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Filtration of Fluoride and Iron from Drinking Water: A Critical Appraisal

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Abstract: The WHO limit of groundwater containing Fluoride content in groundwater is 1.5mg/l, excess of Fluoride resulting tooth's and bones diseases. In India, many states have problem of excess fluoride and Iron excess in drinking water is one of the major impurities and filtration of iron is biggest problem reportedly, we are trying to give main points all the reported till now for the filtration of fluoride and Iron present in ground water.

Keywords

Fluoride, water purification, filtration, oxidation, defluorination, absorbent.

1. Introduction: -

Fluoride exists mainly as fluorospar, cryolite, etc. Fluorescent to rocks and attention like cripolite to igneous rocks exist. These sources of fluoride are almost insoluble in water. (Mohapatra et al. 2009). Therefore, fluoride will be present in the water beneath the earth and also released in the water industry. Fluoride water and drinking is dangerous for health. The fluoride displacement of the hydroxide protons from idrossipatite, the main source source component of teeth and bones, makes fluorapatiti difficult and difficult to form.

(Czarnowski et al., 1996; Azbar and Turkmen names, 2000; Wang et al., 2002; . long-term exposure (Dissanayake, 1991) high concentrations of fluoride, dental fluorosis leads to avian fluworjo. According to the World Health Organization, fluoride was therefore considered to have positive concentrations of 0.7 mg /l. However, when the concentration is 1.5 mg /l, it is as harmful as (WHO, 1985; Smet, 1990). High fluoride concentration in the biggest concern of Rajasthan today. The region of Nagaur is gone. is most affected by fluoride. (Ground Water Book Rajasthan 2016-17).

Iron is one of the most precious metals in the cross of the world. It occurs naturally in water and soluble fluids such as ferrous Fe (II) iron or as multipart as ferric iron Fe (III) iron. Iron can enter the water through industry, rust, mining, etc. (Ghosh et al., 2008)

Excessive iron content in drinking water and water supply causes problems such as redness and odor. Iron removal is one of the most important topics in water treatment. (Yeon et al., 2005) Excessive iron has a taste, intensity and distortion. This may be due to the presence of hot iron in the water or due to impurities in

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the hardness or iron content of the iron. Iron consumption in cold water is typically between 0 and 50 mg/l (WHO 1984). During the drought, the rain dwells in the water, collecting iron from rocks and minerals. The amount of iron added depends on the acidity of the water and the decrease in oxygen content. More acid and oxygen levels cause more damage. Depending on the species and size, a person may experience a metallic and reddish-brown taste. In addition, more than 0.3 mg / L absorbs iron soils and coatings (Colvin et al., 2011). Some bacteria evolve from large iron mines that can use their intestines as their home, and even when the tube is closed, the population grows and can cause injury. If water is found in the water, an irregularity can occur. The following chemical reactions show that iron bicarbonate forms iron acids with water and oxygen. These packs are insoluble and accumulate to block pipelines (Colvin et al., 2011).

$$4Fe(HCO_3)_2 + 2H_2O + O_2 \rightarrow 4Fe(OH)_3 + 8CO_2$$

Low iron intake is a great complement to our health and a proper diet. Generally, the recommended dose ranges from 10 to 50 mg/l, depending on the dosage, gender and physiological parameters. (Colvin et al, 2011).

For this reason, holding water is not harmful to our health. Water treatment methods use many methods to remove iron. It is often associated with acid rain / oxyhydroxide, and is associated with poor acidity and paralysis due to the strong oxidative stress of fatty acids. iron. These activities are particularly interesting (Credit, et al., 2006). Iron deficiency is common because gelatin is so difficult to use and difficult to analyze. The World Health Organization (WHO) has prescribed 0.3 mg / l of iron in drinking water. There are many ways to remove iron from drinking water, such as contact with soft water, carbon dioxide and other filtering devices, which reduce their solubility, acidity and oxygen. alcohol and ash using aerated and adsorbent analysis (Tahir and Rauf 2004) Classification and separation are the most common methods for extracting iron from water in the system. However, water supply at the construction level may not be possible. Knowledge and tradition are sometimes important indicators of solving a problem (Mahanta et al., 2004). Assam is one of the most polluted water in India and cannot be treated with purified water, so the citizens of Assam carry out iron purification and ash and water purification exams using various wood ash. (Houben et al, 2003; Komnitsas et al, 2004.)

