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# Physico-Chemical Analysis of Drinking Water of District, Chindwara (M.P.)

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**Abstract**

Human health benefits from drinking clean, fresh water. Surface water is the source of clean, drinkable water. Contaminated drinking water is harmful to human health and can lead to conditions like lung irritation, cancer, paralysis, disorder, neurological, nerve damage, thyroid issues, kidney issues, liver issues, and many more conditions that are also severe issues noted in this study. The ratio of ions and dissolved oxygen, which is fictitiously present in both ground water and surface water, changes abruptly as a result of the mixing of ground water and industrial waste, posing a major threat to human health in the form of water-borne diseases. For this investigation, fifteen locations out of a total of sixty were chosen. Investigations into physico-chemical analyses of ground and surface water in Chindwara were conducted, including measurements of dissolved oxygen (DO), total dissolved solids, COD, BOD, total alkalinity, temperature, and pH. (TDS). All data were compared to industry standards, and our goal is to educate the local population about the water quality they are consuming and encourage them to take the necessary steps to improve it as needed.

**Keywords:** Industrial waste, Physico-chemical, Dissolved Oxygen (DO), Total Dissolved Solids (TDS)

## 1. Introduction-

Groundwater is one of the most dependable sources of supply for potable water in both rural and urban areas of India. Services for water irrigation are available in urban areas but not in rural ones. Compared to groundwater, drinking water from a tube well is pure, uncontaminated, and fresh. Man depends primarily on surface water. Rainfall is the primary source of fresh water protection for Earth, shielding it from disaster-causing droughts and floods. For humans and other living things, access to clean, potable water is a crucial issue. It is crucial that a reserve be used for a variety of objectives. One of India's few sources of drinking water is surface water. India's rural and urban areas rely heavily on surface-based sources of drinkable water. Water that has been purified and is free of pollutants is referred to as potable water. Water that is both fresh and pure is essential for human health. Surface water is the source of high-quality, safe water, but contaminated drinking water is harmful to human health and can cause diseases like lung irritation, lung cancer, paralysis, neurological disorders, kidney problems, thyroid problems, diarrhoea, fingernail loss, hair loss, and other conditions. In remote places, the level of nitrate found in surface water samples taken during the monsoon and examined after the season was found to be below the safety limit. However, with a growing tendency towards the bank, total dissolved solids are above the drinkable limits. Sea water incursion was cited as the cause of intrinsic saltiness. Due to current societal injustices, different locations are experiencing varied levels of ground water pollution. The utilisation of water purification systems and the knowledge of the need for clean water are widely diverse, ranging from modest river osmosis systems used by wealthy urbanites and NRI-funded village organisations to straightforward filtering methods employed in rural areas. Increasing water source monitoring raises public awareness, and drinking clean water is a must for a safe lifestyle. In most regions of the world, unsafe public hygiene issues are caused by contaminated water, incorrect waste management, and poor water administration. Numerous people pass away each year as a result of water-borne illnesses like typhoid, cholera, and schistosomiasis. Overuse and waste of water resources are also a significant burden and a growing threat to many forms of life. This study aims to characterise the various types of water in terms of their temperature, pH, dissolved oxygen (DO), total dissolved solid (TDS), hardness, total alkalinity, fluoride, phosphate, chloride, calcium, magnesium, and nitrate values.

## 2. Methodology:

### 2.1-Sample collection-

A spot was selected for each station in the various Tehsils of the Chindwara district in order to collect ground water samples during the three different seasons of the year: May 2020 (summer), August 2020 (monsoon), and January 2021 (winter). In order to assess TDS, pH, Total Hardness, $Ca^{2+,}$ $Mg^{2+,}$ $Cl^{-}$, $SO_4^{2-}$, $NO_3^{-}$, $F^{-}$, alkalinity, turbidity, and EC, the samples were then analysed. Open dug wells, hand pumps, tube wells, bore wells, and wells used for irrigation or human use all had water samples taken from them. A water sample from a hand pump, tube well, or bore well was immediately collected in a pre-cleaned 2.5 L glass sample bottle after flowing for five minutes. Samples from open-dig wells, on the other hand, were immediately taken in 2.5 L glass sample bottles that had already been cleaned.As soon as possible, samples were examined for BOD, COD, temperature, and turbidity. They were then transported to a lab and examined within fifteen days.

