

# Assessment of Defluoridation of Water using Mosambi Peel Powder as Adsorbent

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**Abstract:** Fluoride contamination in ground water is one of the serious problem in world. Higher dose of fluoride in drinking water casues fluorosis. So removal of fluoride from water is necessary. Present study deals with removal of fluoride by using mosambi peel as adsorbent. Effect of various parameters like effect of contact time, effect of initial fluoride concentration, effect of adsorbent dose has been studied.

**Keywords:** Adsorbent, fluoride, mosambi peel.

## INTRODUCTION:

Water is required for all forms of life. Safe Drinking water is very important for every human being. Pure water is not available at all. It is observed that most of the diseases in world are due to poor quality of drinking water. Pollution of water occurs when substances that will alter the water in negative way are discharged in it. Water pollutants can be organic or may be Inorganic. Organic water pollutants include Detergents, Disinfection by products, Food processing waste, insecticides and pesticides, petroleum hydrocarbons etc. Inorganic water pollutants include Ammonia from food processing waste, chemical waste as industrial by products, fertilizer containing nitrate and phosphate, heavy metals from motor vehicles. Even in very low concentration, these chemicals may be toxic to aquatic life as well as terrestrial life. Therefore, treatment of these toxic material is required before its discharge. Fluoride is the major inorganic pollutant of natural origin found in ground water. Fluoride contamination in ground water is one of serious problem in world [1]. Larger contributor of fluoride is Drinking water [2]. Fluoride is a naturally occurring compound derived from fluorine, 13th most abundant element on earth. It is found in rocks, soil and fresh water. Fluoride comes in water due to weathering of fluoride containing rocks and soils and leaching from the soil into ground water. Fluoride enters into ground water due to dissolution from minerals/rocks like topaz, fluorite, fluorspar, cryolite, fluorapatite etc. [3]. Fluoride is physiologically more active ion. Salts of fluorides with monovalent cation i.e. NaF & KF are water soluble. But if fluoride make salts with divalent cation such as CaF<sub>2</sub> are insoluble in water. For Human metabolism fluoride is significant element [4].

## Health Impacts of fluoride:

**As per standards permissible limit of fluoride in drinking water is 1.5 ppm.** Beyond this it is harmful and not suitable [7]. Fluoride in drinking water has a profound effect on teeth and bones. Up to a small level (1–1.5 mg/L) this strengthens the enamel of teeth. **If range of fluoride is 1.5–4 mg/l it will results in dental fluorosis.** In dental fluorosis there are many changes in enamel [8] causing degrees of intrinsic tooth discoloration and, damage the physical structure of teeth. In the mild fluorosis there are mottled patches on half of surface of teeth and in moderate fluorosis all of the surfaces of the teeth are mottled and teeth may be ground down and brown stains appear on teeth. In severe fluorosis there is wide spreading of brown stains and pitting in teeth. High risk of fluorosis is from 6 years old age because after that permanent teeth would have undergone complete development and therefore their susceptibility to fluorosis is greatly reduced [9] and **if fluoride concentration is (4–10 mg/L), it progresses to skeletal fluorosis** [10]. In this case the bone is hardened and thus less elastic, resulting in an increased frequency of fractures. Other symptoms include thickening of the bone structure and accumulation of bone tissue, which both contribute to impaired joint mobility [11].

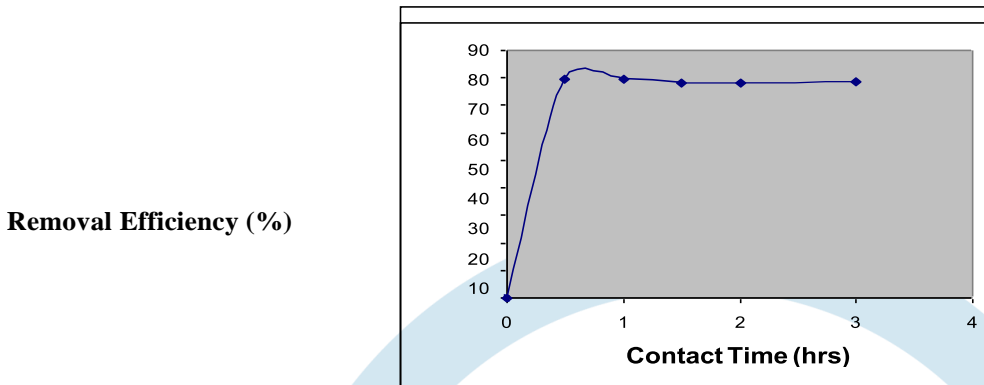
## 2. EXPERIMENTATION:

- 1. Preparation of Adsorbent:** Peels of Mosambi were collected from local area. Washed them with distilled water and laid flat on clean table to dry. Dry peels were grounded with grinder. After grounded, the peel powders were sieved and stored in plastic bags for further use.
- 2. Preparation of Adsorbate:** A fluoride stock solution of 100 mg/L was prepared by dissolving 0.221g of sodium fluoride in 1 L of double distilled water at room temp. The solution was diluted as required to obtain working solution. Fresh solution were used for each study.
- 3. Adsorption experiment:** All experiment were done out in Batch mode. In the Batch adsorption process, fluoride solution of known concentration were agitated with peel powder in a mechanical shaker till equilibrium was achieved. This study included the influence of various parameters like adsorbent dose, pH, Contact time and initial fluoride concentration. At the end of experiment,

sample was filtered through Whatman no. 42 filter paper. using UV-Spectrophotometer [13].

