



# Hydrochemistry Of Groundwater In Chandrapur District

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## Abstract

**Aim** – The study was carried out to find the hydrochemistry groundwater of Korpana block, Chandrapur district, Maharashtra, India.

## Material and method-

A study of seven villages of Korpana block, Chandrapur district, Maharashtra, India was included. Groundwater samples were collected and analyzed for various physicochemical parameters, including: fluoride. Fluoride was measured colorimetrically (SPANDS) using sodium 2-(parasulfophenylazo-)-1,8-dihydroxy-3,6-naphthalene disulfonate.

**Result-** The borewell samples collected from Asan and Mykalpur village showed the fluoride concentration more than permissible limit of 1.5ppm. The borewell samples collected from Bori Navegaon, Gadegaon, Sangoda, Antargaon, Kadholi showed with permissible limit.

**Conclusion-** Fluoride concentration is higher than the permissible limit in some of the samples.

**Medical Significance-** Fluoride is one of the essential nutrients required for normal growth and development of human being. High fluoride i.e above 1.5mg/l shows adverse effects on growth like dental and skeletal fluorosis.

**Keywords-** Groundwater, Hydrochemistry, Fluorosis, Fluoride

## Introduction

About Korpana --- Korpana is a Town and Tehsil in Chandrapur District of Maharashtra.

According to census Total area of korpana tehsil is 560 km<sup>2</sup> with a population of 1,25,317 peoples. Sub-tropical climate with average rainfall of 1066 mm.

Fluoride ions exhibit distinct features among the physico-chemical parameters; an appropriate concentration is beneficial to health, while an excessive concentration poses a risk. Presence of fluoride in water does not changes colour, smell and taste. So, it is not easy to determine through physical examination. Fluoride concentration can be determined only by chemical analysis [1]. Fluoride is such a substance which affects our health if its concentration lower than 0.6mg/l or higher than 1.5mg/l in drinking water. Lower concentration causes tooth decay whereas higher concentration causes dental and skeletal fluorosis. Dental fluorosis is more susceptible in children with permanent yellowing and discoloration of teeth. This condition is permanent and not curable.

In many parts of the world concentration of fluoride is very high in groundwater and surface water. The overabundance of Fluoride in groundwater is a result of various factors like rock weathering (fluorite, fluorapatite, cryolite, ferromagnesium silicate, etc), hydrological and human activities (land deformation, mining, coal burning, industrialization, etc) was reported [2]. Around 28 districts of Maharashtra are found rich in fluoride. Excessive intake of fluoride through drinking water causes an endemic disease called fluorosis [3]. Chronic toxicity that leads to skeletal fluorosis whereas dental fluorosis which causes only mottling of teeth.

Fly ash also accounts for high fluoride in groundwater. Worldwide approximately 100 -150 tons of fly ash is produced due to the coal combustion especially from power plants [4,5].

Improper dispose of this fly ash results in leaching of fluoride in groundwater. The fluoride content of coal depends on type of coal burnt. Brick kilns used for burning of coal also acts as a source of fluoride pollution [6]. So present study is carried out to assess the quality of groundwater and impact on population of villages of Korpana tehsil, Chandrapur district, Maharashtra, India. This study has tried to compare the relationship of F<sup>-</sup> with pH, Alkalinity, Total Hardness, Electrical Conductivity and TDS.

## III MATERIALS AND METHODS

**Area of Study:** This study was carried out on the groundwater of Korpana Taluka at villages Bori Navegaon, Asan, Mykalpur, Gadegaon, Sangoda, Antargaon and Kadholi in pre-monsoon season May 2023. As per CGWB report of Chandrapur district average rainfall of 1066 mm. Groundwater samples were collected from seven different locations of Korpana block in Chandrapur region.

Various physicochemical parameters such as temperature, pH, conductivity, TDS, DO, COD, BOD, alkalinity, total hardness and fluoride were analyzed. For the analysis of various water quality parameters, the standard methods described in Table 1 are used.

## Water Sampling

The samples of groundwater from borewells were collected. Groundwater collected after pumping for 5-10 min to stabilize the electrical conductivity. After rinsing bottles for two-three times with water to be sampled, Sterile and clean 3 litre polythene cans were used for sampling with all precautions to avoid contamination. pH, Temperature, Electrical Conductivity (EC), Total dissolved solids (TDS), Total Hardness (TH), Total Alkalinity (TA), COD, DO, BOD and Fluorides were analysed.

## IV Result and Discussion

The information regarding the levels of fluoride in groundwater of Korpana taluka, Chandrapur district in the Indian state of Maharashtra is provided in this study. Field samples from several locations were gathered and examined for this. This study presents and discusses the collected results.

