# Estimation of Fluoride Concentration Level in Coimbatore (TN)

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Running Title: Estimation of fluoride concentration level in Coimbatore (TN), India

Abstract: <u>Introduction</u>: The aim and objective of this study is to evaluate the fluoride concentration of drinking water that is available in Coimbatore. <u>Material and Method</u>: The fluoride concentration of drinking water collected from Pollachi is analysed. The F ion selective electrode method was used to measure the F concentration in the samples. The measurements were obtained for every sample to ensure reproducibility and appropriate statistical analyses were employed. <u>Results</u>: The fluoride content is compared with EPA and WHO guidelines of drinking water. <u>Conclusion</u>: Fluoride in water is usually of geologic origin. Waters with high levels of halide content square measure principally found at the foot of high mountains and in areas wherever the ocean has created geologic deposits. Intake of excess halide, most ordinarily in drinking-water, will cause pathology that affects the teeth. The management of drinking-water quality is thus crucial in preventing pathology.

Keywords: Fluoride, water, estimation, concentration

#### 1. Introduction

Water may be a chemical substance with the statement binary compound. A water molecule contains one element and 2 atomic number 1 atoms connected by valency bonds. Water may be a liquid at close conditions, however it typically co-exists on Earth with its solid state, ice, and vaporised state (water vapor or steam). Water conjointly exists in a very liquid state close to deliquescent surfaces . below word wont to name chemical compounds, alter oxide is that the scientific name for water, tho' it's nearly ne'er used .Water covers seventy.9% of the layer, and is important for all legendary kinds of life on Earth, 96.5% of the planet's water is found in oceans, 1.7% in groundwater, 1.7% in glaciers and also the ice caps of Antarctica and Greenland, a-little fraction in alternative giant water bodies, and 0.001% within the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Only 2.5% of the Earth's water is fresh, and 98.8% of that water is in ice and groundwater. Fluoride is naturally occurring substance which is present in water [1]. Fluoride when present in optimal quantities is known to prevent caries by various mechanisms but more predominantly by deposition of calcium fluoride crystals which is more resistant to demineralisation [2].Community water fluoridation began as early as 1945 and is considered as an effective way of preventing caries in children as well as adults [3]. The World Health Organisation has identified dental caries as a worldwide epidemic and also recommended to add fluoride to drinking water in naturally occurring water which has less than optimal fluoride levels. The optimal fluoride level in drinking water is 0.7 to 1.2 ppm [4]. Fluorine is the most abundant element in nature, and about 96% of fluoride in the human body is found in bones and teeth. Fluorine is essential for the normal mineralisation of bones and formation of dental enamel Fluorine is often called as twoedged sword. Fluoride is the major component in water which prevents dental caries. If the level of fluoride in bottled water is too low, optimal caries prevention may not be achieved whilst if levels are too high, developing teeth may be at risk of enamel fluorosis. Logaswamy et al. assessed the standard of groundwater in Kavundampalayam region in Coimbatore district and finished that groundwater quality varied drastically. Sundar et al. studied the groundwater quality on Noyyal watercourse in Coimbatore district and finished that the studied parameters were on top of the standards. a shot has been created to work out the suitableness of groundwater in Coimbatore district for various functions. The groundwater quality of the Singanallur sub-basin are analysed by Priya et al. to envision its suitableness for drinking, irrigation further as domestic usage. it absolutely was finished that the Singanallur tank water was of dangerous quality thanks to the discharge of domestic sewerage. The seasonal differences within the groundwater quality of Coimbatore town throughout the year 2011 are analysed throughout pre-monsoon and postmonsoon periods victimization Geographic data system (GIS) by Jebastina et al . supported the water quality index, the samples were categorised as glorious, good, poor, terribly poor and unsuitable. Variable applied math analysis, cluster analysis and Principal part analysis were performed by Jebastina et al. on water quality information of twenty seven samples collected among Coimbatore district. attainable factors that cause contamination are identified. Water quality index has been calculated by Priya et al. for the Singanallur sub-basin and also the entire sub-basin was zoned to check the suitableness of water for drinking functions victimization the thus ware ArcGIS and also the results showed that the groundwater quality was international organisation t for drinking in a number of the areas marking a water quality index bigger than one hundred.

