

“EXPERIMENTAL STUDY ON REMOVAL OF FLUORIDE BY ACTIVATED COAT BUTTONS”

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Abstract – Defluoridation of water is carried out using the cost effective adsorbent such as Coat Buttons. Activated carbon of the adsorbent is made for batch study. Batch adsorption study is carried out by varying initial concentration, agitation time, hydrogen ion concentration, temperature, adsorbent dosage. For conducting the above study Ion Selective Electrode is used for determining the fluoride concentration. Hydrogen ion concentration is made neutral and room temperature is maintained. The removal efficiency of the activated carbon prepared from the Coat Buttons is found to be 97%. Isotherm models were studied and satisfied.

Key Words: Defluoridation, Coat Buttons, Batch Adsorption, Isotherm study, Activated Carbon, Fluoride Concentration, Ion Selective Electrode

1. INTRODUCTION

Water is the main source of survival for the living beings on this planet. Potable water is becoming scarce day by day therefore it becomes more important to study about the contamination of water by various sources. One of the source is the fluoride. Fluoride is nowadays used in industries for various purposes. Care is taken less in case of disposal and waste is let off directly into the natural streams without treatment. Hence there is possible contamination of water by fluoride. It is one of the man made contamination. Sometime the fluoride concentration gets triggered by the geological formation of the earth which tends to increase the level of fluoride in the ground water.

2. SOURCES OF FLUORIDE

Dental products contain about 95% of fluoride with respect to the concentration levels maintained below desirable levels. Processed eatables and soft drinks contain the fluoride content that is used while manufacturing. Since the fluoride is fatal in nature if consumed it is used as an pesticide and insecticides. Tea plants are one of the major source which absorb fluoride in the soil and the tea leaves which are old in age constitutes high fluoride concentration. Pharmaceuticals industry which uses fluoride as a source for the medicines. Use of the pans manufactured from Teflon contains fluoride which imparts NaF when the food is cooked using it. In case of the meat that is being used for the packaging contains maximum concentration of fluoride from the chicken sticks.

3. IMPACTS ON HEALTH

The permissible limit of the fluoride is 1.0-1.50 mg/L. If the above limit is crossed the health problems are witnessed that are incurable in nature and the prevention is the only remedy. If the fluoride is consumed in higher concentrations it may results to be fatal or death. The effects of the fluoride on human body are deformation of the bone which is irreversible. Skeletal fluorosis and the Dental fluorosis is most common.

Table -1: Effects of Fluoride

SL NO	Concentration(mg/L)	Effects
1	0 (Nil)	Affected growth and reproduction
2	Less than 0.5	Dental problems
3	0.5-1.5	MaintainsDental health
3	1.5-4.0	Deformaton of teeths
4	4.0-10	Deformation in bones
5	More than 10	Crippling

3. MATERIALS AND METHODOLOGY

3.1 EQUIPMENTS REQUIRED

- pH meter
- Fluoride ion Selective electrode
- Rotary shaker
- Muffle Furnace
- Pipettes and Burettes
- Digital weigh balance
- 250ml conical flask

3.2 STOCK SOLUTION PREPARATION

221 grams of anhydrous NaF was dissolved in 1000ml of the distilled water.

3.3 PREPARATION OF ADSORBENTS

Adsorbent collected from a source facility locally and was washed with distilled water for several times to wash out the impurities. Dried naturally and was treated with H_3PO_4 and heated with high temperature ranging from 550-600°C and was activated.

3.4 METHODOLOGY

Batch adsorption study was carried out. The batch study was carried out to determine the reduction efficiency of fluoride by cost effective adsorbents. Adsorption were carried out by taking 250ml of fluoride solution in Erlenmeyer flask containing 5gm to 25gm of each dried sieved adsorbent. The mixture was then mixed and shaken well in rotary shaker at 150rpm at room temperature. The reduction of fluoride concentration depends on the following : initial fluoride concentration, agitation time and adsorbent dosage. Different preliminary fluoride absorption of 5mg/L to 25mg/L with different adsorbent dosage of 5gm/250ml to 25gm/250ml studies and contact time 30min to 180min were carried out for isotherm studies.

