973/E2

Nitrate, phosphate and sulfate concentrations of well water in CKDu endemic areas and non endemic areas and their relation to water hardness

S I Fonseka[1], M D Amarasinghe[1*] and P A Paranagama[2]
[1]*Department of Botany, University of Kelaniya, Kelaniya*
[2]*Department of Chemistry, University of Kelaniya, Kelaniya*

Increasing hardness and the unpleasant taste of water from dug wells and tube wells in areas where chronic kidney disease of unknown etiology (CKDu) prevails in Sri Lanka is a major problem for the inhabitants and their daily water consumption is reported to be low due to this reason. This research was carried out to determine the hardness of ground water and the presence of other ions in well water located in Anuradhapura, Padavi-Sripura, Nikawewa and Moragollagama which were identified as areas where CKDu prevailed (endemic) and Ampara, Gampaha as areas where CKDu was non prevalent. The selected sites are agricultural areas and farmers use inorganic fertilizer on the crops. As chemical fertilizers contain higher amounts of nitrate (NO_3^-), phosphate (PO_4^{3-}) and sulfate (SO_4^{2-}), the research was aimed at determining these ions in well water. Samples of groundwater were collected in triplicate into polypropylene bottles from dug wells and tube wells used by the villagers for drinking and domestic purposes. Concentrated HNO_3 was added for preservation (HNO_3 was not added to samples used to determine NO_3^-). Total hardness was measured using standard EDTA titrations. PO_4^{3-}, SO_4^{2-}, NO_3^- contents were measured colorimetrically using standard spectrophotometric methods. Total hardness of water in CKDu prevailing areas (n = 280) ranged from 30 – 840 ppm. PO_4^{3-} contents ranged between 0.11 – 23.6 ppm, SO_4^{2-} contents ranged from 0.0 – 11.5 ppm and NO_3^- contents ranged from 0.0 – 15.6 ppm. In CKDu non prevailing areas, total hardness of water (n = 290) ranged from 9.4 – 480 ppm. PO_4^{3-} contents ranged from 0.1 –16 ppm, SO_4^{2-} contents ranged from 0.0 – 152.0 ppm and NO_3^- contents ranged from 0.01 – 0.0 ppm. Pearson correlation analysis revealed a strong positive correlation between PO_4^{3-} and SO_4^{2-} with total hardness of the water in CKDu endemic areas. Nitrate content shows a negative correlation with total hardness. Water in wells in CKDu non endemic areas were observed to be lower in hardness and also showed weak positive correlations between PO_4^{3-} and SO_4^{2-} ions and total hardness. No statistically significant correlation was observed for NO_3^-. These results therefore indicate that hard water has an ability to retain PO_4^{3-} and SO_4^{2-} ions and that may be one of the causes that deteriorate the quality of ground water.

Keywords: CKDu, nitrate, phosphate, sulfate, water-hardness

mala@kln.ac.lk Tel: 1122914480