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Assessment of Physico-Chemical Parameters of Erai River of Chandrapur District in Maharashtra State

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ABSTRACT: Due to increase population, advanced agricultural practices, industrialization, man- made activity, water is being highly polluted with different contaminants. In present situation, the waterway water has become wastewater because of removal of city squander through which it streams. Water is a vital resource for human survival. His accessibility of good quality water is an essential component for forestalling infections and improving personal satisfaction. It is necessary to know details about different physico-chemical parameters such as color, temperature, total dissolved solids, Total hardness, and pH, dissolve oxygen, chemical oxygen demand, used for testing of water quality. Chandrapur city is developing rapidly due to industrialization seeing that ultimate too many years. It's far considered as fourth most polluted city in India. the existing look at become completed which will have an expertise approximately the pollution status of Chandrapur district, particularly first-rate in location of business area and mining initiatives. Environmental studies have been achieved on floor and floor water to discover the physico-chemical parameter like TDS. it is necessary to accrued sample from distinct sites, for you to compare the consuming water first-rate in and around Chandrapur district. The analysis of various parameters the use of trendy methods (APHA/NEERI) and their assessment with WHO (international health corporation) standards values, suggest that most of the parameter within permissible limit given by critical pollution manipulate board of India (CPCB). awareness of parameters beyond the bounds in some regions might be reduced and could be a useful source for domestic functions within the vicinity. the existing challenge bills water satisfactory of diverse websites situated in Chandrapur and their efficiencies respectively. Commonly Water is a great solvent and chooses up impurities easily. Natural water is tasteless, colorless, and odorless. "Dissolved solids" consult with any minerals, salts, metals, cations or anions dissolved in water. Total dissolved accommodates inorganic salts (basically calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulphates) and a few small amount of organic be counted which might be dissolved in water. We typically speak TDS for freshwater machine only, as salinity consists of some of the ions contributing within the definition of TDS. The look at of water fine for streams, rivers and lakes is the maximum critical application of TDS, despite the fact that TDS is not primary pollutant, however TDS used as a hallmark of aesthetics characteristics of consuming water and as indicator of the presence of extensive array of chemical contaminant. In this project the study was carried out during monsoon for a period of two months (July-August) of the Erai River in the Chandrapur district of Maharashtra, to determine the quality of river water. Various Physico-chemical parameters such as rainfall, pH, turbidity, color, TDS, DO, etc.

KEYWORDS: TDS (Total Dissolve Solids), Turbidity, Dissolved solids, Suspended solids, Hydroponic, Gravimetry, conductivity,Surface water, Physico-Chemical Parameters

I. INTRODUCTION

The physico-chemical profile and biological analysis of flora and fauna is needed to obtain a clear picture of the underlying water conditions in a freshwater ecosystem. In recent years there is increase in water pollution as side effect of industrial and anthropogenic activities. The increase in load of pollutants bring about a rapid shift in the biota of the ecosystems and thus affect the water quality and subsequently biodiversity of the area. In view of this there is need for designing an appropriate framework to safeguard our natural resources for sustainable environmental management. Today water bodies throughout the world are medium to heavily polluted by man's negligent attitude and investigations are needed to overlook the changes.The environmental aspects of the earth are linked in a closed loop of which water is the essential component in the sustenance of the living organism. Water occurs on earth in various forms, one of which is liquid. The purest form being rain makes its way towards water bodies increasing their level when falls on the earth and provides moisture to the crops for cultivation. The study was carried out during monsoon for a period of two months (July-August) of the Erai River in the Chandrapur district of Maharashtra, to determine the quality of river water. Various Physico-chemical parameters such as rainfall, pH, turbidity, color, TDS, DO, etc., were determined and the final result was evaluated from the average determined from a period of two months. The samples were collected

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from five different locations of Erai River. Erai River is the tributary river of the Wardha River which meets to Erai River at Hadasti village. The turbidity was found greater and Dissolved oxygen was found almost negligible in the water. This indicates the river was polluted during monsoon which is a serious threat to aquatic life.