Taste, pH, conductivity, and TDS measurements were made right away after sample collection. Only a panel of 10 lab analysts and coworkers evaluated the flavour to determine whether it was acceptable or not. The portable turbidimeter (Jenway 6035) was used to directly measure the turbidity of the water sample at room temperature. A portable pH metre (Jenway 370) was used to measure pH at room temperature after being calibrated with pH 7 and 4 buffer. After calibrating with calibration solution, the conductivity metre (Jenway 470) measured conductivity and TDS at 25C. (HI-7031, Henna instrument Hungry). 16.9gm NH4Cl (ScharlauChemie, AM 0270) was dissolved in 143 ml of NH4OH to create buffer solution (pH = 10). (Fisher Scientific, UK Limited). 250 ml of deionized water should be diluted with 1.25 gramme of magnesium EDTA. In a 1L volumetric flask, 1.00gm of CaCO3 (ScharlauChemie, CA 0184) was dissolved to create the calcium standard solution. Once the CaCO3 has dissolved, add 200 ml of deionized water and concentrated HCl drop by drop. Burn for around five minutes to release the CO2. The volume is made up of cool and the. 3.723gm of Na2EDTA are required to make 0.01M EDTA solution. After being weighed, H2O (ScharlauChemie, AC 0963) was dissolved in 1L of purified water. To make the indicator powder, combine 100g of NaCl with 0.5g of erichrome black T (Fluka, 45600). (ScharlauChemie, SO 0227). By diluting a water sample of 10 millilitres (ml) to about 50 millilitres (ml) with deionized water, the total hardness of the water was calculated. Add 1 to 2 ml of the buffering liquid (pH 10). Shake thoroughly after adding 250 mg of Sodium Cyanide (ScharlauChemie, SO 0190) and 200 mg of indicator powder. Within five minutes, steadily titrate with EDTA standard solution while stirring continuously until the crimson tint has vanished. Titrate a sample of calcium standard solution to determine its hardness as follows: Hardness (ppm) is calculated as follows: (ml titration for sample × mg CaCO3 equivalent to 1 ml EDAT titrant/ml of Sample) × 1000

## Result and Discussion-

**Table-1 Maximum and minimum values of parameters of ground water quality of Chaurai Tehsil of Chindwara district, M.P. pH**

| Name of station | pH | Mg(mg/ml) | Cl-(mg/ml) | F-(mg/ml) | SO4(mg/ml) | NO3(mg/ml) | Alkalinity(mg/ml) | BOD(mg/ml) | COD(mg/ml) | TDS(mg/ml) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bagbardhiya | 6.85 | 35 | 81 | 0.3 | 22 | 15.9 | 219 | 5 | 13 | 485 |
| Chhinda | 7.41 | 87 | 91 | 0.5 | 23 | 12.1 | 292 | 9 | 10 | 508 |
| Damua | 7.72 | 42 | 87 | 0.3 | 30 | 17.1 | 312 | 11 | 7 | 448 |
| Ghaliwada | 7.32 | 31 | 167 | 1.0 | 11 | 19.3 | 386 | 5 | 8 | 588 |
| Harrai | 7.79 | 29 | 163 | 1.3 | 20 | 8.0 | 460 | 2 | 11 | 738 |
| Jatachhapar | 7.81 | 24 | 111 | 0.2 | 46 | 8.2 | 358 | 4 | 14 | 633 |
| Kohka | 7.10 | 50 | 40 | 1.2 | 15 | 9.2 | 289 | 4 | 8 | 420 |
| Likhawadi | 7.71 | 56 | 110 | 0.3 | 40 | 11.3 | 361 | 6 | 9 | 632 |
| Mandla | 7.65 | 58 | 165 | 0.5 | 35 | 18.1 | 320 | 7 | 9 | 650 |
| Pagara | 7.15 | 48 | 68 | 0.6 | 38 | 12.2 | 351 | 9 | 10 | 624 |
| Rawanwada | 7.20 | 49 | 79 | 0.4 | 16 | 13.6 | 420 | 5 | 8 | 710 |
| Suthiya | 6.95 | 85 | 160 | 0.3 | 12 | 14.8 | 445 | 10 | 12 | 460 |
| Thesgora | 6.98 | 76 | 145 | 1.1 | 35 | 12.9 | 450 | 9 | 13 | 435 |
| Toomdi | 7.64 | 77 | 135 | 1.0 | 34 | 10.1 | 396 | 5 | 12 | 463 |
| Urdhan | 7.30 | 69 | 124 | 0.9 | 38 | 17.2 | 381 | 6 | 9 | 570 |

After exercising-related dehydration, high alkaline, electrolyzed water may also be beneficial.Alkaline water contains alkaline minerals. It is also less acidic than regular drinking water and has a higher pH. Proponents believe it has benefits such as improving your stool and supporting your immune system.

