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FLUORIDE REMOVAL USING LOW COST ADSORBENT - LIME

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Abstract - *Fluoride is naturally found in water. If fluoride level exceed, it causes dental problems and even several other effects on human body. Thus, removal of Fluoride from aqueous solution by using lime is an adsorbent has been investigated. Lime is locally available and is a low cost alternative to other adsorbents. The studies were carried out by varying the contact time, dose of adsorbent and pH. The optimum condition for removal of Fluoride from aqueous solution is described. The possibility of lime as a adsorbent is studied.*

Key Words: Fluoride, adsorbent, low cost, contact time, dose of adsorbent, pH.

1. INTRODUCTION

Fluoride is a naturally found in the water. Fluorine is present in the form of fluorides in a number of minerals and in many rocks. Fluorine and its compounds are used in industry such as production of high purity graphite, fertilizers, electrolysis of alumina, semiconductors, etc. Fluoride is beneficial in human body for the formation of dental enamel and maintenance of healthy bones when present within the permissible limit. The ingestion of excess fluoride can cause fluorosis which affects the teeth and bones. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe bone problems. Low levels of fluoride intake help to prevent dental caries. Researchers during the last 5–6 years have proved that life-long impact and accumulation of fluorides cause changes in the DNA-structure, cancer, etc.

The various methods used for defluoridation include adsorption, ion exchange, precipitation and electro dialysis. Out of all these methods adopted for defluoridation, adsorption is most commonly and extensively used method for defluoridation. The adsorption method is low costing. The method is used widely due to wide range of adsorbents available. One of such waste products i.e. lime is used to explore the possibility of its utility for adsorption.

2. MATERIALS AND METHODS

2.1. Materials:

The raw material required is locally available. The lime was collected from the shop directly. The reagent used is acid- zirconyl SPADNS for spectrophotometric determination of fluoride.

2.2. Samples:

The water sample was prepared synthetically by using the stock solution. The stock solution for fluoride was prepared by dissolving 221mg anhydrous sodium fluoride in 1000ml distilled water.

2.3. Method:

The material was treated with chemicals as a pretreatment. To obtain the powder form, the material was crushed to required size. The experimentation was carried out by batch study. The 25 ml of sample was taken in 100ml volume flask. The water sample has initial concentration of 3mg/l. After adding of the adsorbents, the mixture was mixed thoroughly. After roughly 2

min of settlement of adsorbents further testing of sample was carried out. Out of the treated samples, 10ml was taken separately and 2ml of SPADNS reagent was added and absorbance level for fluoride was checked using spectrophotometer.

Similar experimentation was done by varying the parameters like contact time, dose of adsorbents and pH. Contact time was varied at 15min intervals each starting from 30minutes to 120 minutes. Similarily, dose were varied from 4, 8, 12, 16 and 20g/l and pH was checked over a range 4 to 9.

3. RESULTS AND DISCUSSION:

3.1. Effect of variation of Contact Time:

The contact time for the materials was varied from 30, 45, 60, 75, 90, 105 and 120 minutes. The interval was kept 15minutes between two consecutive readings to get uniform curves. It was noticed that as the contact time increases, the adsorption or the removal efficiency of the adsorbents was increased significantly.

Table 1: Variation of Contact time

Sr no.	Contact Time (min)	% Removal of Lime
1	30	17
2	45	23
3	60	47
4	75	52
5	90	77
6	105	80
7	120	85