II. LITERATURE REVIEW

[1] M. M. Akhtar and Zhonghua tang (june 2013): In various developing countries, groundwater pollution arises from various sources, such as sewers, rivers, industrial and agricultural sectors, which can contain highly complex toxic elements. , policies and proper enforcement of environmental laws have made groundwater systems unsuitable for the general public. Pakistan's second-largest city, Lahore, faces similar problems. About 36% of the groundwater samples had high concentrations from the Pakistan Quality Control Agency (PSQCA) and 1.5% exceeded the WHO standards for drinking water. According to 2010 groundwater chemical analysis data, most areas have adequate drinking zones. However, there is a higher risk of continuous contamination. Finally, this study identifies highly contaminated groundwater, facilitating identification of actual contaminants. Therefore, we need practical strategies to protect aquifers .

[2] Soni Chaubey and Mohan KumarPpatil (november 2015): Shows relationships between variables and shows that one variable actually causes a change in another. In this paper, 52 data on drinking water from different sources in his four areas (i.e, Khaparkheda Water Supply, Koradi Gram Panchayat, Koradi Devi Mandir and Bokara) in the hot and dry climate city of Nagpur Use the point statistical regression method. Made in Maharashtra, Central India. Samples were collected from October 2013 to May 2014. This technique was based on the study and calculation of correlation coefficients between various physicochemical parameters of drinking water. The results were further compared with drinking water quality standards published by the World Health Organization (WHO) and concluded that most water samples were not potable.

[3] Tan C. W, Thishalini A., Goh, E. G.andEdlic S.: synthetic water was used to study the relation of turbidity with suspended solid, velocity, temperature and time. Results indicated that turbidity increases with increasing temperature, suspended solids concentration, and velocity, but reduces with time. In phase there were four set of parameter-modified and four set of respective control water samples. Parameter-modified water samples were subjected changes of temperature (25-70 oC), pH (5-10), color (red, yellow, blue, orange, green, brown, and black at 500 mg/L), and conductivity (100-1000 µS/cm). Results showed the relation of these parameters fell between most likely positive and negative. In addition, the current proposed model gives a high R-squared (> 0.969), low mean square error, and has a p value lesser than 0.05.

[4] Anurita Sharma (2015), We have established that clean drinking water is the foundation of good health. The aim of this study was to analyze the physico-chemical properties of Chandigarh tap water. Tap water was sampled from different locations in Chandigarh and physico-chemical parameters such as color, odor, temperature, pH value, turbidity, electrical conductivity; total dissolved solids (TDS), dissolved oxygen and salinity were analyzed. The tested water samples showed that the values of various parameters were within his BIS (Indian Bureau of Standards) / WHO (World Health Organization) guidelines. Although it was concluded that the quality of the tested water samples was acceptable based on various physico-chemical parameters, regular monitoring of drinking water is recommended as human health is affected. It is important.

[5] Bhalme S.P and Dr Nagarnaik P.B (2012), It was explained that this study was based on the analysis of drinking water parameters in an educational institution in Nagpur, Hingna MIDC Region. From this, it was concluded that the quality of drinking water is deteriorating due to the progress of industrialization, and appropriate water analysis and pretreatment are required.

[6] Boob T.N (2014), It declared that providing clean and affordable water that meets human needs is a major challenge of the 21st century. Water supplies around the world are struggling to keep up with rapidly increasing demand exacerbated by population growth, global climate change and deteriorating water quality. The need for technological innovation to enable integrated water management cannot be overemphasized. The world will face a significant freshwater crisis in the coming decades due to high levels of surface and groundwater pollution. Groundwater is the ultimate and optimal freshwater resource for human consumption in both urban and rural areas. Groundwater quality reflects information about natural and anthropogenic sources of pollution. A study was conducted in his Pusad city, Yavatmal district, India to determine the groundwater quality of parameter d. H. TDS, Hardness, Ph, Chloride, Fluoride, Nitrate levels in water. Experimental analysis shows that fluoride, chloride and hardness are within limits. TDS and nitrates are unacceptable, degrading groundwater quality and contributing to cardiovascular damage, immunodeficiency, coordination problems, premature aging, cancer, coronary artery disease, atherosclerotic heart disease and cardiovascular disease. It causes various diseases such as mathemoglobinemia and Blue-Baby. cause syndromes, etc.