According to Ground water year book 2016-17 (Rajasthan state) About 35.12% of samples have iron value yonder the allowable limit of 1.0 mg/L & 64.88% samples are insideTolerable limit of 0.3 mg/L. Dungarpur & Rajsamand are nastiest exaggerated districts where 75.00% & 65.00% samples have Iron value pasttolerable limit respectively. Minimum value of iron as 0.0 mg/L has been observed at in Hasanpur in Alwar district and maximum value of 13.08 mg/l at Deeg in Bharatpur district. (Ground water book Rajasthan 2016-17)

2. Methods of defluorination from aqueous solutions

2.1 Membrane techniques

Briefly, the following sections describe the membrane processes involved in nano-filtering and reverse osmosis.

R.O method;-

R.O. method clean the raw water to a greater extent. Few usages of R.O. method was discussed in (Schneider and Middlebrooks 1983; Arora et al. 2004, Ndiaye et al.) deliberate fluoride elimination of diverse effluents using RO technique. The observation was that fluoride ion decline typically exceeded 98%, given that the RO membrane was completely after each series of experiments. Nano-filtration works according to the R.O. general phenomenon. The membranes of nano- filtration are bigger than that of R.O. membranes hence they are more porous and provide lesser resistance to the passage of dissolved substances and solvents. As a result, the required pressures are lower, the energy requirements are also lower, the removal of dissolved substances comparatively very low , and the filtrations rate is more than R.O membranes

2.2. Adsorption technique
The membranous methods have been workable abridged the concentration of fluorine to an imperative extent, the surface adsorption is the main spot of flow and flow studies due to its improved obtainability and lowcost. Thus, inlast few decades, as interest in other methods of fluoride flow increased rapidly, many scientists continued to study the development of cheap and effective adsorbents. (Biswas et al., 2007).

2.2.1 Alumina and aluminium based adsorbents

2.2.1.1. Alumina plus manganese dioxide.

(Maliyekkalet al. 2006) It was founded that new alumina coated with oxide manganese was able to reduce the water level by allowing 1.5 mg / l, for drinking water and was more active than the active average and had increased fluoride production. 2.85 mg/g compared to 1.08 mg/g for modified alumina. (Tripathi and Raichur 2008).

2.2.1.2. Alumina as primary adsorbent

In past studies and experiments (Farrah et al. 1987) studied the reactions of ion fluoride with free aluminum hydroxide (Al $(OH)_3$), gibsite (which takes place aluminum hydroxide) and aluminum oxide (Al_2O_3) at pH 3 to 8 with a concentration of fluoride from 1.9 to 19 mg /L. At pH <6.To be an effectible contaminant, alumina has to be activated before being used for heating. This usually involves preparation by pyrolysis on the gibsite, Al $(OH)_3$ or slowly containing a gibsite, which results in a large crystallineproduct at very large amount of heat energy very quickly.(Rozic et al., 2001, 2006).

2.3 Carbon
The three most famous carbon allotropes are diamond, graphite and fullerene. Diamond is not related to fluorine adsorption, but graphite and fullerene can be good adsorbents with proper processing and addition.

2.4 Graphite
(Abe et al. 2004) have deliberate the fluoride acceptance capacity of various carbon-based adsorbents in the order bone char > coal charcoal > wood charcoal > carbon black - > petroleum coke. (Bhargava and Killedar 1992) stated the fluoride adsorption on fishbone charcoal over a stirring media absorber. (Daifullah et al. 2007) fluorine adsorption on activated rice straw was investigated, which leads to the production of an activated product of low density and high porosity. Activated carbon from rice straw with strong oxidizing agents, nitric acid and

potassium permanganate, etc. We have treated. This effect was more effective when activation was carried out at extremely high temperatures than at lower temperatures of activated carbon atoms. The effect of permanganate was maximal, followed by nitric acid.

2.5 Synthetic resins

Synthetic resins are materials with the property of interest that is similar to natural plant resin;in this method ion exchange resins (RSO3H) is changed RNA by treating with NaCl ion. However, (Ku et al. 2002) have noted that +ion-exchange resins are resistance toinclusion than -ion-exchange resins. (Lopez et al. 1992) made alike explanations, verdict that on Amberlite IRA-410 anionic resin the order of selectivity was sulphate, chloride, bicarbonate, hydroxide, fluoride.

2.6. Alumina-impregnated graphitic carbon.

(Ramos et al., 1999) stated that thealumina-impregnated activated carbons adsorb the fluoride from an aqueous solution made by stirring up an aluminum nitrate solution at a fixed pH, followed by calcination under nitrogen at temperatures >= 300 C (Ramos et al., 1999). It has been shown that the adsorption process of fluorine on soluble carbon is responsible for the pH of the impregnating solution and the calculus temperature. Concentrated carbon has been shown to have greater fluoride heating capacity than conventional activated carbon. With the increase in calcium temperature from 300 to 1000 ° C, fluorine intake decreased.

