

Assessment of Significance of Effect of Initial Fluoride Concentration and Dose of Activated Charcoal on Defluoridation of Water by using Two Way Analysis of Variance

S. V. Agarkar

B.B. Arts, N.B. Commerce & B.P. Science College, Digras ,
 Yavatmal , India

N. P. Shinkar

Government Polytechnic,
 Nagpur , India

Abstract :- The Rural Population mostly depends on ground water sources for drinking and domestic purposes. Unfortunately most of the sources are contaminated and review of literature revealed that the available ground water sources such as borewells, wells, handpumps etc. are contaminated. The Fluoride is one of the prominent contaminant polluting the water sources. Management of Fluoride contamination is a major public health Issue. In the present study attempts were made to use low cost and eco friendly Charcoal for defluoridation and to study the effects of process parameters using two way Analysis of Variance method. The results are encouraging.

Key Words :-Fluoride in Water, defluoridation, Significance of process parameters, ANOVA method.

I. INTRODUCTION :-

Water quality of both surface and ground water resources is depleting at very high rate. In many states, ground water sources are considered to be one the major water supply sources and unfortunately these are highly contaminated. Presence of various contaminants such as nitrates, sulphates, fluorides, heavy metals have been reported and causing serious health consequences. This re-enforced selection of the topic by the investigator. In the present work attempts were made to study the defluoridation of water by using phytocharcoal and effects of process parameters on fluoride removal.

II. MATERIALS & METHODS :-

The activated Charcoal was prepared from plant parts of Terminalia belerica using pyrolysis process.^{[2][3]} The defluoridation of water samples containing various fluoride concentrations were conducted in batch adsorption process.^[4] The fluoride concentrations in water samples before and after charcoal treatment were determined according to standard methods (APHA, 1998)^{[1][5]}.

The significance of process parameters such as initial fluoride concentration & dose of activated charcoal on fluoride removal was studied by using two way analysis of variance (ANOVA) All chemicals and reagents used were of analytical grade.^[6]

III. EXPERIMENTAL PART :-

The series of experiments were carried out to study the effects of initial concentration of fluoride in water samples and amount (dose) of prepared activated charcoal on removal of fluoride from given water samples. The experimental

conditions maintained during all sets of experiments are as mentioned below :-

- 1.Amount of Activated Charcoal :2g/l to 16g/l
2. Contact Time : 60 Minute
3. P^H of Water Samples : 7.5(± 0.5)
4. Temperature of Water Samples : 25⁰C(± 3⁰C)
5. Volume of Water Samples Taken:1000ml
6. Stirring Speed :70rpm(± 0.5)

The results of defluoridation study are discussed below given in the table 1.

IV. RESULTS & DISCUSSION :-

The results of defluoridation of water samples using activated Charcoal by batch adsorption process are given in table 1.

Table. 1 Result of defluoridation of water samples at experimental conditions and effects of process parameters.

Percent Fluoride Removal	Amount of Activated Charcoal (g/l) Dose								
	2	4	6	8	10	12	14	16	
Initial Fluoride Concentration	1.5	0	0	0.6	0.	1.	1.	2.	2.

			7	6	33	33	67	67
2.0	0	0.5	0.5	1	1.5	2	3	3
2.5	0	0.4	0.8	1.2	1.2	2	3.2	3.6
3.0	0.33	0.33	1	1.3	1.67	3	3	3
3.5	0.29	0.29	0.86	1.4	1.71	2.57	3.14	3.14
4.0	0.25	0.25	0.75	1.2	1.5	2.25	2.75	2.75
4.5	0.22	0.22	0.67	1.1	1.33	2	2.44	2.44
5.0	0.2	0.2	0.6	1	1.2	1.8	2.2	2.2
5.5	0.18	0.18	0.55	0.9	1.09	1.64	2	2
6.0	0.17	0.17	0.5	0.8	1	1.5	1.83	1.83

The amount of fluoride removed from water samples at 1.5mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.0mg/l to 2.67mg/l

The amount of fluoride removed from water samples at 2.0mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.0mg/l to 3mg/l

The amount of fluoride removed from water samples at 2.5mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.0mg/l to 3.6mg/l

The amount of fluoride removed from water samples at 3.0mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.33mg/l to 3mg/l

The amount of fluoride removed from water samples at 3.5mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.29mg/l to 3.14mg/l

The amount of fluoride removed from water samples at 4.0mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.25mg/l to 2.75mg/l

The amount of fluoride removed from water samples at 4.5mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.22mg/l to 2.44mg/l

The amount of fluoride removed from water samples at 5.0mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.2mg/l to 2.22mg/l

The amount of fluoride removed from water samples at 5.5mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.18mg/l to 2mg/l

The amount of fluoride removed from water samples at 6.0mg/l initial fluoride concentration and the amount of activated Charcoal employed were from 2g/l to 16g/l and ranged from 0.17mg/l to 1.83mg/l

At initial fluoride concentration 2.5gm/l and 16gm/l dose of activated Charcoal prepared has removed 3.60 % fluoride concentration, which is optimized value at experimental conditions. The result of mathematical analysis by two way ANOVA are given in the table 2.

Table. 2 Report of two way Analysis of variance for Assessment of significance Process parameters .

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	4.63696	9	0.51522	8.0513	7.9E-08	2.03224
Columns	69.0406	7	9.86295	154.128	3.9E-37	2.15883
Error	4.03149	63	0.06399			
Total	77.7091	79				

P-value for the study of effects of initial fluoride concentration in water samples on removal of fluoride is 7.9E-08 , which is significant and P-value for the effect of dose of activated charcoal is 3.9E-37, which is also significant, because both the P-values are less than 0.05 value.

V. CONCLUSION :-

The purpose of this work was to assess the significance of process parameters in defluoridation of water samples using phytocharcoal with the help of two way Analysis of Variance method. At set experimental conditions and variable process parameters such as initial fluoride

concentration and dose of activated Charcoal, the percentage of fluoride removal is varies & thus the effect of both the process parameters is significant.

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