Table 1: Standard Methods for testing physico-chemical parameters of groundwater.

| S.No. | Parameters                      | Standard Method           | Test Method                          |
|-------|---------------------------------|---------------------------|--------------------------------------|
| 1     | Colour                          | Visual Comparision Method | NA                                   |
| 2     | Temperature                     | Mercury Thermometer       | NA                                   |
| 3     | pH                              | Electrometric Method      | IS 3025-Part II                      |
| 4     | Electrical Conductivity         | Conductivity Meter        | IS 3025-Part 14                      |
| 5     | Total Dissolved Solids          | TDS Meter                 | APHA 23 <sup>rd</sup> Edn (4500 F D) |
| 6     | Alkalinity as CaCO <sub>3</sub> | Titration Method          | IS 3025 (Part 23)                    |
| 7     | Total Hardness                  | EDTA Titration Method     | IS 3025 (Part 51)                    |
| 8     | Chemical Oxygen Demand          | Open Reflux Method        | IS 3025 (Part 58)                    |
| 9     | Biological Oxygen Demand        | BOD incubator             | IS 3025 (Part 44)                    |
| 10    | Dissolved Solids                | Wrinkler Method           | IS 3025 (Part 38)                    |
| 11    | Fluoride                        | SPADNS Method             | APHA 23 <sup>rd</sup> Edition (2540) |

The physical observations of groundwater samples shows that they are colorless, Odorless and clear. The results of study have been reported in the table given below. The values of all parameters are found to be as follows. pH of all samples were observed from 6.68 – 7.31. The lowest value of pH

value was found at Bori navegaon and highest value of pH in another sample of Sagoda village. For potable condition of water pH value should be in the range of 6.5 to 8.5 as per WHO standards (2011). In this study area water samples shows moderately acidic to alkaline nature. Temperature is a very important factor various chemical and biological reactions in water [7]. The temperature of the sample was between 35 – 43 degree celsius. Temperature can influence concentration of fluoride in groundwater [8,9]. The electrical conductivity measures the total amount of solids dissolved in water. It is directly proportional to temperature. It decides the taste of water [10,11,12]. EC of water increases by 2-3 % for an increase of 1 degree celcius of water temperature. Electrical Conductivity ranges from 780 to 1334  $\mu\text{S}/\text{cm}$ . According to WHO EC value should exceed 400  $\mu\text{S}/\text{cm}$ . Total dissolved solids in water is generally the sum of positively charged and negatively charged ions. So, it provides a qualitative measure of total dissolved ions. TDS of these samples ranges from 468 to 753mg/l. TDS should not be more than 500 as per WHO. Alkalinity is acid neutralizing capacity of water. It gives the idea of bicarbonates, carbonate or hydroxides present in water. It ranges from 300 to 480 mg/l of the present samples. Recommended range as per standards is between 30 – 400 mg/l. Hardness of samples ranges from 221 to 381mg/l. All samples are considered as hard with total hardness >150mg/l. COD of samples found to be between 7.96 - 63.74 mg/l. Higher values of COD shows improper drainage system in village. BOD of samples ranges between 2-27 mg/l. DO of samples 6.0-6.70mg/l. Fluoride ranges from 0.84 to 2.06 mg/l of the samples. Fluoride is seen to be above permissible limit in two samples.

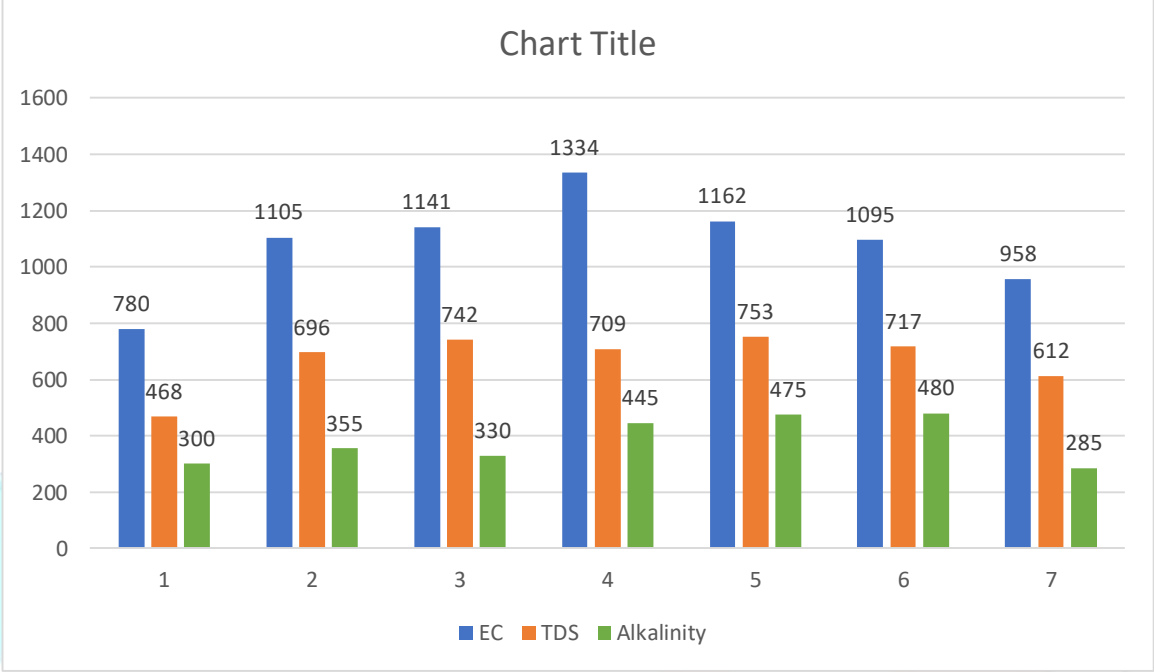
### Conclusion –

This article concludes, from hydrochemical analysis of groundwater from Korpana block area, Chandrapur district of Maharashtra, India, that high F- content in groundwater, above 1.2 mg/l, is characterized in samples with High alkalinity and low total hardness. 25% of samples showed higher fluoride concentrations in groundwater. Dental fluorosis in children and the occurrence of non-skeletal fluorosis in adults were observed during sampling.

