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# Analysis of water quality using physico-chemical parameters in Samudrapur, Wardha District, Maharashtra, India

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**ABSTRACT**

Ground water samples were taken from different locations of Samudrapur region, Wardha District, Maharashtra. Studies of Physico-chemical characteristics of ground water quality based on Physic-chemical parameters have been taken up to evaluate its suitability for different purposes. Total 11 samples were collected. The quality analysis has been made through the Temperature, Turbidity, $P^H$, Electrical Conductivity, Alkalinity, Total Hardness, TDS, Dissolved Oxygen, Chloride, COD, Iron, Fluoride and Nitrate. All Parameters were within the Permissible limits except few locations. The results indicate that the ground water is Non-polluted and can be used for Domestic, Irrigation and Pisciculture. The results were compared with standards prescribed by WHO, BIS and ICMR. However, there is always need for proper protection and management of ground water

**Key words:** Physico-Chemical Parameters, TDS, COD, BIS, WHO, ICMR, Ground water, Irrigation, Pisciculture, Domestic.

## INTRODUCTION

Water is an essential component for survival of life on earth, which contains minerals, important for humans as well as for earth and aquatic life (Versari et al., 2002). Lakes and surface water reservoirs are the planet's most important freshwater resources and provide innumerable benefits. They are used for domestic and irrigation purposes, and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity. They have important social and economic benefits as a result of tourism and recreation, and are culturally and aesthetically important for people throughout the world. They also play an equally important role in flood control (An 2002).

Ground water is the principal source of drinking water in our country and indispensable source of our life. The problem of ground water quality is acute. Groundwater is particularly important as it accounts for 88 % of the drinking water in rural areas (Kumar, 2004).

In India, there are over 20 million private wells in addition to the government tube wells. The wells are generally considered as the worst type of ground

water sources in the term of physio-chemical contamination due to the lack of concrete plinth and surrounding drainage system (WHO, 1997).

Life is not possible on this planet without water. It exists in three states namely solid, liquid and gas. It acts as a media for both; chemical and biochemical reactions and also as internal and external medium for several organisms (Kumar and Yadav. 2011). According to Central Pollution Control Board, 90% of the water supplied in India to the town and cities are polluted, out of which only 1.6% gets treated. Therefore, water quality management is fundamental for the human welfare (Gupta ,1991) and Madhuri, 2004).

Hence, there is always a need for and concern over the protection and management of ground water quality. Any imbalance in its physical or chemical properties beyond permissible limit would be harmful for the whole eco-system.

## MATERIALS AND METHODS

### Sample Collections

Ground water sample were collected in polythene bottle of 2.5 lit and 2 lit from different location of Samudrapur tehsil. The samples were collected from well as well as from hand pump. The polythene bottle have been previously washed with 10% $HNO_3$ and 1:1 HCl and rinsed with same sample water taken in that bottle and labeled them serially. Immediately add few drops of $HNO_3$ were added in order to prevent bacterial and fungal growth.

The sample are collected from different location of Samudrapur region are listed below as

**$GWS_1$** – Samudrapur
**$GWS_2$** – Sujatpur
**$GWS_3$** – Sawangi
**$GWS_4$** – Sakuli
**$GWS_5$** – Dhondgaon
**$GWS_6$** – Govindpur
**$GWS_7$** – Hirdi
**$GWS_8$** – Narayanpur
**$GWS_9$** – Dahegaon
**$GWS_{10}$** – Wagheda
**$GWS_{11}$** – Wasi

The result of ground water sample from different location in Samudrapur region were noted and listed below in table B.

### Sample Analysis

The ground water sample were analyzed as the water sample was taken immediately at the site of collection using a simple thermometer calibrated in degree Celsius, pH was measured using pH meter and also other parameter were measured later in preserved water as shown in table A.

## RESULT AND DISCUSSION

The quality of water sample from different location of Samudrapur tehsil are collected and analyzed by different method and fine out some physicochemical parameter such as pH, Total dissolved solid, Total hardness, Chemical Oxygen Demand, Dissolved Oxygen, Alkalinity, Chloride, Fluoride, Iron and Conductivity. The Status of water quality of these water sources are presented in table 2.