Knowledge of the fluoride content of the drinking water is essential to all oral care professionals to plan of preventive dental programs and prescribes of fluoride supplements. Evidence of fluoride content in drinking water around Coimbatore district, India is largely anecdotal. Hence this study was designed to estimate the fluoride concentration in drinking water in Coimbatore district.

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#### 2. Material and Method

Coimbatore also known as Kovai, is a major city in the Indian state of Tamil Nadu. Located on the banks of the Noyyal River surrounded by the Western Ghats, it is the second largest city in the state after Chennai and 16th largest urban agglomeration in India. It is the largest city in the Kongunadu region. It is administered by the Coimbatore Municipal Corporation and is the administrative capital of Coimbatore district. It is one of the fastest growing tier-II cities in India and a major hub for textiles, industries, commerce, education, information technology, healthcare and manufacturing in Tamil Nadu. It is often referred to as the "Manchester of South India" due to its cotton production and textile industries. Coimbatore is also referred to as the "Pump City" and it supplies nearly half of India's requirements of motors and pumps. The city is one of the largest exporters of jewellery, wet grinders, poultry and auto components with "Coimbatore Wet Grinder" and "Kovai Cora Cotton" recognised as Geographical Indications by the Government of India.

Coimbatore has an area of city 246.75 km2 (95.27 sq mi) and Metro 642.12 km2 (247.92 sq mi). Coimbatore has a population of 1,601,438. As per the 2011 census based on pre-expansion city limits, Coimbatore had a population of 1,050,721 with a sex ratio of 997 females for every 1,000 males, much above the national average of 929. It is the second largest city in the state after capital Chennai [47] and the sixteenth largest urban agglomeration in India. A total of 102,069 were under the age of six, comprising 52,275 males and 49,794 females. The average literacy of the city was 82.43%, compared to the national average of 72.99%.

#### **Collection of Water Sample**

About 500ml of water was collected in a clean dry polythene container and labeled with information like date of collection, source and place. Fluoride levels were analyzed by ion exchange method by the chief water Analyst, state level water testing laboratory, Tamilnadu Water Supply and Drainage Board (TWAD), Government of Tamilnadu, Chennai (ISO 9001-2000- Certified).

# 3. Results

Source

Open well

#### **Experimental Section**

The fluoride concentration of drinking water collected from Coimbatore around 5 places Singanallore, Kaliyapuram, Karupapalayam, Puliyakulam, and Agilandapuram. Thereafter it was subjected to analysis for the estimation of fluoride at the Tamil Nadu Water supply and Drainage Board using the SPADNS colorimetric method.

Table 1: Fluoride content of drinking water in Coimbatore,

| 1N   |               |                           |
|------|---------------|---------------------------|
| S.No | Place         | Fluoride Content in Water |
| 1    | Singanallore  | 0.130                     |
| 2    | Kaliyapuram   | 0.882                     |
| 3    | Karupapalayam | 0.116                     |
| 4    | Puliyakulam   | 0.043                     |
| 5    | Agilandapuram | 1.424                     |

Table 1 shows the fluoride ion concentration in drinking water in Coimbatore. It was found that fluoride content ranging from 0.04 to 1.424.

Conversely, some drinking water contains insignificant amounts of fluoride which may deprive the child of the optimal daily fluoride requirement [5]. However, in view of increasing awareness of toxic effects of elevated F intake, particularly in children, it is important that the F level of drinking water be monitored closely to prevent adverse reactions to F from that source.

