19$ ,  $411.60 \pm 35.60$ ,  $15.74 \pm 1.76$ ,  $52.30 \pm 11.00$ ,  $0.01 \pm 0.01$ ,  $8.85 \pm 0.71$  and  $0.04 \pm 0.04$ , respectively. According to the toxicological studies, all existing concentrations were below the permissible levels considering the nephrotoxic heavy metal contents in soil (Cd, Pb, Cr, and As are proven as nephrotoxic heavy metals according to the toxicological studies), instead of that, Mn ( $p = 0.020$ ), Cu ( $p = 0.036$ ), and Zn ( $p = 0.042$ ) were significantly higher in the CKDu hotspot than the reference levels of Mn, Cu, and Zn in soil (in mg/kg) were 476.00, 36.00, and 50.00, respectively. The average content of Zinc in soil exceeded the permissible levels given by WHO. Hypothesizing the Phosphates as an interactive anion to the availability of cations in soil, the phosphate concentrations in soil and sediment samples were measured using Ion Chromatography (IC). The average concentration of phosphate in soil was  $7.08 \pm 1.29$  mg/kg. Pearson correlation coefficients indicated a negative correlation between the existing cadmium (Cd) concentrations and the phosphate ( $\text{PO}_4^{3-}$ ) concentrations (-0.093) in soil and sediments. The mean soil pH in the CKDu hotspot showed a slightly acidic condition which was  $6.78 \pm 0.15$ , and it was within permissible soil pH limits. The mean conductivity was compiled with the acceptable conductivity range, which was  $118.20 \pm 25.20$   $\mu\text{S cm}^{-1}$ . Lead, Chromium, Arsenic, and Cadmium were nephrotoxic heavy metals and were proved by toxicology chemistry. According to the results, the spatial distribution of Pb and Cr within the CKDu hotspot showed a clustered pattern, and those clustered appeared especially related to the agricultural lands in the area. Whether those heavy metal concentrations were below the permissible levels, lower concentrations can cause nephrotoxicity with long-term exposure.

**Keywords:** CKDu, Long-term exposure, Satisfied random sampling, Soil, Toxic heavy metals

**\*Corresponding Author:** sakunthalasewwandi11@gmail.com