### Temperature:

The temperature of ground water sample of Samudrapur tehsil from different location varied between 20.1 to 23.2$^{o}$C. It was found that the temperature of ground water is maximum in Govindpur area. However, the variation of the water temperature affects directly or indirectly all life processes.

### Turbidity:

The turbidity of water fluctuates from 0.18 NTU to 0.91 NTU. The maximum values (0.91 NTU) was recorded in the Narayanpur village water and minimum value (0.18NTU) in the Sujatpur village of Mandgaon Grampanchayat. It should be noted that the value of turbidity are within the permissible limit of WHO.

### pH

$P^H$ is the measurement of the potential activity of hydrogen ions in the sample. $P^H$ of the water body is affected by several factors. One of the most important factors is the bedrock and soil composition through which water the water moves, both in its bed and as groundwater. $P^H$ is not a static, it changes over time, and in fact it changes over the course of a single day.

The pH of ground water sample varied from minimum of 8.01 to a maximum of 8.7 of Narayanpur village and Hirdi village respectively. The factors like air temperature bring about changes the pH of water. Most of bio-chemical and chemical reactions are influenced by the pH. The reduced rate of photosynthetic activities reduces the assimilation of carbon dioxide and bicarbonates which are ultimately responsible for increase in pH. However, the analyzed water sample values are within the permissible limit of WHO.

**Table 1: Methods Used for Analysis of water Sample**

| Sr. No | Parameters | Methods | Units |
|---|---|---|---|
| 1 | Temperature | Digital Thermometer | ℃ |
| 2 | Turbidity | Nephelometric | NTU |
| 3 | pH | pH – Meter | -------- |
| 4 | Conductivity | Conductivity meter | umhos/cm |
| 5 | Alkalinity | Titrimetric Method | mg/l |
| 6 | Total Hardness | Titrimetric Method | mg/l |
| 7 | TDS | Gravimetric Method, drying at 105℃ | mg/l |
| 8 | DO | Titrimetric Method | mg/l |
| 9 | Chloride | Argiometric Method | mg/l |
| 10 | COD | Open reflux method | mg/l |
| 11 | Iron | Colorimetric Method | mg/l |
| 12 | Fluoride | SPAND Method | mg/l |
| 13 | Nitrate | UV- Spectrophotometric Screening Method | mg/l |

