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COMPARATIVE STUDY OF ADSORPTION OF FLUORIDE BY USING PADDY HUSK CHARCOAL AND COCONUT SHELL CHARCOAL

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ABSTRACT

This paper deals with a comparative study of the adsorption of fluoride by using paddy husk charcoal and coconut shell charcoal. The adsorption depends upon the percentage of alkali and amount of adsorbent used in this process.

INTRODUCTION

Elements depending upon the requirement by human beings can be divided into two groups, essential and non essential. Essential elements like Zn, Cu, Fe, Ca, F etc., play an important role in the metabolism of human beings. But even the essential metals at high concentration, when they cross permissible limits prove to be harmful. For example, fluoride is an essential element for human and animal health particularly of dental caries. But high fluoride content in drinking water gives rise to harmful effects in human beings and animals.

Fluoride deficiency, on the other hand may have a harmful influence on the growth of teeth. One ppm of fluoride present in drinking water has been found to be the safe limit prescribed by Indian council of Medical Research and Committee on Public Health Engineering Manual and code of practice.

Many porous substances such as paddy husk and coconut shell charcoal, possess the property of adsorbing gases and also adsorbing substances from solution. Adsorption is a physical treatment method and it is a permissible technique to remove excessive elements from drinking water. In recent years, the research is on to look for low cost and eco friendly non conventional adsorbent materials for the removal of excessive elements from drinking water.

This paper describes the comparative study of removal of fluoride by using paddy husk charcoal and coconut shell charcoal. This method is based on the principle of physical adsorption process.

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Table 1. Adsorption of Fluoride by using Coconut Shell Charcoal (Adsorbent Coconut Shell Charcoal, Quantity Of Sodium Fluoride Solution 100mL, Time 24 Hrs)

S.No	Amount of adsorbent (in g)	% of KOH	% of ALUM	Fluoride content (in ppm) Initial	After Treatment	pH Initial	After treatment
1.	1	0.5	2	2	1.53	7.8	10.1
2.	1	0.5	2	3	2.43	7.8	10.1
3.	1	0.5	2	4	2.81	7.8	10.1
4.	1	0.5	2	5	4.01	7.8	10.1
5.	2	0.5	2	2	1.45	7.8	10.1
6.	2	0.5	2	3	2.15	7.8	10.1
7.	2	0.5	2	4	2.98	78	10.1
8.	2	0.5	2	5	3.72	7.8	10.1
9.	3	0.5	2	2	1.39	7.8	10.1
10.	3	0.5	2	3	2.50	78	10.1
11.	3	0.5	2	4	3.55	7.8	10.1
12.	3	0.5	2	5	3.98	7.8	10.1
13.	4	0.5	2	2	1.42	78	10.1
14.	4	0.5	2	3	2.57	7.8	10.1
15.	4	0.5	2	4	3.80	7.8	10.1
16.	4	0.5	2	5	4.29	78	10.1
17.	5	0.5	2	2	1.91	7.8	10.1
18.	5	0.5	2	3	2.64	7.8	10.1
19.	5	0.5	2	4	3.26	78	10.1
20.	5	0.5	2	5	4.29	7.8	10.1

Table 1 A. (Changing the % of KOH)

S.No	Amount of adsorbent (in g)	% of KOH	% of ALUM	Fluoride content (in ppm) Initial	After Treatment	pH Initial	After treatment
21.	1	1	2	2	1.91	7.9	12.3
22.	1	1	2	3	2.64	7.9	12.3
23.	1	1	2	4	3.86	7.9	12.3
24.	1	1	2	5	4.57	7.9	12.3
25.	2	1	2	2	1.89	7.9	12.3
26.	2	1	2	3	2.43	7.9	12.3
27.	2	1	2	4	3.12	7.9	12.3
28.	2	1	2	5	4.27	7.9	12.3
29.	3	1	2	2	1.87	7.9	12.3
30.	3	1	2	3	2.47	7.9	12.3
31.	3	1	2	4	3.05	7.9	12.3
32.	3	1	2	5	4.49	7.9	12.3
33.	4	1	2	2	1.85	7.9	12.3
34.	4	1	2	3	2.75	7.9	12.3
35.	4	1	2	4	3.08	7.9	12.3
36.	4	1	2	5	4.62	7.9	12.3
37.	5	1	2	2	1.88	7.9	12.3
38.	5	1	2	3	2.92	7.9	12.3
39.	5	1	2	4	3.36	7.9	12.3
40.	5	1	2	5	4.77	7.9	12.3

Table 2. Adsorption of Fluoride by using Paddy husk Charcoal (Adsorbent Paddy husk Charcoal, Quantity of Sodium Fluoride Solution 100mL, Time 24 Hrs)

