Eco. Env. & Cons. 28 (4) : 2022; pp. (1841-1843)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i04.028

Treatment of Fluoride Contaminated Water Using Coconut Waste as Natural Adsorbent

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(Received 24 March, 2022; Accepted 26 May, 2022)

ABSTRACT

The removal of fluoride from groundwater has been researched using a variety of treatment approaches. The adsorption process for defluoridation is widely used in poor nations since it is a technologically and economically viable method that is both environmentally beneficial and simple to implement. As a result, it is necessary to monitor defluoridation using a low-cost and simple technology. This research examines defluoridation using a natural absorbent, coconut husk, which is both inexpensive and effective. The appropriate dose of adsorbent was also determined for improved fluoride removal percentage efficiency. Based on the findings, it can be inferred that coconut husk can be a low-cost replacement for Defluoridation in the process of removing fluoride from water.

Key words *: Coconut husk, de-fluoridation, and Adsorption.*

Introduction

The health implications of high fluoride concentrations in drinking water is a global issue. In India, the majority of the population lives in rural areas and relies on ground water for their drinkable water. The amount of fluoride in ground water varies depending on where you live. The statistics demonstrate that the fluoride dispersion in the groundwater is not uniform.

Water concentrations usually range from 0.01 mg/l to 48 mg/l. Fluoride enters ground water in a variety of ways, including. Weathering of rocks, industrial effluents, and geochemical reactions are all examples of geochemical reactions.

It is an important component for the production of tooth enamel in both animals and humans, but its high concentration makes it difficult to use.

More than 1.5 mg/l causes irreversible demineralization of bone and tooth tissues, resulting in skeletal and dental fluorosis, brain damage, kidney and liver damage, headache, skin rashes, bone cancer, and even death in extreme cases.

The World Health Organization (WHO) recommends a fluoride content of 1.5 mg-F- /l for drinking water (TBS, 2003), while the Tanzania Bureau of Standards (TBS) recommends a lower limit of fluoride of 1.5 mg-F- /l and a tolerable fluoride level of 4.0 mg-F- /l for potable water (WHO, 1971). However, the World Health Organization recommends that fluoride levels in the range of 1.5 to 4.0 mg-F-/l

Coagulation and precipitation, membrane separation, ion exchange, and electrolytic deposition were all used to defluoridate water, but they were found to be expensive and unsuitable for developing nations (Murugan and Subramanian, 2006). Adsorption is a low-cost method for removing fluoride from drinkable water using locally available adsorbent materials. Plant biomass and agricultural waste

by-products can be employed for effective fluoride uptake while also alleviating the problem of disposal. These low-cost materials can be used to replace more expensive commercial adsorbents, such as activated carbon, which has regeneration issues.

Methodology

Procedure

Make a solution of 0.5 g of sodium fluoride in 500 ml of distil water and tap Water and keep the sample for 24 hours and take the solution (50 ml) for different Time intervals for reading as followings:

1. 50 g of coconut hard shell (brown) in 50 ml of normal tap water. (HS-1)
2. 50 g of coconut hard shell (brown) in 50 ml of normal distil water. (HS-2)
3. 50 g of coconut hard shell (brown) in 50 ml of tap water fluoride Solution. (HS-3)
4. 50 g of coconut hard shell (brown) in 50 ml of distil water fluoride Solution. (HS-4)
5. 50 g of brown fiber coconut in 50 ml of tap water. (BFC-1)
6. 50 g of brown fiber coconut in 50 ml of distil water. (BFC-2)
7. 50 g of brown fiber coconut in 50 ml of tap water fluoride solution. (BFC-3)
8. 50 g of brown fiber coconut in 50 ml of distil water fluoride solution. (BFC-4).
9. 50 g of green shell coconut (drinking coconut) in 500 ml of distil Water fluoride solution and take 50 ml instantly for reading after dipping the Coconut shell. (CB)
10. Keep the same sample for 1 hour and take the solution for reading. (CB-1)
11. Keep the same sample for 2 hour and take the solution for reading. (CB-2)
12. Keep the same sample for 3 hour and take the solution for reading. (CB-3)
13. Keep the same sample for 4 hour and take the solution for reading. (CB-4)

Compare the following points with each other

1, 3, 5, 7 = as these all are the sample of tap water. 2, 4, 6, 8 = as these all are the sample of distil water. 9 to 13 = as these are sample of coconut green.