**Table 2: Reading of water quality parameters at different location in Samudrapur Region.**

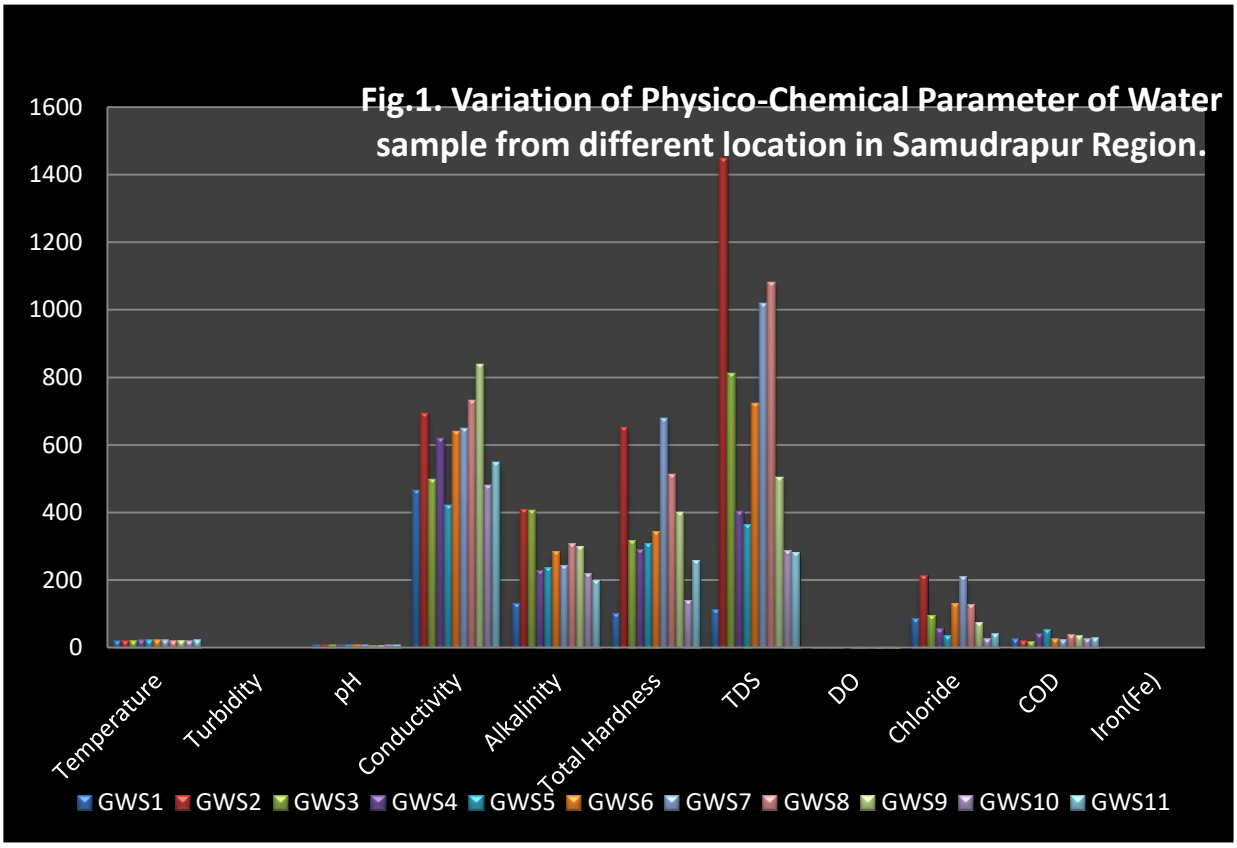
| Sr. No | Parameter | $GW_1$ | $GW_2$ | $GW_3$ | $GW_4$ | $GW_5$ | $GW_6$ | $GW_7$ | $GW_8$ | $GW_9$ | $GW_{10}$ | $GW_{11}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Temperature** | 21.1 | 22 | 21.5 | 23.1 | 23.2 | 23 | 22.8 | 21.3 | 22.3 | 20.1 | 22.4 |
| 2 | **Turbidity** | 0.52 | 0.18 | 0.40 | 0.41 | 0.33 | 0.55 | 0.64 | 0.91 | 0.31 | 0.57 | 0.54 |
| 3 | pH | 8.3 | 8.42 | 8.47 | 8.29 | 8.28 | 8.30 | 8.7 | 8.01 | 8.08 | 8.64 | 8.52 |
| 4 | Conductivity | 465 | 694 | 497 | 620 | 420 | 642 | 649 | 733 | 839 | 479 | 549 |
| 5 | Alkalinity | 130 | 409.8 | 406 | 229.3 | 236.8 | 285.7 | 244.4 | 308.3 | 300 | 220 | 200 |
| 6 | Total Hardness | 102 | 652 | 316 | 292 | 308 | 344 | 680 | 512 | 400 | 140 | 260 |
| 7 | TDS | 112 | 1450 | 811 | 403 | 366 | 723 | 1020 | 1083 | 505 | 288 | 282 |
| 8 | DO | 2.24 | 1.89 | 3.03 | 2.44 | 1.02 | 2.06 | 2.09 | 3.26 | 3.82 | 1.94 | 2.1 |
| 9 | Chloride | 86.5 | 213.4 | 96.5 | 55.7 | 37.1 | 131.8 | 209.7 | 126.6 | 73.7 | 27.6 | 40.5 |
| 10 | COD | 26.5 | 21.3 | 19.1 | 42.5 | 54.5 | 26.5 | 24.8 | 38.5 | 35.2 | 28.5 | 29.3 |
| 11 | Iron(Fe) | 0.094 | 0.171 | 0.051 | 0.086 | 0.103 | 0.115 | 0.047 | 0.030 | 0.516 | ---- | 0.089 |
| 12 | Fluoride ($F^-$) | 0.401 | 0.101 | 0.140 | 0.210 | 0.338 | 0.511 | 0.546 | 0.271 | 0.040 | 0.421 | 0.274 |
| 13 | Nitrate($No_3^-$) | 65.7 | 336.8 | 81.8 | 39.9 | 35.3 | 64.2 | 319.6 | 5.71 | 55.48 | 0.57 | 12.0 |

**Electrical Conductivity:**

Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts. EC values were in the range of 420 umhos/cm to 839 umhos/cm. High EC value observed for Dahegaon village and low EC value for Dhondgaon village water sample indicating the presence of high amount of dissolved inorganic substances in ionized form.