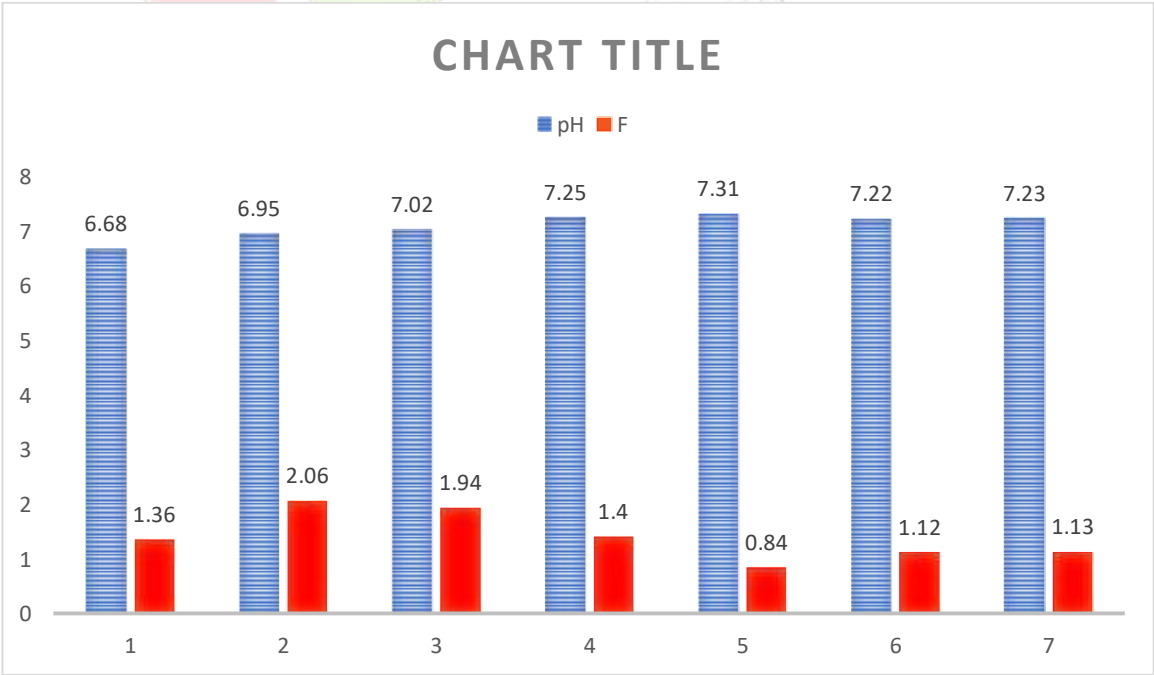
**Table 1:** Physico-chemical prperties of groundwater of Chandrapur City for Pre-Monsoon season

| S.No. | Parameters   | S-1  | S-2  | S-3   | S-4  | S-5  | S-6  | S-7  |
|-------|--------------|------|------|-------|------|------|------|------|
| 1     | Temperature  | 39   | 43   | 41.5  | 39   | 35   | 40   | 42   |
| 2     | pH           | 6.68 | 6.95 | 7.02  | 7.25 | 7.31 | 7.22 | 7.23 |
| 3     | Conductivity | 780  | 1105 | 1141  | 1334 | 1162 | 1095 | 958  |
| 4     | TDS          | 468  | 696  | 742   | 709  | 753  | 717  | 612  |
| 5     | BOD          | 2    | 20   | 14.50 | 4.0  | 27   | 12   | 22   |

|    |                  |       |        |        |        |        |        |        |
|----|------------------|-------|--------|--------|--------|--------|--------|--------|
| 6  | COD              | 7.96  | 59.76  | 35.85  | 11.95  | 63.74  | 35.85  | 47.80  |
| 7  | DO               | 6.70  | 6.40   | 6.20   | 6.0    | 6.20   | 6.1    | 6.30   |
| 8  | Total Alkalinity | 300   | 355    | 330    | 445    | 475    | 480    | 285    |
| 9  | Total Hardness   | 343.2 | 274.56 | 320.72 | 246.48 | 221.52 | 380.64 | 283.92 |
| 10 | Fluoride         | 1.36  | 2.06   | 1.94   | 1.40   | 0.84   | 1.12   | 1.13   |



Graph showing comparision between EC, TDS and Alkalinity.



Graph showing pH and Fluoride in samples.

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