Observations no.1

The results are shown in Table 1 as followings

Table 1. Quantity of fluoride after treatment with coconut husk as an adsorbent

Symbols	Flouride (mg/l)
HS-1	7.4
HS-2	0.4
HS-3	5.3
HS-4	0.31
BFC-1	7.7
BFC-2	0.36
BFC-3	5.3
BFC-4	0.29
CB	0.01
CB-1	0.23
CB-2	0.12
CB-3	0.11
CB-4	0.19

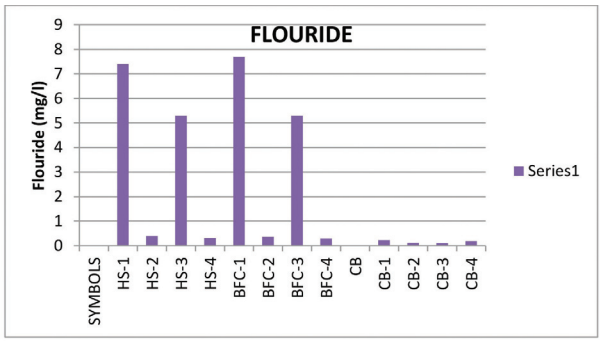

Fig. 1. Quantity of fluoride after treatment with coconut husk as an adsorben

Procedure

Make a solution of 0.5 g of sodium fluoride in 500 ml of distilled water and Tap water and keep the sample for 24 hours and take the solution for Reading 100 ml at different time intervals as followings

1. Reading of plain distilled water. (DW)
2. Reading of fluoride solution of in distilled water. (F-DW)
3. Reading of fluoride solution of in tap water. (F-TW)
4. Reading of just washed sample of coconut shell with distilled water. (HS-1 WASHED)
5. Reading of just washed sample of brown fiber coconut with distil water. (BFC WASHED)
6. 50 g of hard shell of coconut kept for 24 hours in distil water and taken 100 ml for sample. (DW-HS-1)
7. 50 g of hard shell of coconut kept for 24 hours in fluoride solution of distil water and taken 100 ml for sample. (F-HS-2)

8. 50 g of brown fiber coconut kept for 24 hours in distil water and taken 100 ml for sample. (DW BFC-1)
9. 50 g of brown fiber coconut kept for 24 hours in fluoride solution of distilled water and taken 100 ml for sample. (F-BFC-2)
10. 50 g of hard shell of coconut kept for 24 hours in fluoride solution of tap water and taken 100 ml for sample. (F-HS-TAP)
11. 50 g of brown fiber coconut kept for 24 hours in fluoride solution of tap water and taken 100 ml for sample. (F-BFC-TAP)

Observation 2

Result are shown in Table 2.

Table 2. Treatment of fluoride contaminated water (50 ml) with coconut husk

Symbols	Flouride (mg/l)
Distil water	0
F Solution (DW)	0.02
F Solution (TW)	2.5
HS-1(WASHED)	0.12
BFC-1 (WASHED)	2.4
DW(HS-1)	0.044
F(HS-2)	0.022
DW(BFC-1)	0.14
F(BFC-2)	0.083
F(HS-TAP)	3.3
F(BFC-TAP)	0.67

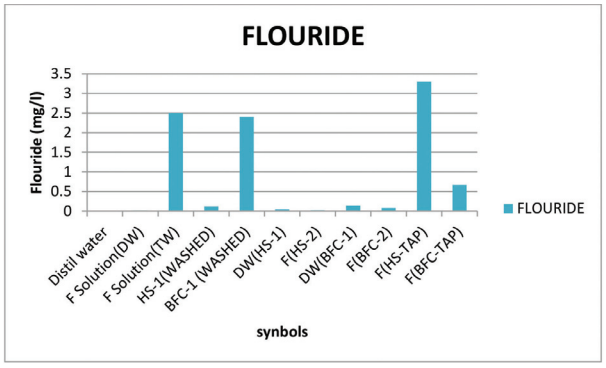

Fig. 2. Treatment of fluoride contaminated water (50 ml) with coconut husk

Results and Discussion

In Table 1 green coconut shell show excellent result for the removal of fluorides. The quantity of fluoride in filtrate was found less than 1. Thus other parts of coconut also show good results as adsorbent.

In Table 2 hard shell and coconut brown fiber as an adsorbent also show good efficiency for the removal of fluoride from contaminated water.

Based on the result of this research, it can be stated that coconut husk has a good ability to adsorb fluoride from drinking and tap water, particularly at high fluoride concentrations, and has produced excellent outcomes. The biosorbent coconut brown fiber husk was effective in removing fluoride ions from an aqueous solution with fluoride content.

Acknowledgements

I pay respect to HOD Department of Chemistry, my supervisor and all other teaching staff. I acknowledge all the non teaching staff member of department of chemistry who directly and indirectly help during my research work.

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