**Table-2 Maximum and minimum values of parameters of ground water quality of TAMIA Tehsil of Chindwara district, M.P.**

| Name of station | pH | Mg(mg/ml) | Cl-(mg/ml) | F-(mg/ml) | SO4(mg/ml) | NO3(mg/ml) | Alkalinity(mg/ml) | BOD(mg/ml) | COD(mg/ml) | TDS(mg/ml) |
|---|---|---|---|---|---|---|---|---|---|---|
| Anhoni | 6.58 | 40 | 83 | 0.2 | 22 | 15.8 | 315 | 6 | 12 | 487 |
| Bamdi | 7.45 | 85 | 30 | 0.4 | 23 | 12.1 | 285 | 10 | 11 | 510 |
| Chaurad ongri | 7.70 | 40 | 98 | 0.2 | 30 | 17.0 | 310 | 12 | 8 | 450 |
| Delakhar i | 7.30 | 32 | 166 | 0.9 | 11 | 20.3 | 385 | 6 | 9 | 590 |
| Gonawad i | 7.81 | 30 | 162 | 1.0 | 20 | 8.0 | 458 | 2 | 12 | 470 |
| Umarbah | 7.83 | 25 | 110 | 0.3 | 46 | 8.2 | 360 | 3 | 15 | 633 |
| Hirripath ar | 7.01 | 30 | 115 | 1.4 | 15 | 9.2 | 300 | 4 | 9 | 635 |
| Itawa | 7.12 | 35 | 85 | 0.6 | 40 | 10.1 | 335 | 6 | 12 | 455 |
| Jhirpa | 7.15 | 36 | 92 | 0.8 | 35 | 18.1 | 360 | 8 | 11 | 610 |
| Kajra | 7.10 | 40 | 60 | 0.9 | 38 | 15.3 | 410 | 10 | 10 | 620 |
| Lotiya | 7.07 | 45 | 65 | 0.4 | 16 | 16.2 | 420 | 11 | 14 | 700 |
| Mordhan | 6.48 | 80 | 150 | 0.3 | 12 | 19.4 | 435 | 10 | 13 | 480 |
| Nagri | 7.25 | 75 | 145 | 1.1 | 35 | 17.2 | 320 | 9 | 12 | 465 |
| Pandupip ariya | 7.35 | 72 | 135 | 1.0 | 34 | 16.2 | 350 | 8 | 10 | 705 |
| Sajkuh | 7.45 | 73 | 124 | 0.9 | 38 | 17.2 | 380 | 4 | 9 | 640 |

The body needs calcium for stronger bones, but only in certain amounts; in excess, calcium can lead to kidney or bladder stones. For improved digestion, the body needs magnesium. Magnesium over a certain limit can irritate the gastrointestinal tract when sulphate ions are present. Results show that there are several regions with high magnesium concentrations. Content of chloride Nearly all bodies of water contain chloride. More over half of common salt is chloride. In addition to having a bad taste, too much chloride also has laxative effects and can lead to kidney and heart damage. In the analysed sites, the concentration of chloride ions is low. Compared to chloride, sulphate has a very minor impact on the taste of water.

**Table-3 Maximum and minimum values of parameters of ground water quality of HARRAI tehsil of Chindwara district, M.P.**

