

Study on the Potential Usage of *Hygrophila schulli* (Neeramulliya) for Removal of Water Hardness as a Method of Phytoremediation

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A high level of water hardness in drinking water is a serious problem in different regions of Sri Lanka. Phytoremediation acts as an effective, environmentally friendly, and low-cost technology for the removal of water hardness. Therefore, the current study was intended to identify the potential usage of *Hygrophila schulli* (Neeramulliya) for the removal of water hardness using a hydroponic system. This plant was selected for the current study based on traditional beliefs, literature records, and availability in the natural environment. Preliminary trials were conducted to identify the appropriate maturity stage of plants, the number of plants, treatment time, and growth medium of hydroponic system. Based on the above results, final experiments were conducted in two hydroponic systems (Treatment 01: 4 plants, Treatment 02: 5 plants) with 16 L of natural hard water (Initial hardness: 300 mg L⁻¹ CaCO₃) in the growth medium of 1:1 ratio of coconut coir: sand using one-month-old *H. schulli* plants. Three replicates for each of the systems were used during the final experiment. Temperature, pH, Electrical Conductivity, Dissolved Oxygen, and Hardness level of water were measured every 12 hours for 36 hours of the experimental period. According to the results, the number of plants and treatment time had a significant effect on the removal rate of water hardness ($p < 0.05$). The hardness removal efficiency of 2 treatment systems ranges at an average of 3.85-21.25% within 36 hours. This explains the capacity of *H. schulli* plants in absorbing causative ions responsible for water hardness during the phytoremediation process. The hydroponic system with 5 plants per unit was recorded average 250 mg L⁻¹ of hardness which satisfies the standard level permissible for drinking water after 36 hours of the time. Accordingly, the absorbance level of Ca²⁺ ions had recorded 10 mg L⁻¹ per single plant of *H. schulli*. Consequently, the treatment system having 5 plants acts as the most effective hydroponic unit in the removal of water hardness. There was no significant difference between pH, Dissolved Oxygen, Electrical Conductivity level in each experimental system, and treatment time ($p > 0.05$). The current study recommends identifying the applicability of similar hydroponic units for removal of extremely high hardness levels from natural water which is over 500 mg L⁻¹ in certain areas of Sri Lanka. In conclusion, this study reveals the appropriateness of *H. schulli* for the reduction of hardness level (300 mg L⁻¹ CaCO₃) during the water treatment process.

Keywords: Hardness Removal Rate, Phytoremediation, Hydroponic system, Water quality parameters, Water treatment