



Analysis of Underground Water of Girna River belt from Chalisgaon Tehsil in Jalgaon district, Maharashtra Using Physicochemical Parameters

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ABSTRACT

Water is the most important component of the ecosystem and essential for life on earth. All living organism depends on water for their growth and existence. The water has to be in a pure form otherwise it directly influences the ecosystem. With the increase in pollution, population, and practicing heavy doses of fertilizers in agriculture, many times natural water is perceived in contaminated form. Therefore, it is essential to analyze water which directly utilized for drinking and agriculture applications at regular time intervals. This work deals with the physicochemical analysis of underground water collected from selected eight villages from the Girna river belt of Chalisgaon Tehsil in Jalgaon District, Maharashtra. The evaluation of water quality was carried out in the summer season for the period of 1st Feb. to 31st May 2022. These samples were analyzed for 11 parameters like Temperature, P^H, EC, TDS, COD, BOD, Total Hardness, Alkalinity, Cl⁻, PO₄³⁻, and SO₄²⁻ were determined. The physicochemical characteristic parametric values equate with BIS and WHO standard limits.

KEYWORDS : Water sample, Physico-chemical Analysis, Parameter, Hardness, Standards.

INTRODUCTION

Water is one of the nature's wonderful gift to humanbeings. Water is most essential constituent which is directly influences to human health and their survival. It occupies significant position in human life due to its wide range of applications.[1] It has been utilised in various fields such as, industrial, irrigation, domestic and agricultural fields etc. Among these the most important use of water is for drinking and agriculture which directly influences to human health and crop production. The water which consumed for drinking and irrigation purposes must be in highly pure form. Underground water can be considered as a source for drinking, irrigation and agricultural determinations. [2] But due to climatic variation the amount of rainfall

changes every year as well as with increase in urbanisation, industrialisation, over use of fertilisers- pesticides in agriculture and various man-made practices result into increase in physico-chemical parameter values of water than permitted standards.[3] The use of such water may cause hazards to the beneficiary.

Jalgaon district is well known as “Banana district of India”. It has been observed that Jalgaon district contribute about two –third of Maharashtra’s banana production.[4] Not only Banana but also many other cash crops like sugar cane, Cotton, Maize etc. are cultivated across the district in wide amount. The agricultural water thirst of all these various cultivated cash crops are fulfilled by Girna and Tapi Rivers. Between these Girna river is one of the most important river for south-east Tehsils of Jalgaon district (M.S.) on which maximum domestic and irrigation water activities get monitored.[5] Specifically, Chalisgaon Tehsil drinking and irrigation water system depends on underground water from Girna River belt. Thus, health of public and crop depends on the quality of underground water from the vicinity.

With this contextual, this research article aims to analyse the physico-chemical properties of underground water collected from Chalisgaon Tehsil’s different villages belongs to Girna River Belt.[6] This underground water can be considered safe for drinking and also used in agriculture and various domestic purposes.

MATERIAL AND METHODOLOGY-

Chemicals utilised for analysis of underground water samples were AR grade purchased from Merck. The site and methodology used for collection and analysis of water samples as-

1.1. Site description and sample collection -

Girna river originates from Girna dam located in Nasik district and initially flows in Chalisgaon tehsil of jalgaon district at geographic coordinates, latitude $20^{\circ} 44'$ and longitude of $73^{\circ} 51'$. Flowing in easterly direction upto Jamada and then turn north toward jalgaon city and finally joins to Tapi River. The samples of underground water have been collected from eight different villages belongs to Chalisgaon Tehsil which are in vicinity of Girna River. The villages which selected for present study are namely- Saygaon (SP₁), Pilkhod (SP₂), Tamswadi (SP₃), Varkhede (BK) (SP₄), Tirpole (SP₅), Jamada (SP₆), Rahipuri (SP₇) and Bahal (SP₈). Water samples were collected from wells of listed villages. The sampling point of respective village within 3 Kms distance from Girna River. The water samples were collected in summer season from 01st February 2022 to 31st May 2022 from wells of selected villages. These samples were collected in last week of each month. In order to determine quality of underground water, collection of samples with proper precaution is most important. In that concern, collection of samples carried out in morning time at 9-10 am from the deep wells of selected villages. Before collecting water samples, the electrical pumps were run for 5 minutes and using the polystyrene bottles these samples were collected. (Polystyrene bottles were pre-washed using detergent, tap-water, followed by alcohol and purified water. The collected samples were immediately labelled and taking them into the laboratory as early as possible. The essential 11 parameters of collected samples were studied using standard methods.[7-9] Also samples were stored and preservation techniques were applied to preserve the samples for further analysis.

1.2. Physico-chemical analysis/Methodology-

The underground water samples from wells of selected villages were collected and analysed by using 11 different parameters. The analysis includes parameters like Temperature, P^H, Electrical conductivity (EC), total

dissolved solid (TDS), Total hardness (TH), biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Alkalinity (AK), Chloride (Cl^-), Phosphate (PO_4^{3-}) and Sulphate (SO_4^{2-}). The parametric evaluation of collected water samples were done using APHA standard and other standard methods of water analysis. [10-13]