S.No	Amount of adsorbent (in g)	% of KOH	% of ALUM	Fluoride content (in ppm) Initial	After Treatment	pH Initial	After treatment
1.	1	1	2	2	1.73	7.5	10.3
2.	1	1	2	3	2.87	7.5	10.3
3.	1	1	2	4	3.74	7.5	10.3
4.	1	1	2	5	4.52	7.5	10.3
5.	2	1	2	2	1.25	7.5	10.3
6.	2	1	2	3	2.10	7.5	10.3
7.	2	1	2	4	3.42	7.5	10.3
8.	2	1	2	5	4.33	7.5	10.3
9.	3	1	2	2	1.09	7.5	10.3
10.	3	1	2	3	2.58	7.5	10.3
11.	3	1	2	4	3.87	7.5	10.3
12.	3	1	2	5	4.84	7.5	10.3
13.	4	1	2	2	1.94	7.5	10.3
14.	4	1	2	3	2.75	7.5	10.3
15.	4	1	2	4	3.83	7.5	10.3
16.	4	1	2	5	4.90	7.5	10.3

Table 2A. (Changing the % of KOH)

S.No	Amount of adsorbent (in g)	% of KOH	% of ALUM	Fluoride content (in ppm) Initial	After Treatment	pH Initial	After treatment
17.	1	0.5	2	2	1.19	8.1	9.4
18.	1	0.5	2	3	2.46	8.1	9.4
19.	1	0.5	2	4	3.42	8.1	9.4
20.	1	0.5	2	5	3.77	8.1	9.4
21.	2	0.5	2	2	1.14	8.1	9.4
22.	2	0.5	2	3	2.17	8.1	9.4
23.	2	0.5	2	4	3.31	8.1	9.4
24.	2	0.5	2	5	3.38	8.1	9.4
25.	3	0.5	2	2	0.69	8.1	9.4
26.	3	0.5	2	3	2.14	8.1	9.4
27.	3	0.5	2	4	3.05	8.1	9.4
28.	3	0.5	2	5	3.17	8.1	9.4
29.	4	0.5	2	2	1.10	8.1	9.4
30.	4	0.5	2	3	2.28	8.1	9.4
31.	4	0.5	2	4	2.86	8.1	9.4
32.	4	0.5	2	5	3.31	8.1	9.4
33.	5	0.5	2	2	1.50	8.1	9.4
34.	5	0.5	2	3	2.42	8.1	9.4
35.	5	0.5	2	4	3.25	8.1	9.4
36.	5	0.5	2	5	4.21	8.1	9.4

permissible limits prove to be harmful. For example, fluoride is an essential element for human and animal health particularly of dental caries. But high fluoride content in drinking water gives rise to harmful effects in human beings and animals.

Fluoride deficiency, on the other hand may have a harmful influence on the growth of teeth. 1 ppm of fluoride present in drinking water has been found to be the safe limit prescribed by Indian council of Medical Research and Committee on Public Health Engineering Manual and code of practice.

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solution. Adsorption is a physical treatment method and it is a permissible technique to remove excessive elements from drinking water. In recent years, the research is on to look for low cost and eco friendly non conventional adsorbent materials for the removal of excessive elements from drinking water.

This paper describes the comparative study of removal of fluoride by using paddy husk charcoal and coconut shell charcoal. This method is based on the principle of physical adsorption process.

MATERIALS AND METHODS

The procedure and method followed to investigate the adsorption using paddy husk charcoal and coconut shell charcoal are given below in detail.

The adsorbents (Paddy husk and Coconut shell charcoals) were ground into fine powder. The weighed adsorbent was taken in a polythene container. 100mL standard sodium fluoride (known concentration) solution was taken in the same container. One g (1%) potassium hydroxide and two g (2%) alum were added and shaken well.

The mixture was allowed to stand for 24 hours and it was filtered through whatman No. 42 filter paper. Then the fluoride content was estimated by using spectrophotometer. pH of the filtrate was measured by pH meter.

This method was repeated by changing the weight of charcoal and the percentage of potassium hydroxide to find out the efficiency of adsorbent.

RESULTS AND DISCUSSION

The experimental data are given in the Table 1, 1a, 2 and 2a. The two adsorbents have adsorbed the fluoride content, but the pH values of the resultant solution gets increased.

Under the treatment of low concentration of potassium hydrocide, both the asorbents gave better result than high concentration of potassium hydroxide.

Under the treatment of high concentration of potassium hydroxide, the adsorbents have less tendency to adsorb the fluoride but the pH values of the resultant solution gets increased.

The investigation revealed the fact that among these two adsorbents paddy husk charcoal showed the better results than coconut shell charcoal.

CONCLUSION

Adsorption is used to separate small amount of substances dissolved in large volumes of liquid. It is widely used in analytical chemistry for separating compounds which otherwise are difficult to separate.

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