| Name of station | pH | $Mg^{2+}$ (mg/ml) | $Cl^-$ (mg/ml) | $F^-$ (mg/ml) | $SO_4^{2-}$ (mg/ml) | $NO_3^-$ (mg/ml) | Alkalinity (mg/ml) | BOD(mg/ml) | COD(mg/ml) | TDS (mg/ml) |
|---|---|---|---|---|---|---|---|---|---|---|
| Andol | 6.10 | 38 | 82 | 0.4 | 21 | 42.9 | 313 | 6 | 14 | 480 |
| Bargi | 7.41 | 89 | 30 | 0.7 | 21 | 12.13 | 289 | 9 | 11 | 510 |
| Chaurasi | 7.92 | 35 | 98 | 0.4 | 29 | 18.09 | 310 | 11 | 10 | 440 |
| Dendu | 7.42 | 32 | 168 | 0.7 | 10 | 21.33 | 382 | 4 | 11 | 600 |
| Gaorpani | 7.82 | 28 | 165 | 1.2 | 16 | 8.10 | 457 | 2 | 12 | 735 |
| Hadai | 7.86 | 22 | 110 | 0.2 | 43 | 8.42 | 353 | 5 | 16 | 620 |
| Jamuniya | 6.15 | 36 | 60 | 0.4 | 15 | 9.15 | 310 | 4 | 11 | 550 |
| Karapatha | 7.15 | 40 | 65 | 0.6 | 20 | 10.45 | 315 | 6 | 12 | 565 |
| Lohajhiri | 7.10 | 42 | 85 | 0.8 | 36 | 30.36 | 410 | 5 | 15 | 710 |
| Manakwadi | 7.20 | 80 | 160 | 1.1 | 41 | 35.38 | 415 | 3 | 12 | 650 |
| Nachna | 6.95 | 75 | 150 | 1.0 | 34 | 40.10 | 368 | 8 | 11 | 615 |
| Ojhaldhana | 6.85 | 72 | 140 | 0.8 | 20 | 15.20 | 370 | 10 | 14 | 733 |
| Rajadhana | 6.50 | 76 | 143 | 0.7 | 25 | 16.38 | 420 | 9 | 13 | 480 |
| Sukhapura | 7.68 | 68 | 136 | 0.9 | 26 | 17.02 | 415 | 5 | 15 | 520 |
| Unchakheda | 6.15 | 65 | 120 | 1.1 | 38 | 60.20 | 410 | 6 | 14 | 680 |

Despite the fact that nitrate is a compounded form of nitrogen, which is necessary for a plant's proper growth. Fluoride salts, which are present in many minerals, make them soluble. It is essential up to a point because past that point it leads to fluorosis, porous bones, etc. Turbidity The ideal limit is 10NTU. The average soluble oxygen value in groundwater ranges from mg/ to 6.0 mg/l. WHO advises against using water with a DO value less than 3 mg/l as potable water. Water that has been oxygenated tastes good. Water that has a DO below the prescribed threshold may be fatal to aquatic life. BOD The amount of oxygen needed for bacteria and/or protozoa to metabolise organic waste in water is measured by the biochemical oxygen demand (BOD). The value of BDO reduces when BOD levels are high. Total dissolved solids refer to all minerals, salts, and non-volatile inorganic contaminants. The TDS in this study spans from 200 to 6000 mg/l.

**Table-4 Maximum and minimum values of parameters of ground water quality of Parasia Tehsil, Chindwara, M.P.**

Standard values of parameters are also given with each parameter.

| Name of station | pH | Mg(mg/ml) | Cl-(mg/ml) | F-(mg/ml) | SO4(mg/ml) | NO3(mg/ml) | Alkalinity(mg/ml) | BOD(mg/ml) | COD(mg/ml) | TDS(mg/ml) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bagbardhiya | 6.85 | 35 | 81 | 0.3 | 22 | 15.9 | 313 | 5 | 13 | 485 |
| Chhinda | 7.41 | 87 | 91 | 0.5 | 23 | 12.1 | 283 | 9 | 10 | 508 |
| Damua | 7.72 | 42 | 87 | 0.3 | 30 | 17.1 | 308 | 11 | 7 | 448 |
| Ghaliwada | 7.32 | 31 | 167 | 1.0 | 11 | 19.3 | 387 | 5 | 8 | 588 |
| Harrai | 7.79 | 29 | 163 | 1.3 | 20 | 8.0 | 460 | 2 | 11 | 738 |
| Jatachhapar | 7.81 | 24 | 111 | 0.2 | 46 | 8.2 | 360 | 4 | 14 | 633 |
| Kohka | 7.10 | 50 | 40 | 1.2 | 15 | 9.2 | 288 | 4 | 8 | 420 |
| Likhawadi | 7.71 | 56 | 110 | 0.3 | 40 | 11.3 | 360 | 6 | 9 | 632 |
| Mandla | 7.65 | 58 | 165 | 0.5 | 35 | 18.1 | 315 | 7 | 9 | 650 |
| Pagara | 7.15 | 48 | 68 | 0.6 | 38 | 12.2 | 350 | 9 | 10 | 624 |
| Rawanwada | 7.20 | 49 | 79 | 0.4 | 16 | 13.6 | 415 | 5 | 8 | 710 |
| Suthiya | 6.95 | 85 | 160 | 0.3 | 12 | 14.8 | 450 | 10 | 12 | 460 |
| Thesgora | 6.98 | 76 | 145 | 1.1 | 35 | 12.9 | 455 | 9 | 13 | 435 |
| Toomdi | 7.64 | 77 | 135 | 1.0 | 34 | 10.1 | 397 | 5 | 12 | 463 |
| Urdhan | 7.30 | 69 | 124 | 0.9 | 38 | 17.2 | 388 | 6 | 9 | 570 |