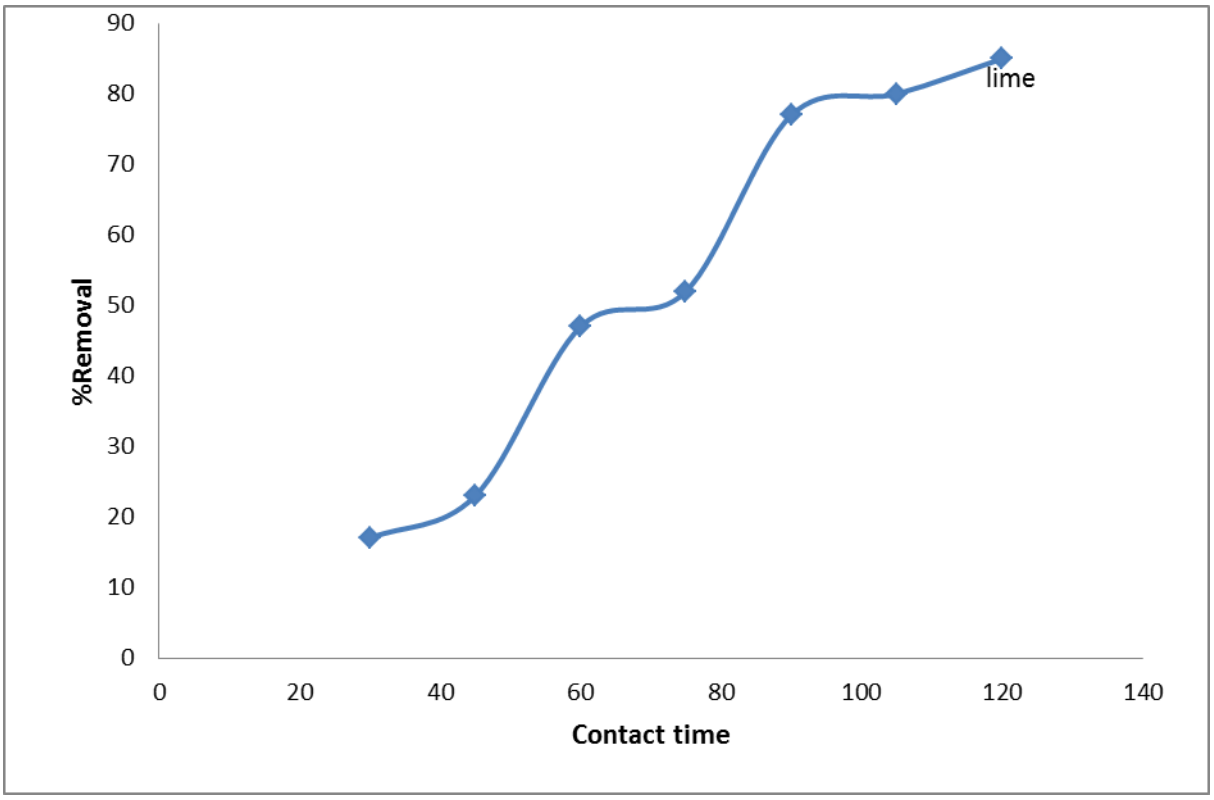

Fig1. Contact time Vs % Removal

3.2. Effect of variation of Dose of Adsorbents:

The adsorbance capacity increases with the increase in dosage. The initial concentration of fluoride in the sample was kept 3 mg/l. The dose of adsorbents was varied from 4, 8, 12, 16 and 20 g/l.

Table 2: Variation of Dose of Adsorbents

Sr no.	Dose of Adsorbent (g/l)	% Removal Lime
1	4	40
2	8	50
3	12	53
4	16	65
5	20	68