4.RESULTS AND DISCUSSION

Time	Initial Conc(mg/L)	Final Conc(mg/L)	% Removal
30	10	2.10	79
60	10	1.8	82
90	10	1.2	88
120	10	1.0	90
150	10	0.6	94
180	10	0.3	97

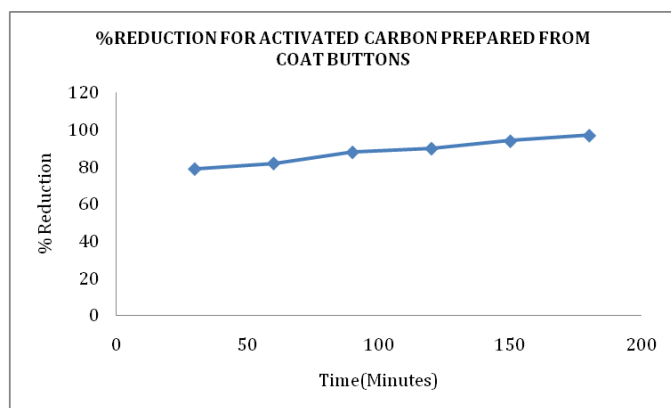


Figure 4.1 Effect of contact time on reduction of fluoride

The percentage Reduction of the fluoride concentration for stem as an adsorbent is as shown in the above Figure 4.1 with contact time (minutes) along X-axis and % Removal of the fluoride concentration along Y-axis

Adsorption Kinetics for the reduction of fluoride using Coat Buttons

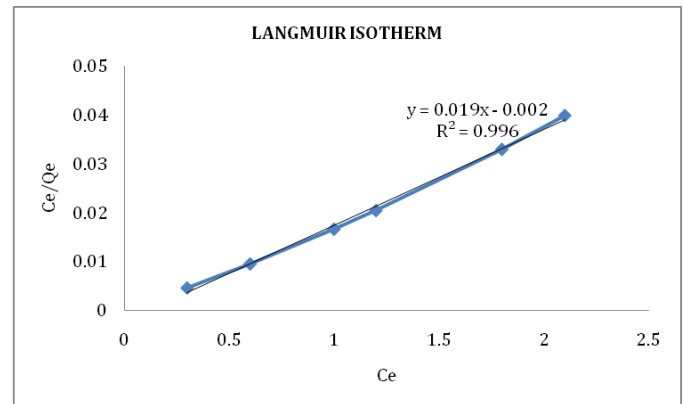


Figure 4.2 Calculation of Langmuir Isotherm for Reduction of Fluoride

The Isotherm was plotted with C_e/Q_e along the Y-axis and C_e along the X- axis as shown in the above figure 4.2

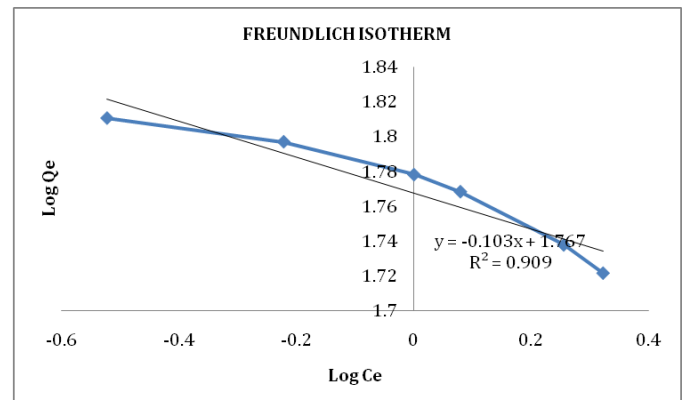


Figure 4.3 Calculation of Freundlich Isotherm for Reduction of Fluoride

The Isotherm was plotted with $\text{Log } Q_e$ along the Y-axis and $\text{Log } C_e$ along the X- axis as shown in the above figure 4.3

5. CONCLUSION

From the above study it is evident that the reduction of fluoride can be witnessed more in the case where the dosage and the contact time is more with the pH being neutral that is 7 along with the stirring rate of 150rpm at the room temperature. Freundlich and Langmuir isotherms were plotted and constants were determined. It is evident that both the above isotherms were satisfied. The removal efficiency of adsorbent is 97%.The use of the Coat Buttons proves to be an cost effective adsorbents for the defluoridation process.

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