

**Phytoremediation for Excess Water Hardness in Drinking Water: A Causative Factor for CKDu in Bandagiriya****Premarathne M.A.P.N., Asanthi H.B.\* , Atapaththu K.S.S.***Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Sri Lanka**\*asanthi@fish.ruh.ac.lk***Abstract**

Agricultural communities in Sri Lankan Dry Zone are recorded to be endemic to Chronic Kidney Disease of unknown aetiology (CKDu). The causative factors and possible relationship between CKDu prevalence and the quality of drinking water are still in debates. However, water hardness in most of the reservoirs in dry zone is extremely higher than that of the recommended levels delineating a relationship with the geographical distribution of CKDu. Thus, present study was conducted in Bandagiriya of Hambantota District to study the possible relationship between CKDu prevalence and the hardness of drinking water, selecting Godagama in Matara District as the reference site with no CKDu prevalence and water hardness well below the quality standards. A social survey was conducted for randomly selected families (n=30) to collect data mainly on their drinking water source, occupation, habits and practices. Water samples from drinking water source of surveyed families were collected and analyzed primarily for total water hardness. Results of the social survey combined with water quality analysis has differentiated three different drinking water sources with higher levels of total water hardness at study site: Bandagiriya Reservoir (146-180 ppm), Lunugamwehera Reservoir (128-134 ppm), Walawe River (112-127 ppm), compared to the total water hardness in reference site: Godagama (9-84 ppm). These results pooled with risk factor analysis has revealed a prevalence rate of 10% for CKDu in Bandagiriya and Risk Ratio of 0.61 for the consumption of drinking water with total hardness  $\geq 120$  ppm (hard water range according to the WHO classifications for drinking water). Therefore, phytoremediation for removing excess water hardness was tested as an economically greener method as a laboratory experiment using three aquatic plants: *Chara sp.*, *Lemna minor* and *Nitella sp.*, those are naturally abundant in Sri Lankan reservoirs. Three setups were prepared for three plant species for four different hardness levels, (50 ppm (control), 200 ppm, 400 ppm, 600 ppm) and the experiment was conducted for one month. Hardness levels were pre-decided to fall into the range of drinking water hardness of CKDu endemic areas recorded island wide. Control concentration is the average natural hardness level at reference site. Reduction rate for total hardness found to be higher in Charophytes: *Chara* (75-54%) and *Nitella* (78-48%) than *Lemna* (68-48%) and also, was higher for lower concentrations than that of for higher concentrations. But the survival rate was two times higher for *Lemna* in higher concentrations than that of for Charophytes. However, both the Charophytes and *Lemna* can be counted on as reliable bioremediators for excess water hardness as economic and eco-friendly methods; Charophytes for much lower concentrations and *Lemna minor* for higher concentrations.

**Keywords:** Drinking water quality, Water hardness, CKDu, Risk factor analysis, Phytoremediation