ORIGINAL RESEARCH PAPER

Engineering

REMOVAL OF FLOURIDE USING LOW COST TECHNIQUE

KEY WORDS: Sugarcane bagasse, Neem Leaf, Adsorbent, and Low cost technique etc…

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ABSTRACT

The present study concentrates on use of low cost materials like sugarcane bagasse and neem leaf as adsorbents to remove fluoride from water. Various batch studies were conducted by varying the adsorbent concentration and contact time to remove fluoride from the prepared synthetic water. It was found during the studies that fluoride removal was maximum for sugarcane bagasse adsorbent with an efficiency of 55.36%, 55.96% and 56.15% where as for neem leaf adsorbent, the maximum fluoride removal efficiency was found to be 40.75%,44.60% and 47.92% for adsorbent dosage of 2 mg/l 5mg/l and 10mg/l respectively. The comparative studies showed that the sugarcane bagasse adsorbent was more effective then neem leaf adsorbent in the removal of fluoride from water.

INTRODUCTION

Fluoride is considered as double edged sword because it causes problems if it is not present within the desired range. Hence the removal of excess fluoride from drinking water is necessary. Even though some methods available but are costly, as a consequence of this, there is a need to develop an alternative method and economical method to remove fluoride from drinking water.

Fluoride is an ionic compound derived from fluoride, which is the single most reactive element, it is naturally found in many rocks. The concentration of fluoride in public water supplies should be about 1 parts per million to 1.5 parts per million (1 to 1.5 ppm) according to Indian standards. Usually fluoride concentration in the water depends upon the locality but in normal surface water fluoride concentration is about 0.3ppm which do not have any effect on human health if consumed. Ground water may contain much higher levels of fluoride concentration due to presence of minerals like horn blende and biotite, however excess fluoride concentration causes severe effects in human body. In this project adsorption technique is used to bring down the fluoride concentration to its standard limits. The present study includes use of natural low-cost adsorbents like neem leaf powder and sugarcane bagasse.

1.1OBJECTIVES

1. To reduce fluoride concentration in water using neem leaf and sugarcane bagasse.
2. To use naturally available low cost adsorbents effectively.
3. To study and compare the adsorbents based on their performance and efficiency.

2. Preparation of Adsorbents.

At first the stock solution containing fluoride was prepared by dissolving 221 mg of anhydrous sodium fluoride in 1000 ml distilled water. By using this stock solution, the required standard solutions were prepared by further dilution. To get a concentration of 2mg/l, 2 ml of stock solution was diluted to 100 ml of distilled water, similarly 5 mg/l standard solution was prepared on which the test was conducted.

2.1 Preparation of Neem leaf adsorbent.

The neem leaves collected were initially dust freed and washed to remove the impurities. Then it was sundried for 3- 4 days to remove the moisture content. Then the leaves were oven dried for 24 hours with the temperature of 60 to 70°C maintained throughout the drying process. After the completion of drying process, the material was mechanically crushed and sieved in 150µ sieve to get uniform size. Then the sieved material is washed using distilled water to remove the impurities and at last it is dried at a room temperature to remove the moisture content. Finally activated carbon is ready to use for removal of fluoride.

Fig: 1 Preparation of Neem Leaf Adsorbent

2.2 Preparation of Sugarcane bagasse adsorbent.

After collecting the waste sugarcane bagasse, it was washed using distilled water for 2 to 3 times to remove the impurities. The washed bagasse was sundried for 24 hours to remove the moisture content. Then the sundried bagasse was taken into laboratory and it was soaked into concentrated sulphuric acid of 0.05normality for 2 hours to oxidize the organic substances present in the bagasse. Then it was air dried for 24 hours and then kept into oven at 250°C for 60 minutes from which burnt carbon material was obtained which was further soaked in 1% sodium bicarbonate solution for 24 hours to remove the excess acid content present in the burnt carbon material. Then the sodium bicarbonate is separated from the powdered carbon using filter paper. Then the powder is dried in oven for 12 hours at 130°C and at last the activated carbon was obtained which was sieved in 150µ sieve to get the uniform size particles.

