

## Study on Removal Efficiency of Fluoride in Water using Environmentally Friendly, Low Cost Filter System

D.M.K.M. Chandrasena<sup>1</sup>, W.L. Alwis<sup>2</sup>, G.G.N. Thushari<sup>1\*</sup>, A.P. Abeygunawardana<sup>1</sup>,  
A.P.R. Silva<sup>1</sup>, D.S.W.N. Jayarathne<sup>1</sup> and L.D. Gayathry<sup>1</sup>

<sup>1\*</sup>Department of Animal Science, Uva Wellassa University, Badulla, Sri Lanka

<sup>2</sup>National Water Supply & Drainage Board, Anuradhapura, Sri Lanka

Water sources in specific regions of dry zone in Sri Lanka naturally contain high fluoride level than the maximum requirement level of drinking water. The intake of excessive amounts of fluoride in water causes different human health issues. This study was intended to identify the potential of using the biomaterials for an integrated water filtration system to improve the water quality. Based on the literature records, production cost and availability of biomaterials, Areca nut (*Areca catechu*) husk fiber, Coconut (*Cocos nucifera*) spathe charcoal and Snake Cucumber (*Cucumis melo*) seeds were used to identify the fluoride removal rate in water. Fluoride rich natural water was subjected to different biomaterial weight and treatment time combinations during preliminary trials. Based on the results of preliminary trials, the final experiment was conducted in the column systems using four types of integrated water filter setups at different weight ratios between areca nut husk fiber: coconut spathe charcoal {Experimental setups: A (1:1, 25g:25g), B (1:2, 25g:50g), C (1:1, 50g:50g), D (2:1, 50g:25g)} with 3 layers of sand. Equal treatment period (1½ hrs) was used for all 4 column experimental setups since the adsorption capacity of biomaterials depends on the contact time. Fluoride removal efficiency and other water quality parameters were measured in each filter setup. Biomaterials amount in the filter setups had a significant effect on the fluoride level, pH, and Total Dissolved Solids in water ( $p < 0.05$ ). The fluoride removal rate of filter setups was 27.90%, 28.80%, 34.49%, and 43.15% in the A, B, C, and D systems respectively. Although the same biomaterial ratio (1:1) had for the A and C experimental setups, the fluoride removal efficiency was significantly different due to the variations of biomaterials dose in two systems (A: 25g, C: 50g). The most effective filter setup was identified as the integrated system with 50g of areca nut husk fiber and 25g of coconut spathe charcoal considering Sri Lanka Standards for potable water (SLS 614:2013). Turbidity, nitrate, nitrite, phosphate, sulphate, iron, and chloride level of water had recorded the acceptable levels as meeting with drinking water standards after 1½ hrs of the treatment period. The pH of all the filter setup was recorded at the range of 7.1-8.1 within the permissible level for drinking water. In conclusion, areca nut husk fiber and coconut spathe charcoal act as effective, low-cost biomaterials in removing the fluoride from water while maintaining the quality of water.

**Keywords:** Water quality, Biomaterials, Integrated water filter system, Fluoride removal rate, Fluorosis