**Alkalinity:**

The alkalinity of water is caused mainly due to OH, $CO_3$, $HCO_3$ ions. Alkalinity is an estimate of the ability of water to resist change in pH upon addition of acid. Total alkalinity ranges from 130 mg/l to 409.84mg/l the maximum value (409.84mg/l) was recorded in the Sujatpur Village and minimum value (130mg/l) was recorded in the Samudrapur. However, all the values from different sample are within the permissible limit of BIS.




**Total Hardness:**

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values varied from 102 mg/L to 680 mg/L. However, the value of water sample from Sujatpur and Hirdi were 652mg/l and 680 mg/l respectively over the permissible limit of ICMR

**Total Dissolved Solid:**

In water, total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and manganese, organic matter, salt and other particles.

Total Dissolved Solids (T.D.S.) value were ranging from 112 to 1450 and the water samples of Sujatpur, Hirdi, Narayanpur have maximum value and not within permissible limit of ICMR which is not acceptable for drinking purpose. While Sawangi, Govindpur have high value but within permissible limit of ICMR.

**Dissolve Oxygen:**

The value of DO fluctuates from 1.02 mg/l to 3.82 mg/l. The maximum value (3.82 mg/l) was recorded in the Dahegaon Village and the minimum value was recorded in the Dhondgaon. However, the value of DO is within the permissible limit of BSI and WHO.

**Chloride:**

The chloride content of ground water varied from a minimum of 37.12 mg/lit to a maximum of 213.44 mg/lit of Dhondgaon Village and Sujatpur village respectively.

The higher content of chloride in water may be due to animal origin like human faces and sewage inflow. Chloride increases with the increasing degree of eutrophication. Sujatpur and Hirdi village water sample have high chloride contents i.e. out of permissible limit of BIS and WHO.

**Chemical Oxygen Demand:**

Chemical oxygen demand determines the oxygen required for chemical oxidation of organic matter. COD values convey the amount of dissolved oxidisable

organic matter including the non-biodegradable matters present in it. The COD of dug well water ranged from a minimum of 19.1 mg/lit to a maximum of 54.5 mg/lit of Sawangi Village and Dhondgaon Village respectively. Chemical Oxygen Demand is changed with seasons and also with the release of chemical substances from agricultural waste and sewage. All the water sample values are out of maximum permissible limit of BIS and WHO.

**Iron:**

Iron is an essential element in human nutrition. Estimates of the minimum daily requirement for iron depend on age, sex, physiological status, and iron bioavailability.

The minimum value of ground water sample of Wasi village is 0.089 mg/l and maximum value recorded for Dahegaon is 0.516 mg/l which is out of permissible limit of BIS and WHO.

**Fluoride:**

Fluoride at a lower concentration at an average of 1 mg/lit is regarded as an important constituent of drinking water. Surface water generally contains less than 0.5 mg/lit fluoride.

However, when present in much greater concentration, it becomes a pollutant. Excess intake of fluoride through drinking water causes fluorosis on human being. The minimum values were recorded in Dahegaon (0.040mg/l) while the maximum values were recorded in Hirdi (0.546mg/l).

**Nitrate:**

Nitrates represent the final product of the biochemical oxidation of ammonia. Monitoring of nitrates in drinking water supply is very important because of health effects on humans and animals. Surface water contains nitrate due to leaching of nitrate with the percolating water.

The nitrate content was minimum in Narayanpur Village and found to be 5.71 mg/l while the maximum nitrate content in Sujatpur Village was found to be 336.8mg/l which is out of maximum permissible limit of ICMR.

**CONCLUSION**

The study assessed the evolution of water quality in ground water of Samudrapur region, Wardha district. A study of ground water was carried out by taking certain important parameters like temperature, pH, total dissolved solid, alkalinity, dissolved oxygen, chemical oxygen demand, Nitrate, Chloride, Iron, Electrical Conductivity and Turbidity.

Hence, the present study shows that the proper protection and Management of quality of ground water is required for the healthy eco – system and selecting proper treatment to minimize ground water pollution.

**Conflicts of interest:** The authors stated that no conflicts of interest.

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