## 4. Discussion

In the present study, fluoride contains in all samples ranged from 0.04-1.42 mg/L, which is less than optimum range of 1.5 mg/L, as recommended by WHO. Hence, fluoride contents in all the samples exhibit their suitability for drinking. In a study to assess the groundwater fluoride concentration in Kanchipuram by Pradeep Kumar during 2014 it was found that the fluoride concentration ranged between 0.05-1.04 mg/l. (6). Similar studies done by Pradeep Kumar in Chennekothapalli Mandal, Anatapur District, Andra Pradesh the fluoride concentration was 1.46 and 1.68mg/dl (7) and in Ennore, Chennai it ranged from 1.83 to 2.01 ppm (8,9). In general, fluoride is value-added to water as a removal agent to get rid of microorganism and alternative doable contaminants (Sharma and Soneja,2003).In numerous countries, particularly in developing countries, fluoridization is commonly embarked upon so as to enhance the facility. Water fluoridization may be a relatively cheaper and easier possibility for many components in Central Asia, whose would like for water removal is imperative.(10) On the opposite hand, developed countries have higher water removal choices therefore sanctionative them to disenlist the fluoridization of water in their water purification schemes. In Central Asia, fluoridization of water is living despite the substantive proof of high levels of water fluoridization in several regions of Asian country, Asian nation and alternative Central Asia countries.(11,12) However, in recent years, numerous health problems relative to the persistent introduction of halide within the water are raised.Based on the assessment conducted by British earth science Survey(2012), fluoride build-up has became considerably apparent within the ground waters of Central Asia and African countries that are hardest hit embody China, India, Sri Lanka, Pakistan, and alternative African and South yankee territories (British earth science Survey, 2012).Fluorosis arose in Asian nation and have become major problems for its numerous territories, together with Andra Pradesh and province. pathology additionally emerged as a significant issue in Democratic Socialist Republic of Sri Lanka and Bangla Desh (Fawell et.al., 2006). In Asian country, fluorisis is additionally a significant health issue, significantly in metropolis, Kusur and Sargogha districts (Tariq et.al.,2012).In recent years, recommendations on the elimination or a minimum of the reduction of halide within the water are steered as a healthier possibility for the removal of water. To some extent, reduction in halide usage has been implemented; but, undeniably, the health effects of halide in water ar still persistent. (13)

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The fluoride content within the well water of the Coimbatore District varied from 0.2 to 1.2 mg/L in 2007 with minimum worth in Vadavalli Poosarpatti and most in P.N palayam. In 2008 the concentration of halide varies from 0.2 to 2.3 mg/L with minimum worth in Gopalapuram and most in Kavundampalayam. throughout 2009 the variation in fluoride from 0.1 to 2.7 mg/L with minimum worth in Dayanur, Mandripalayam, Natchipalayam, Senjeripudur and most worth in Andipalayam and in 2010 the fluoride concentration varies from zero.1 to 2.5 with minimum worth in Bogampatti, Kolarpatti, Marudur, Samathur, Valparai and most worth in Andipalayam and P.N palayam.It is possible that this deficiency in halide or its low concentration may need affected the dental health of the shoppers. From the Indian Standards (ISI, 1991), 1.0 mg/L is that the fascinating limit of halide in potable and low halide level could cause decay and high fluoride level ends up in pathology. The sources of halide in well water could also be because of weathering of igneous and matter rocks, phosphate fertilizers, that area unit extensively used, typically contain halides as impurity and these could increase levels of fluoride in soil. the buildup of fluoride in soil eventually ends up in its leach because of percolating water, therefore increase halide concentration in well water (Alexander, 2008).(14, 15)

Fluoride may be a chemical that happens naturally at intervals many sorts of rock. the common concentration of inorganic halide from natural sources in Asian nation normal drinkable is mostly lower than 0.050 milligrams per metric capacity unit (mg/L), however concentrations will get beyond one mg/L. the utmost Acceptable Concentration of halide in drinkable in Asian nation is one mg/L. fluoridization is that the addition of halide compounds into drinkable, to regulate concentrations to levels between 0.8 and 1.0 mg/L for the helpful result of dental caries hindrance.(16) The general public also are exposed to halide in dentifrice or alternative dental merchandise. Most of the halide found in groundwater is of course occurring from the breakdown of rocks and soils or weathering and deposition of part volcanic particles. halide may come back from in runoff and infiltration of chemical fertilizers in agricultural areas, septic and waste matter treatment system discharges in communities with fluoridated water provides and liquid waste from industrial sources.(17)