On a sample of drinkable water, these minerals were tested. The outcomes were within the parameters of the Test for Minerals. Potable water should have an alkalinity and total hardness of less than or equal to 10 and 300 ppm, respectively. The results were within the parameters of both tests. The season, place, and time of the sampling can all affect the water temperature. Aquatic life finds it more challenging to obtain the necessary amounts of oxygen as water temperature rises. Changes in the community structure of aquatic species can result from thermal pollution.

The lake's turbidity fluctuates from 4 NTU to 11 NTU. Some environments are inherently very turbid, however due to human activity, many habitats now have higher suspended solids levels. Total dissolved solid measurements in the lake range from 668 ppm to 942 ppm. High levels of suspended solids can sometimes almost completely remove algae and other macrophytes, reducing the primary Productivity of the system. The low oxygen level was observed during the summer and was mostly caused by the demand for oxygen during the decomposition of organic matter and the removal of free oxygen by bacteria and other animals through respiration. For the majority of aquatic organisms, DO is the most crucial gas. The majority of the biota in the aquatic system would be killed if the level of free oxygen fell below 2.0 mg/l for a few days in a lake holding aquatic organisms. Higher free carbon dioxide values are correlated with lower dissolved oxygen levels. Generally speaking, animals, birds, and aquatic life use habited water.

The average pH of the water samples used in the study was 7.9, with a standard deviation of 0.5. In assessing how corrosive water is, pH is crucial since, in general, the lower the pH, the more corrosion will take place (WHO, 1996). At all stages of water treatment before distribution, careful attention to pH is necessary for optimal clarity and disinfection to reduce water corrosion. Human hair fibres swell during extreme ($pH > 11$) exposure, which also irritates the skin, eyes, and mucous membranes. Low pH likewise has similar effects to high pH, and the intensity of these effects increases as pH drops (WHO Working Group, 1986). The WHO advises against customers objecting to or disliking the taste of drinking water. The 2.1% of water samples analysed were found to have unpleasant tastes, especially due to the significant degree of hardness. The flavour of water will be affected by the presence of organic (humic acid, hydrophilic acids, carboxylic acids, etc.), inorganic (salts and ions), and biological (algae, fungi, protozoa) substances (WHO, 1999). The salt concentration in water must be nearly equal to that in saliva for the water to taste neutral, even if the flavour change caused by hardness may vary from community to community (Bartoshuk, 1974).

**Conclusion and Future Prospects-**

A better understanding of the quality of the ground water in Madhya Pradesh was made possible by mapping the spatial distribution of ground water contaminants. It is claimed that shallow ground water and industrial wastewater regularly mingle during the monsoon. Numerous businesses discharge partially treated sewage into the canal. The main cause of elevated TDS is the percolation of residential sewage and waste water. TDS levels were consequently found to be relatively high in the areas where the Lake or canals are located. Furthermore, the amount of household sewage produced in this area increases along with the population. Water's flavour is changed by TDS concentrations above 500 mg/l, becoming salty, bitter, or metallic. TDS concentrations above a particular threshold signify the presence of poisonous minerals that are harmful to human health. In prior years, sulphate concentration readings at over half of the sites were either below or somewhat above the threshold. The study's conclusions show that sulphate content rises uniformly and gradually in every region. As a result, but not at an alarming rate, sulphate pollution has increased. It was found throughout the examination that there is a significant variation in the quantity and quality of waste water flow, which is discharged as a mixture of sewage and industrial effluents. Additionally, quality drastically declines in the direction of the downflow, and TDS measurements from some bore well and tube well samples are higher than what is permitted by drinking water standards. Thorough monitoring of the ground water quality of the Industrial Zone deep aquafer system is necessary due to the significant volume of effluent discharge produced as well as the widespread pollution of shallow ground water in many industrial regions.

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