The TDS meter was used to measure the pH and temperature of water samples during the time of water collection. The values of pH and Temperature were taken keeping the respective parametric values constant in TDS meter for 60secs. The TDS of respective collected water samples were performed at ambient temperature using TDS meter. Before each measurement, the TDS meter was cleaned with distilled water and wiped with tissue paper. In the determination of Electrical conductivity (EC) pre-calibrated conductivity meter was used. The measurement was carried out at room temperature and after each reading conductivity cell was cleaned with distilled water and wiped with tissue paper. In determination of Sulphate (SO_4^{2-}) in water samples turbidimeter was utilised. The amount of phosphate in water sample were determined by using Spectrophotometer. The complexometric titration method was used for determination of Total hardness (TH) of water using EDTA solution. The COD of water samples were determined using dichromate refluxing method and BOD using incubation followed by titration method. Similarly, alkalinity is measured by titrating with standardised Hydrochloric acid (HCl) solution using phenolphthalein indicator. The Chlorides contents of water samples were determined by argentometric titration carried out by using silver nitrate solution. [9]

RESULTS AND DISCUSSION-

The underground water samples were analysed using 11 parameters like Temperature, pH, EC, TDS, Total Hardness, COD, BOD, Alkalinity, Chloride, PO_4 and SO_4 . The average values for each parameter for specified summer season period are enlisted in Table-1 and the values compared with BIS [14] and WHO standards [15] range in below table.

| Parameter | SP ₁ | SP ₂ | SP ₃ | SP ₄ | SP ₅ | SP ₆ | SP ₇ | SP ₈ | BIS | WHO |
|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------|----------|
| Temp. | 30 | 29 | 29 | 28 | 31 | 29 | 30 | 29 | ----- | ----- |
| pH | 6.9 | 7.1 | 7.0 | 7.2 | 6.8 | 7.1 | 7.2 | 7.1 | 6.5-8.5 | 6.5-8.5 |
| EC | 28.6 | 32.5 | 38.1 | 35.4 | 42.4 | 50.6 | 45.8 | 39.8 | ----- | ----- |
| TDS | 386 | 360 | 394 | 403 | 395 | 742 | 413 | 402 | 500-1000 | 500-1500 |
| TH | 104 | 89.9 | 91.5 | 104.8 | 163.8 | 267 | 147.8 | 157 | 300 | 500 |
| COD | 21 | 19 | 25 | 22 | 28 | 25 | 21 | 21 | ---- | ---- |
| BOD | 4 | 7 | 6 | 10 | 19 | 8 | 8 | 6 | ----- | ----- |
| AK | 104 | 112 | 102 | 96 | 104 | 122 | 108 | 101 | 200 | 500 |
| Cl^- | 18 | 13 | 16 | 12 | 15 | 23 | 12 | 17 | 250 | 250 |

| | | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|------|-----|
| PO ₄ ²⁻ | 0.46 | 0.59 | 0.43 | 0.53 | 0.64 | 0.62 | 0.65 | 0.61 | ---- | --- |
| SO ₄ ²⁻ | 25 | 27 | 30 | 27 | 29 | 36 | 32 | 28 | 200 | 400 |

Table -1:-Analysis data of underground water samples and their acceptable standards.

EC: Electrical Conductivity; TDS: Total Dissolved Solids;TSS: Total Suspended Solids; TH: Total Hardness; COD: Chemical Oxygen Demand; BOD: Biochemical OxygenDemand; AK: Alkalinity, Cl: Chloride; PO₄³⁻ - Phosphate; SO₄²⁻ - Sulphate, BIS- Bureau of Indian Standards, WHO-World Health Organization standard. The observed parameter values are in mg/L except pH; Temp. in °C; EC in µS/cm;

1.3. Temperature and pH of water-

The water samples were collected in summer season and temp. and pH of samples taken at the time sampling. The observed range of temperature found to be in between 28 to 31°C. The pH value of collected water samples were recorded in the range of 6.8 to 7.2 which are in permissible limit of BIS and WHO standards.

1.4. Electrical conductivity- Tables 1 displays the electrical conductivity of underground water samples. Among all recorded EC values, highest value of 50.6 for sampling point SP6.

1.5. Total dissolved solids (TDS)-From the selected well water samples the maximum TDS of 742 mg/l and minimum TDS of 360 mg/l was observed for PS6 and PS2 respectively, as displayed in Table 1. The measured values of TDS are in standard limit but comparatively indicative for application.

1.6. Total hardness- The total hardness studies report the total hardness of water samples in range of 89.9-267 mg/L, which is within the permissible limit. It can be used for drinking.

1.7. COD and BOD- COD of collected water samples ranged from 22-28 and BOD values were found to be in the range of 4-10.

1.8. Alkalinity- As per the BIS and WHO standard the permissible alkalinity is 200 mg/L and 500 mg/L respectively. In our analysis the alkalinity of collected water samples was found in the range of 96-122 mg/L.

1.9. Chlorides -Chloride found in water samples ranges from 12-23 mg/L. The chloride level increases with increase in level of pollution. The amount of chloride within tolerable limit of BIS and WHO standards.

1.10. Phosphate-The analysis of phosphate content in water samples observed in range of 0.42-0.65 mg/L, which is mild level.

1.11. Sulphates-As per the BIS and WHO standard the permissible sulphate limit is 200 mg/L and 400 mg/L respectively. Our analysis of water samples found the sulphates in range of 25-36 mg/L. Which are well within permissible standard limits.

CONCLUSION

The physicochemical analysis of underground water samples from villages of Chalisgaon Tehsil Girna River belt was carried out using standard analysis methods. These studies revealed that all parametric values of

collected samples are within the permissible limit of BIS and WHO standards. Therefore, it is established that underground water from the selected villages is safe to consume and can be utilised for agriculture and other use.

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