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A Review of Study and Analysis of Fluoride Contamination in Drinking Water with Health Risk Assessment

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ABSTRACT -

Drinking water is the largest contributor to daily fluoride intake. The dissolution of fluorine-containing rock minerals is a natural source of fluorides in groundwater, while the use of phosphate fertilizers, sewage sludge, or pesticides is the artificial source of fluoride in groundwater and surface water. Fluoride concentrations that exceed the standards cause fluorosis of the teeth and skeleton. Fluoride toxicity can also cause non-skeletal conditions such as joint aches and pains, non-ulcer dyspepsia, polyuria (tendency to urinate frequently), polydipsia (excessive urges), muscle weakness, fatigue, and anemia with low hemoglobin levels.

Keywords- Groundwater, Fluoride, Dental Fluorosis, Skeletal Fluorosis,

1. INTRODUCTION

Many researchers have used various types of cheap and effective adsorption media like clay, industrial solid waste like red clay, use bleaching soil, used catalysts and fly ash, activated alumina, carbonaceous materials, bone coal, natural zeolite and synthetics, etc. article provides a review focusing on the sources of fluorine in drinking water, their health effects, and various control measures.

Water is an essential resource for all life on this planet. Water covers more than 71% of the Earth's surface and is a very important natural resource for people. The earth is full of natural resources necessary for human development. Day by day the increasing demand has led to the development of new methods of water quality assessment and management.

Water is the primary means of human ingestion of fluoride. Fluoride in drinking water can be beneficial or harmful to health, depending on its concentration [1]. The presence of fluoride in drinking water within the permissible limits is useful in the calcification of tooth enamel. According to the World Health Organization (WHO), the maximum acceptable concentration of fluoride is 1.5 mg/L, the acceptable limit in South Africa is 0.75 mg/L, while the permissible limit for fluoride in drinking water in India is 1 mg/L. . Concentrations exceeding these parameters showed dental and skeletal fluorosis, as well as endocrine, thyroid and liver damage. Fluoride stimulates bone formation and small concentrations have beneficial effects on teeth, hardening enamel and reducing the incidence of caries. McDonagh et al. Describe in detail the role of fluoride in the prevention of fluorosis [2]. At low levels (<2ppm) soluble fluoride in drinking water can cause enamel staining during tooth formation, but at higher levels other toxic effects can be seen. Severe symptoms lead to death when fluoride doses reach 250-450 ppm. It turns out that the IQ of children in areas with a high content of fluoride (3.15 ppm fluoride in drinking water) is significantly lower.

Ingested fluorides are rapidly absorbed in the gastrointestinal tract, 35-48% is retained in the body, mainly in skeletal and calcified tissues, the rest is largely excreted in the urine. Chronic ingestion of fluoride-rich feed and water in endemic areas leads to the development of fluorosis in animals, for example. Tooth discoloration, difficulty chewing, bone lesions, lameness, weakness and death. In addition to the health effects, dental fluorosis can have both social and psychological consequences [3]. There has been an escalation of daily fluoride intake across the total human food and beverage chain, with the potential for this escalation to continue in the future. Soft drinks contain large amounts of fluoride. Beer brewed in places with high levels of fluoride in water can contribute significantly to your daily fluoride intake, and sweetened iced teas contain significant amounts of fluoride [4].

One serving of chicken fingers will provide about half of the child's safe upper limit for fluoride. Children's intake of fluoride from juices and flavored drinks can be a significant factor in the development of fluorosis. Pura and Dai reported that a large number of the population in India is severely affected by fluorosis. More than 15 states are affected by endemic fluorosis in India. This article states that different fluoride concentrations affect human health [5].

2. SOURCES OF FLUORIDE

The world's soil fluoride reserves are estimated at 85 million tons. The most common fluorine-containing minerals that are a natural source of fluoride in drinking water are fluorite, apatite, rock phosphate, and topaz. Theotheia et al. It was reported that low hardness of calcium and magnesium and high alkalinity are characteristic in most of the drinking water samples. With increasing concentrations of fluoride in drinking water, the hardness of calcium and magnesium decreases and the alkalinity increases. According to epidemiological surveys on endemic skeletal fluorosis, the toxic effects of fluoride on bones and teeth are more pronounced and severe in individuals who drink water with high alkalinity and low hardness of calcium and magnesium (soft water). The hardness of calcium and magnesium in water appears to inhibit fluoride toxicity.