Fig: 2 Preparation of Sugarcane Adsorbent

2.3 Experimental Analysis:

1. Once after the preparation of adsorbent, the required concentration of fluoride water (2mg/l, 5mg/l) was prepared.
2. Synthetic water was taken in three different conical flasks in which 2 gm/l, 5gm/l and 10gm/l of adsorbent was added

respectively and mixed thoroughly.
3. Fluoride concentration was kept constant in each beaker while conducting the experiment.
4. All the flasks were left for 15 minutes undisturbed for the adsorption process to take place.
5. At every 15 minutes time interval the sample was collected from the three flasks and the synthetic water was separated from the adsorbent by using Whatman filter paper.
6. This process of sample collection and filtration was carried out at every 15 minutes interval up to 60 minutes.
7. The process was repeated by varying the fluoride concentration of synthetic water and at last the results were compared.

Fig: 3 Filtration Process after Adsorption process.

3. RESULTS

The main objective of this project was to remove the fluoride content from the synthetic water which was prepared in the laboratory; the adsorption technique was used to remove the fluoride. The low-cost adsorbents such as sugarcane bagasse and neem leaf were used. The experiments were conducted using the natural adsorbents. Adsorption technique has been used to reduce the concentration of fluoride efficiently.

In this section the results obtained from both the adsorbents are compared so that the more efficient adsorbent can be commercialized for the removal of fluoride from the water.

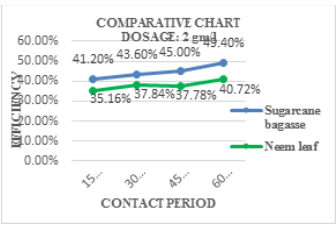

Chart 1: Efficiency vs. contact period

The chart -1 represents the comparative results of sugarcane bagasse and neem leaf adsorbents The dosage of adsorbent being 2 gm/l, it is observed that the efficiency of the sugarcane bagasse adsorbent in removal of fluoride is more with a maximum efficiency of 49.40% compared to the neem leaf adsorbent with maximum efficiency of 40.72%.

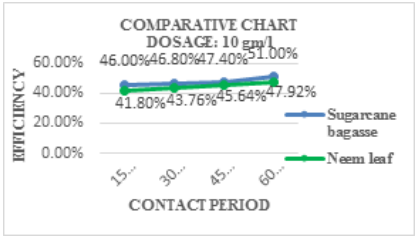

Chart 2: Efficiency vs. contact period

The Chart -2 represents the comparative results of sugarcane bagasse and neem leaf adsorbents. The dosage of adsorbent being 5 gm/l, it is observed that the efficiency of the sugarcane bagasse adsorbent in removal of fluoride is more with a maximum efficiency of 50.20% compared to the neem leaf adsorbent with maximum efficiency of 43.36%.

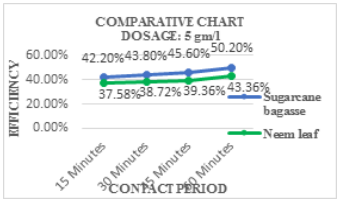

Chart 3: Efficiency vs. contact period

The chart 3 represents the comparative results of sugarcane bagasse and neem leaf adsorbents. The dosage of adsorbent being 5 gm/l, it is observed that the efficiency of the sugarcane bagasse adsorbent in removal of fluoride is more with a maximum efficiency of 50.20% compared to the neem leaf adsorbent with maximum efficiency of 43.36%.

4. CONCLUSIONS

1. The fluoride removal was done using low cost adsorbents like sugarcane bagasse and neem leaf.
2. Since sugarcane bagasse and neem leaf are easily available can be used as adsorbents for fluoride removal.
3. It was found during the studies that fluoride removal was maximum for sugarcane bagasse adsorbent with an efficiency of 55.36% where as for neem leaf adsorbent, the maximum fluoride removal efficiency was found to be 40.75% for adsorbent dosage of 2 mg/l.
4. It was found during the studies that fluoride removal was maximum for sugarcane bagasse adsorbent with an efficiency of 55.96% whereas for neem leaf adsorbent, the maximum fluoride removal efficiency was found to be 44.60% for adsorbent dosage of 5 mg/l.
5. It was found during the studies that fluoride removal was maximum for sugarcane bagasse adsorbent with an efficiency of 56.15% whereas for neem leaf adsorbent, the maximum fluoride removal efficiency was found to be 47.92% for adsorbent dosage of 10 mg/l.
6. Comparing both the adsorbents, it was found that sugarcane bagasse was more efficient in removal of fluoride from the water.
7. It was observed during the experiments that the fluoride removal increased as the contact period and adsorbent dosage increased.

5.REFERENCES

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