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Evaluation of toxic metal contamination in surface sediments and water in Mahakanadarawa tank; Anuradhapura, Sri Lanka

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Toxic elements, including heavy metals/metalloids, readily contaminate water reservoirs via natural mechanisms such as surface runoff, precipitation, and atmospheric deposition. As a result, some toxic metals can be accumulated in surface sediments in the reservoirs and be incorporated into the food chains. It has become a major issue because various trace elements contaminate water, soil, and sediments, which can have serious health consequences due to their toxicity, persistence, and carcinogenic nature. This study was carried out with the aim of analysing the sediment quality in a major irrigation tank called Mahakanadarawa tank in Anuradhapura district, which is located in a high prevalence of chronic kidney disease of unknown etiology (CKDu) in Sri Lanka. Fifteen composite sediment samples (five samples in each of fifteen different locations) were randomly collected around the Mahakanadarawa tank in April (2022). Twenty surface water samples (Triplicated) were collected from the Mahakanadarawa lake using twenty different locations. Concentrations of metal elements including Mn, Co, As, Cd, Pb, Cu, Zn, Na, K, Al, Ca, Mg, Fe, and Ni were determined using inductively coupled plasma mass spectrometry (ICP-MS) and multi-element standards were used for the instrumental calibration. Statistical analysis was done using SPSS Statistics Software. According to the analysis of the sediment samples, none of the analysed toxic metals have exceeded the severe effect level as well as the lowest effect level. Abundance of the metals in the sediments samples is varied as Fe > Mn > Cr > Zn > Cu > Pb > Ni > Co > As > Cd. The Igeo (Geo Accumulation value) values obtained, and the index values exhibit that the sediment samples have a tendency to transfer to an unpolluted to moderately polluted stage with analysed toxic metals except for Zn and Cd. Owing to the long-term intense applications of the crop fertilisers and pesticides in the area, toxic metals may be transferred and concentrated in the tanks from the agricultural fields. Apart from that, average concentrations values of analysed metals, including toxic metals such as Pb, As, and Cd in surface water, were far below the irrigation standards. Contamination of food chains and worsening the hazardous conditions for aquatic life can occur due to the toxic metal accumulations in the surface sediments. In order to conduct a health risk assessment for the consumption of tank fish from Mahakanadarawa tank, further studies should be performed by conducting several sampling cycles of sediment and water as well as toxic metal contamination status of inland fish in Mahakanadarawa tank also need to be evaluated.

Keywords: Sediments, Heavy metals, CKDu, Surface water, Contamination

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