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PERFORMANCE OPTIMIZATION OF ELECTROCOAGULATION REACTOR FOR SIMULTANEOUS REMOVAL OF HARDNESS AND FLUORIDE BY SURFACE RESPONSE METHODOLOGY

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Groundwater is a major source for rural water supply schemes in the dry zone of Sri Lanka. Due to excess residence time of water in aquifers, the water in dry zone is often exerts high concentrations of hardenss and fluoride. Presence of excess hardness and fluoride in water are not only detrimental to human health but also imparts serious impact for industry. Treatment methods, such as reverse osmosis, ion exchange or nanofiltration, are widely used to treat hard water. Pressure driven reverse osmosis technology removes constitutents in water than what is required which renders water unplatable. Ion exchange methods are the oldest and hardness removal is bulky. Both ion exchange and membrane metods generate substantial wastes. Therefore, developing a sustainable technology to mitigate excess hardness and fluoride is important. The electrochemical water treatment methods are robust, low-cost and can be automated, readily minimizing user engagements. Out of electrochemical methods, electrocoagulation holds a great promise in the water treatment industry due to *in-situ* chemicals generation, and low-cost. From electrolytic oxidation of sacrific anode, metal hydroxides act as a coagulant and provide active sites for contaminants removal. Apart from adsorption, sweep coagulation, bridge coagulation and co-precipitation also play a role during the treatment process. In the present work, the relationship between the simultaneous hardness and fluoride removal with current and electrolysis time was examined. Response surface methodology was used for optimization, while keeping most design parameters constant. Borehole groundwater (9G32+FR Mihintale, Rajarata University) was used for the experiments. The efficiencies of hardness and fluoride removal are 63% and 97% at 0.03 A applied current and 52 min reaction time, respectively. The energy consumption was 1.98 kWh m^{-3}. Both hardness and fluoride were removed from the water at near-neutral pH. The residual Al^{3+} in treated water is 2.33 g m^{-3}, which exceeds WHO limits posing a severe health risk. Further experiments are in progress using different anode materials to improve the efficiency of electrocoagulation.

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