### 3. RESULTS AND DISCUSSION:

i. **Effect of contact time:** The effect of contact time on fluoride biosorption on mosambi peel powder is shown below.

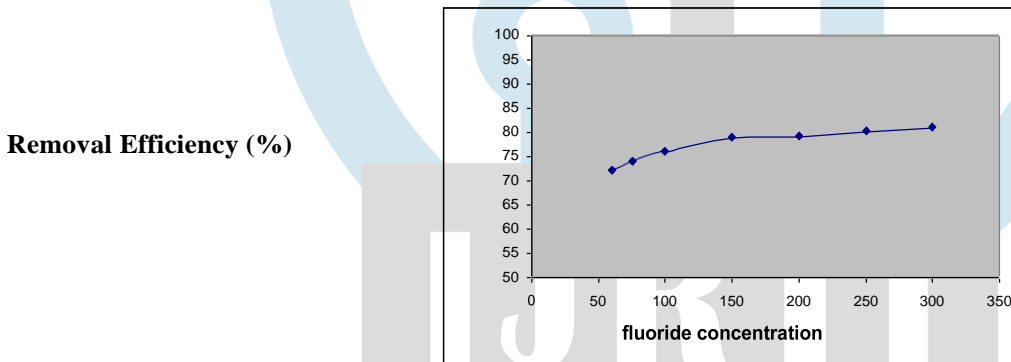


**Figure.1. Effect of contact time on the %age removal of fluoride**

The highest efficiency of nearly 72 % was observed for contact time of 0.5 h; however the removal efficiency for contact time of 1h was also nearly the same.

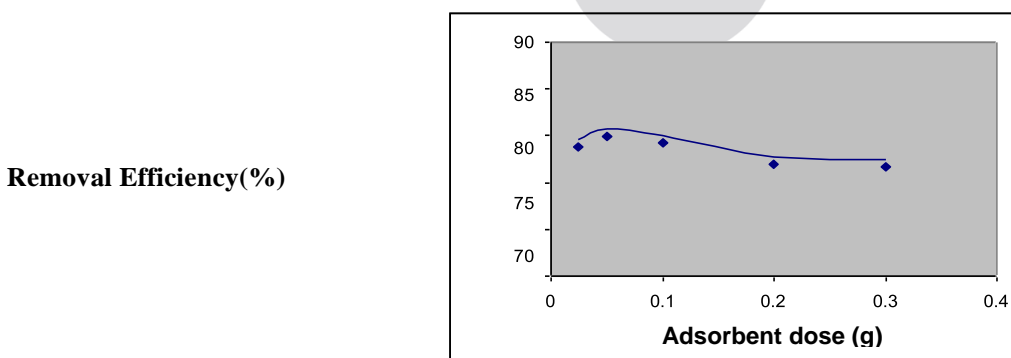
The removal efficiency for contact time of 1.5, 2, 3 hours were nearly same and equal to 71% approximately. Hence Contact time of 0.5 h was selected as optimum contact time and used for all the other experiments.

**II. Effect of fluoride concentration :** The nitrate removal efficiency of Mosambi peel increased with increase in initial fluoride concentration. The increase in removal efficiency is a result of increase in fluoride ions in the solution which compete and adsorb to most of the sites present on the adsorbent.



**Figure.2. Effect of initial fluoride concentration on adsorption**

**III. Effect of adsorbent dose :** The percentage removal of fluoride ion increases with increases in mosambi peel doses from 0.2 g to 1.2 g. After certain dose of bioadsorbent, the maximum adsorption is attained and hence the amount of ions remain constant even with further addition of dose of adsorbent. The increase in fluoride removal %age with increase in adsorbent dose is due to the greater availability of exchangeable sites at higher conc. of adsorbent.



**Figure.3. Effect of adsorbent dose on the %age removal of fluoride**

## IV. CONCLUSION:

The contamination of fluoride in water is profound and emerging technologies are required for removal of it. The present study shows that mosambi peel can act as an efficient Biosorbent in removal of fluoride from water. The effect of different parameters like contact time, adsorbent dosage, fluoride concentration was studied. The removal efficiency of nearly 71% was achieved when 0.05g of mosambi peel powder of 106  $\mu\text{m}$  size fraction was used as adsorbent to treat 100 ml of water sample of 200 mg/l fluoride concentration for a contact time of 0.5h. Further study of effect of parameters like pH, temperature and effect of different pre-treatment methods of adsorbent would help to increase the efficiency of nitrate removal and enhance the applicability of mosambi peel as a biosorbent.

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