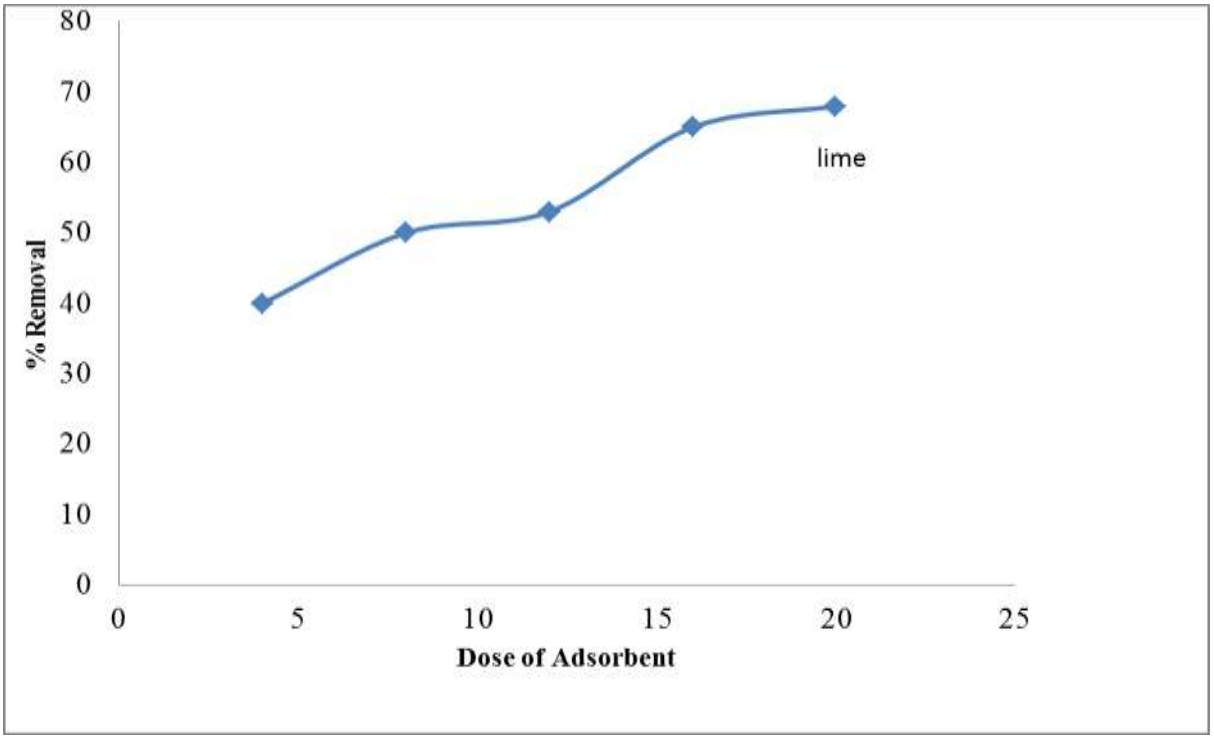

Fig2: Dose of adsorbents Vs % Removal

3.3 Effect of variation of pH:

The pH influences the adsorbance capacities of the materials. Different capacities are shown by materials at different pH.

Table 3: Variation of pH

Sr no.	pH	% Removal Lime
1	4	60
2	6	64
3	8	68
4	9	48

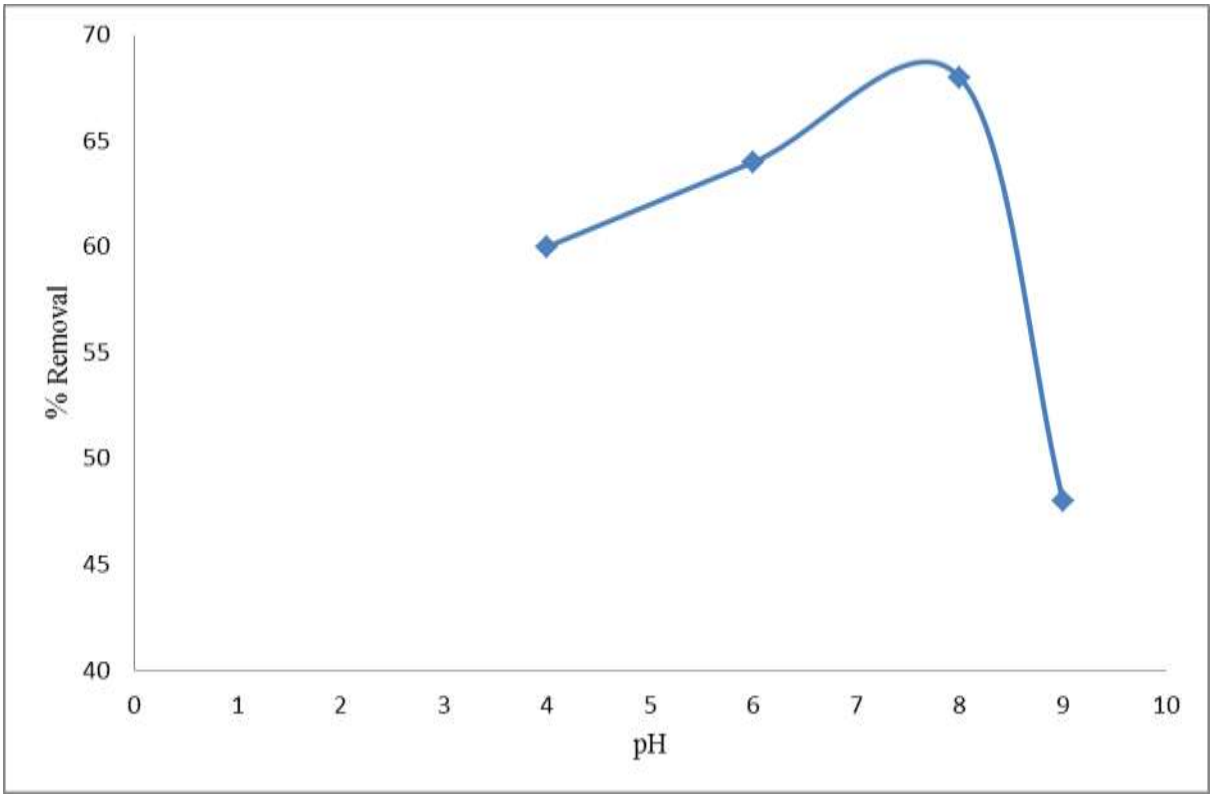

Fig 3: pH Vs % Removal

4. CONCLUSION

Lime is found to be effective in removal of fluoride. The removal percentage for fluoride was found to be different for different condition. The pH 4 is found optimum for fluoride removal.

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