Development of a Water Treatment Filter Bag Using Bael (*Aegle marmelos* L.) and Coconut (*Cocos nucifera* L.) Shell Active Carbon for Removal of Hardness and *Escherichia coli* in Groundwater

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Consumption of hard water and *Escherichia coli* contaminated water cause severe health problems. This study focuses on introducing a portable and user-friendly filter bag to remove hardness and *E. coli* in drinking water using bael and coconut shells active carbon. Alkaline activated bael shell active carbon (BSAC) and coconut shell active carbon (CSAC) were characterized using Fourier-Transform Infrared Radiation (FTIR) spectroscopy and Scanning Electron Microscope (SEM) techniques. The effects of initial hardness, adsorbent dose, pH, temperature, and contact time were determined using batch experiments. The analysis was done by EDTA titrations using AOAC: 973.52B method. F1001 grade filter paper bags with 4.0 g of active carbon were applied to water samples collected from Gonawila. The effect of active carbon on *E. coli* count was analyzed using the most probable number (MPN) test method. Hydroxyl groups were observed in the FTIR analysis of active carbon. BSAC gave SEM images with high porosity. Removal efficiencies at pH 6.3 for BSAC and CSAC were 33% and 25%, respectively. The thermodynamic studies showed that the softening process in BSAC and CSAC is endothermic as removal efficiency increased from 32% and 19% at 303 K to 60% and 47% at 333 K, respectively. Removal efficiency enhanced when increasing contact time and adsorbent dose up to 15 hours and 1.00 g/mL, respectively. The maximum removal efficiency was reported with the initial hardness of 200 mg/L. BSAC showed significantly higher efficiency than CSAC in all optimizations except the pH. Field water samples reported an average hardness reduction of 39% and 36% by BSAC and CSAC, respectively. The microbial analysis resulted *E. coli* counts of 11 MPN/100 mL and <2 MPN/100 mL with 63% and >93% efficiencies for BSAC and CSAC, respectively. The results indicated that filter bags developed using BSAC perform better in water softening while CSAC removes *E. coli* more efficiently.

Keywords: Adsorption, Agricultural waste, Hardness, *Escherichia coli*