At low concentrations fluoride will scale back the danger of dental cavities. Exposure to somewhat higher amounts of fluoride will cause dental pathology. In its mildest type this leads to discolouration of teeth, whereas severe dental pathology includes corrosion and alteration of enamel. Even higher intakes of halide confiscated an extended amount of your time may result in changes to bone, a condition referred to as skeletal pathology. this will cause joint pain, restriction of quality, and probably increase the danger of some bone fractures. The maximum level of halide that the frame could tolerate is 1mg/l. keeping in sight the assorted sources through that halide finds entry into the body, level of + 1.0 mg/l halide in water is taken into account because the optimum level to forestall each decay and numerous types of pathology.(18) The utmost limit prescribed by BIS (Bureau of Indian Standards) for halide in drinkable is additionally 1mg/l. The concentration of halide was determined as 0.2 mg/l, and also the most concentration values were determined as 1.4 mg/l in a recent study conducted in dharmapuri district. Fluoride happens in sellaite, fluorite, cryolite, apatite, apatite, fluormica, biotite, mineral alternative|and several other rocks. Weathering of those rocks and prolonged residence time results in high halide groundwater.(19) Low atomic number 20, high atomic number 11 and high hydrogen carbonate area unit typical of high halide groundwater. the opposite sources for halide area unit infiltration of agricultural run off containing chemical fertilisers, improper disposal of liquid waste from industries. alumina smelting, cement production and ceramic and brick firing. Some quantity of halide is essential for the physical structure for healthy teeth and bones. The popular technologies for the removal of halide from water embody natural action followed by precipitation, membrane processes, action and surface assimilation. In natural action, trace amounts of halide ions tend to stay in answer because of solubility restriction.Clinical dental pathology is characterised by staining and erosion of the teeth. in additional severe cases all the enamel is also broken. However, halide might not be the sole reason for dental enamel defects. Enamel opacities like dental pathology area unit related to different conditions, akin to deficiency disease with deficiency of vitamins D and A or an occasional protein-energy diet. bodily function of halide once six years ancient won't cause dental pathology. The long-run bodily function of huge amounts will cause probably severe skeletal issues. The condition and its result on individuals pathology is caused by excessive intake of halide. The dental effects of pathology develop abundant previous the skeletal effects in individuals exposed to massive amounts of halide. Chronic high-level exposure to halide will cause skeletal pathology. In skeletal pathology, halide accumulates within the bone more and more over a few years. the first symptoms of skeletal pathology, embody stiffness and pain within the joints. In severe cases, the bone structure might amendment and ligaments might calcify, with ensuing impairment of muscles and pain. Acute highlevel exposure to halide causes immediate effects of abdominal pain, excessive secretion, nausea and inborn reflex.

# 5. Conclusion

Extensive abstraction of groundwater for irrigation functions within the central a part of the study space has given rise to a groundwater trough. This space conjointly shows larger annual fluctuations in groundwater levels. (20) The persistence of groundwater trough even once the recharge season indicates over-exploitation condition therein half. Except for this, groundwater levels within the space typically follow the surface topography.

Fluoride in water is usually of geologic origin. Waters with high levels of halide content square measure principally found at the foot of high mountains and in areas wherever the ocean has created geologic deposits. illustrious halide belts toward land. Intake of excess halide, most ordinarily in drinking-water, will cause pathology that affects the teeth. Paradoxically, low levels of halide intake facilitate to stop caries. The management of drinking-water quality is thus crucial in preventing pathology.

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The quality of groundwater is mostly quite contemporary within the hills and slope regions, whereas it's slightly salt within the plains and valleys. AN analysis of temporal changes in groundwater quality indicates that it's passionate further about geophysics, rock-water interaction anthropogenetic activities. in an exceedingly year having adequate rain, the groundwater within the cragged space, having slopes quite one %, typically shows a pointy increase in TDS once recharge, whereas majority of the wells set within the plains show a decrease. Such clear grouping isn't determined in years of below adequate rain. The GIS assisted info system would facilitate to use spring water management practices admire, correct spring water resource management in terms of spring water quality & amp; amount, integrated management of water, land use and also the surroundings, and to forestall spring water quality deterioration through correct observation and analysis.

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