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APPLICATIONS OF INTEGRATED WATER QUALITY INDEX (IWQI) FOR RAPID DEMARCATION OF PALATABILITY PROBLEMS IN GROUNDWATER

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Dominant water quality issues of groundwater in the dry zone regions of Sri Lanka contain higher contents of Total Dissolved Solids (TDS), hardness and fluoride that often exceeds regulatory safety limits. Since the fluoride is a primary contaminant, controlling that level before consumption is mandatory. Even though, both TDS and hardness regulation are not mandatory, such parameters seriously affect the palatability of water. Therefore, water palatability requires improvements before treating fluoride or other trace constituents. Water treatment based on reverse osmosis technology is a widely used treatment method in the dry zone. To address water palatability issues, we proposed an integrated water quality index (IWQI) for rapid demarcation of source water locations. The proposed IWQI was formulated utilizing chemical species. Over thirty-six groundwater samples were collected from existing well locations in Netiyagama village using random sampling techniques. Water samples were analyzed for the physio chemical parameters; pH, electrical conductivity, turbidity, alkalinity, Na^+, Mg^{2+}, K^+, Ca^{2+}, Cl^-, F^-, Br^-, PO_4^{3-}, NO^{3-}, SO_4^{2-}, Fe, Ni, Cu, Zn, As, Cd and Pb (Activities of minor constituents are measured in total). After validating the reliability of thermodynamic parameters, Visual MINTEQ 3.1 was used to calculate chemical species. The IWQI was calculated using open source R-Studio 3.1.3 with weighted arithmetic indexing method. The calculated IWQI values ranged from 9 - 406, and these values were categorized into five classes as very good 0 – 25, good 26 – 50, poor 51 – 75, very poor 76 – 100, and unsuitable > 100. The IWQI values were classified by hierarchical cluster analysis, and the resulted data were shown as dendograms. The water source located at 8° 19' 53.2" N 80° 36' 04.8" E (IWQI 44; raw water composition, TDS 697 mg/L; hardness 399 mg/L $CaCO_3$; fluoride 0.21 mg/L) is selected to introduce a customized water treatment method based on membrane technology. Presently, the laboratory scale facility is operational at 90% yield with the treated water quality with composition: pH 6.7; F 0.21 mg/L, TDS 69 mg/L; hardness 24 mg/L $CaCO_3$.

Keywords: Groundwater, Integrated Water Quality Index, Palatability