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**DEFLUORIDATION OF DOMESTIC WATER USING NATURAL MATERIALS:  
A CASE STUDY OF WEST KARACHUONYO DIVISION,  
RACHUONYO DISTRICT IN KENYA.**

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**A THESIS SUBMITTED TO THE SCHOOL OF ENGINEERING IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF PHILOSOPHY (M.PHIL) IN WATER ENGINEERING.**



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**NOVEMBER, 2009.**



## ABSTRACT

Excess fluoride concentration in domestic water is harmful to human health. The prolonged ingestion of water whose fluoride concentration exceeds the WHO upper limit of 1.5 mg/l is known to cause fluorosis which usually manifest itself in either dental (teeth mottling) or crippling (bone deformation) fluorosis depending on the duration of exposure. Majority of the people (adults and children) residing in West Karachuonyo division, Rachuonyo district in Nyanza province are suffering from dental fluorosis (characterized by the brown colouration of the enamel).

Visual examination of the dental structure among local pupils in randomly selected primary schools indicated that fluorosis levels are ranging between 30% (Kauma location) to 97% (Kakdhimu location). This fluorosis scenario was further confirmed by the laboratory tests results obtained from raw water samples, which showed that raw water fluoride concentration in the division was between 1.13 mg/l to 17.2 mg/l, thereby justifying the widespread occurrence of dental fluorosis.

Three natural materials were chosen and tested as defluoridation media in both bucket and vertical filter column tests with the experimental variables being media particle size, raw water flow rate, initial raw water fluoride concentration and sampling depth. The results from these tests revealed that crushed moringa seeds had higher excess fluoride reduction efficiency from 14.5 mg/l to 1.26 mg/l followed by crushed burnt clay pot particles which registered a fluoride reduction from 8.95 mg/l to 1.60 mg/l. However, maize cob char remained non-responsive to fluoride reduction and achieved insignificant defluoridation in both tests.

The fluoride reduction efficacy of crushed moringa seeds was found to be independent of the initial raw water fluoride concentration and remained unsaturated throughout the test duration of twelve hours but largely depend on the raw water flow rates, achieving minimal defluoridation at high raw water flow rate of 80 ml/min. On the other hand, the defluoridation performance of crushed burnt clay pot particles was found to be entirely dependent on both initial raw water fluoride concentration and raw water flow rates. Furthermore, it was noted that the optimal values for maximum defluoridation by all media materials were; flow rate of 60 ml/min, sampling depth of 240 mm and particle size of 0.60 – 0.50 mm.

In order to mitigate the debilitating effects of dental fluorosis in the division, it was recommended that residents of Kakdhimu location should use crushed moringa seeds for household defluoridation units while persons in other areas can either use moringa seeds or clay pot particles depending on the raw water fluoride concentration. Other dental fluorosis mitigation measures suggested includes; promotion of rain water harvesting techniques, sensitization of the rural folk on the health risks associated with the ingestion of fluoritic water and lastly community participation in the propagation and planting of moringa seedling for sustainable supply of moringa seeds especially in Kakdhimu and Kanjira locations.

**Key words:** Defluoridation, crushed moringa seeds, crushed burnt clay pot particles, maize cob char, fluorosis, bucket test, vertical filter column test, effective size, uniformity coefficient, headloss and saturation ratios.