3. HEALTH EFFECTS OF FLUORIDE

Dental fluorosis, which is characterized by misshapen, misshapen, spotted or chalky teeth, is a clear indication of excessive fluoride exposure during childhood, when teeth were developing. These effects do not appear if the teeth have fully grown before the excessive exposure to fluoride; therefore, the fact that an adult does not show signs of dental fluorosis does not necessarily mean that their fluoride intake is within safe limits.

When tea is widely consumed as sweet and strong and consumed from a very young age when put into baby bottles, it causes dental fluorosis.

Chronic excessive fluoride intake can lead to severe and permanent deformities of the bones and joints called skeletal fluorosis. Early symptoms include intermittent pain and stiffness in the joints: headaches, stomach aches, and muscle weakness can also be warning signs. The next stage is osteosclerosis (hardening and calcification of the bones) and finally damage to the spine, major joints, muscles and nervous system. Whether it is dental or skeletal, fluorosis is irreversible and there is no cure. The only treatment is prevention, and keeping fluoride intake within safe limits. Research conducted by various researchers over the past five to six years has proven that the persistent effect and accumulation of fluorides not only cause damage to the human skeleton and teeth, but also lead to changes in DNA structure, will paralysis, cancer, etc.

4. MATERIALS AND METHODS

Water samples from selected sites, namely Adhartal Lake (L1), Madhotal Lake (L2) and Ranital Lake (L3) were collected in 3 L plastic vials that were pre-cleaned and rinsed with perchloric acid and distilled water used for sample collection. Samples were analyzed immediately for parameters, which must be determined immediately, and the rest of the samples were cooled at 400 °C for further analysis. In this method, fluoride ions react with the compound alizarin and lanthanum (III) to form a violet compound that is photodetermined by the instrument. The pH was estimated using a portable digital system (Systronics pH 361). Data showing the relationship between severity of fluorosis and fluoride concentrations were extracted from fluorosis mapping exercises and water quality control exercises. The average fluoride concentrations in drinking water corresponding to different degrees of severity of fluorosis were also calculated.

5. FLUORIDE TREATMENT

Common techniques for removing fluorine from water include: coagulation followed by sedimentation, membrane processes, ion exchange, and adsorption. In coagulation, trace amounts of fluoride ions tend to remain in solution due to the restriction of solubility. Other shortcomings include the high pH of treated water and the generation of large quantities of wet sludge. The Nalgonda technique, based on precipitation processes, is also a common defluoridation technology.

Process limitations are: daily addition of chemicals, large amount of sludge production, low efficiency of water with high TDS content and hardness. In addition, an increase in aluminum residue was reported in the treated water. This could endanger human health, as

concentrations of aluminum, a neurotoxin, as low as 8.0 x 10-2 mg/L in drinking water have been linked to Alzheimer's disease. Although membrane processes are effective at removing fluoride, they completely remove minerals from the water, in addition to high upfront and maintenance costs. Ion exchange methods are effective for fluoride removal, but they are laborious and difficult to prepare resins, as well as high cost; Make it necessary to search for an alternative technology. Adsorption techniques are very popular in recent years due to their simplicity as well as the availability of a wide range of adsorbents.

Research has focused on different types of cheap and effective adsorption media such as various clays, industrial solid wastes such as red clay, dust used for bleaching, used catalysts and fly ash, activated alumina, carbonaceous materials, coal, natural zeolite and synthetics etc. - cost of adsorbents with varying degrees of success .

6. CONCLUSION

Rock minerals and waste disposal contribute to groundwater pollution with fluoride. Researchers looked at different concentrations of fluoride for different diseases. To mitigate fluoride contamination in the affected area, provision of safe, low-fluoride water from alternative sources should be verified as a first choice; otherwise, various methods developed for water defluoridation can be used to avoid fluoride contamination. Groundwater in a particular area must be thoroughly studied before it is used for domestic purposes, and thus a suitable method for its treatment can be chosen.

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