Methods of removal of iron

3.1. Oxidation/filtration method

Many iron purification systems use oxidation processes. Oxidant chemically oxidizes iron and kills iron bacteria and bacteria that can cause other diseases. Filter removes iron content. Oxidation and filtration are simple processes. To determine the correct amount of oxidizing agent, it is necessary to check the source water and the treated water to verify that the oxidation process has been successful. (Vigneswaran el al. 1995).

3.1.1 Oxidation

Before metal can be evaporated, it is important to use its chemicals in a state where it can produce volatile compounds. Oxidation involves the transfer of electrons to electrons or other chemicals. It is made of iron soils (Fe^{2+}) and is made of cast iron soils (Fe^{3+}), which form the iron oxide insoluble $Fe(OH)_3$ (Vigneswaran el al. 1995). The most common chemical oxidants in water treatment are chlorine, chlorine dioxide, potassium permanganate, etc. The dosage is relatively easy, requires simple equipment and is reasonably priced (Vigneswaran et al. 1995; Robinson et al, 1998).

3. 1.2 Removal of iron by Manganese Dioxide

There are several methods for removing iron, and all the methods are mainly based on the principle of oxidation of iron. Manganese filters contain MnO2, which releases oxygen and the iron is present reacts with oxygen to form a compound which has got into the filter layer**.** (Ellis et al, 2000). As the oxygen content in the filter unit decreases, a feeble solution of potassium permanganate, between 60 and 120 ml per 28 liters of water, helps to oxidize, hydrogen sulfide, iron and manganese.

and facilitates the process and intensification of rainfall.(Chaturvedi and Dave, 2012).Because these chemicals come into contact with manganese, a chemical reaction occurs, which results in the removal of sulfur and iron along with other chemicals.

3.2. Granular activated carbon

Granular activated carbon (GAC) was used to remove organic ingredients, residual disinfectants, iron and manganese in water. It not only improves taste and reduces health risks; This protects other water purifiers, such as reserve osmosis membranes and ion exchange resins, which can be damaged by organic dirt or oxidation. (Chaturvedi and Dave, 2012). Activated carbon is an effective water treatment method because of its multifunctional nature and because it has no adverse effect on the treated water. Most activated carbon is made from raw materials such as wood, coal and oil. (DeSilva, 2000).High carbohydrate is a very attractive indicator because of its low absorption rate. One gram of carbon has an area of 1000 m2. This large space provides a large number of pollutant molecules. The ability of carbon dioxide to absorb natural sugars is related to the quality of the molecule, the total area of carbon dioxide, and the concentration of pollutants in effluent water.

3.3 Pebbles and Sand Filter

Sand and gravel are natural glacial products. High levels of chemicals - silica and calcium, magnesium and iron oxide - meet industry standards. These products are widely used and are used in terms of quality, color, value of the substance and the value of the specific substance. The sand filter is specially designed for water supply companies. It can be used for filters in municipal, industrial, or residential areas (Chaturvedi and Dave, 2012).

3.4.*Aerated granular filter*

Generally, iron ferrous soluble in iron is converted into insoluble iron before removal. There are many ways to remove iron. Laboratory experiments focused on the removal of artificial raw water from an artificial filter (Kenzi and Kanzakal, 1987) using anthracite as a filter medium. There are significant reports that iron oxidation and air filter removal are primarily a catalytic reaction rather than an organic reaction (Cho et al., 2005). Removing ventilated iron does not work effectively. Iron removal was very effective when the pH was slightly acidic. Iron oxide attached to the surface of the medium is a ferrihydrite (Murad and Schwertmann, 1980; Johnston and Lewis, 1983), which catalyzes the oxide of iron.

4. Conclusion

However, a brief description of the evolution of fluoride and iron from drinking water. The fluoride removal techniques include adsorption and membrane techniques. They have been used in reverse osmosis, nanofiltration, alumina filters, carbon and GRAPHITE techniques and synthetic resins. All of these techniques are in place of the current ones used. Iron is one of the greater components of the earth and the planet. Underground water can be damaged by iron. Iron is an important source for the human body, but the water above the level of the soil Water under soil is essentially unobservable in visions want viscosity, stain, disturbed taste, aromas, restlessness, washing and staining. For good drinking water to people, acceptance by humans is necessary. Therefore, effective but powerful technologies of the public and needs (small towns and cities) are needed are identified or categorized by their low income. Based on the review of the work and the results of some experiments, we conclude that the oxidized / waste process in rural areas is more appropriate. Although introduced without power, a number of machineries drinking water is harmful, not rigid or valuable.

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