[7] G. Devendra Dohare and Vyoma Gupta (2014), Suppose the human body contains approximately 60% water, and water is used in many ways in most human activities. It is thus observed that early human civilizations were spread along the riverbanks. If the water quality of the water area deteriorates, it will be in a disadvantageous situation and

cannot be used for various purposes such as swimming, recreation, and raw water supply. According to the Central Environmental Management Board (2008), 90% of all water supplied to Indian cities is polluted and only 1.6% of it is treated. Therefore, water quality management is fundamental to human well-being. A safe supply of water in sufficient quantity is needed at a suitable location and at a reasonable cost to consumers. Therefore, the performance of water treatment plants had to be evaluated and monitored by analyzing various physicochemical and bacteriological parameters.

[8] Devangee Shukla, Kinjal Bhadresha, Dr Jain N.K and Dr Modi H.A (2013), Water has established itself as one of the most important of all known natural resources on earth. It is important to all living things, most ecosystems, human health, food production and economic development. Drinking water safety is important to your health. Drinking water safety is affected by a variety of contaminants, including chemicals and microbes. Such pollutants pose serious health problems. Because of this drinking water, drinking water becomes bad and sometimes such bad water causes many diseases in humans, so it is necessary to test the water quality.During the investigation, WHO (1971) and BIS (1991) found that the maximum number of physical and chemical parameters proposed by was within desirable limits.

[9] Dhawale P.G and Ghyare B.P (2015), It declared that water resources are essential for both natural ecosystems and human development. It is essential for agriculture, industry, and human existence. A healthy aquatic ecosystem depends on physicochemical and biological properties. The quality of water resources depends on numerous physico-chemical parameters and biological properties. We assess that monitoring of these parameters is essential to determine the extent and source of exposure to contamination. These traits can identify specific conditions in an organism's ecosystem and suggest appropriate conservation and management strategies.

[10] Dhirendra Mohan Joshi, Alok Kumar, and Namita Agrawal (2009), It was mentioned that a systematic study was conducted to evaluate the water quality index of Ganga River in Haridwar District. Ninety water samples were collected from five sampling stations and analysed for physicochemical parameters (temperature, flow rate, pH, dissolved oxygen, free CO2, C.O.D., B.O.D., carbonate, bicarbonate, total alkalinity, hardness, turbidity, calcium, magnesium, sodium, potassium, nitrate, phosphate, chloride, sulphate and conductivity, total dissolved solids and total suspended solids). The study area has a seasonal climate, which can be roughly divided into three seasons: winter (November to February), summer (March to June), and rainy season (July to October).

III. OBJECTIVES

The objectives of the present study are as follows: -

1. To analyse water physically, chemically, and biologically parameters.
2. To study the causes of water contamination.
3. To examine how to improve the water quality.
4. Effect of various impurities on human health.
5. To investigate techniques for minimizing the water impurities.
6. To find opportunities for water conservation.
7. To perform the various possible water tests and observe water quality.

IV. PROPOSED METHODOLOGY

4.1 ERAI RIVER CHANDRAPUR DISTRICT PROFILE

The Erai River is one of the many rivers that the Chandrapur district is endowed with. The centre of it is situated in latitude 19°57'31.67"N and longitude 79°16'37.18"E. It is a major river in Chandrapur and a tributary of the Wardha River. In the Chimur taluka, the Erai River rises close to Kasarbodi village, where it merges with the Wardha River close to Hadasti village. It is 78 kilometres long and totally contained inside Chandrapur district. Erai Dam, a structure built across the river, is there. The dam has a height of 30 m and a length of 1620 m. The volume content of the dam is 985 km3 and gross storage capacity is 226,500.00 km^3. The Municipal council in Chandrapur district supplies drinking water to the local public from Erai river dam. This dam over the river was constructed by the Maharashtra State Electricity Board (MSEB) for commercial purposes. The Erai River provides a vital source of water for those who live in and around Chandrapur city. Chandrapur city and Chandrapur Super Thermal Power Station (CSTPS) receive the majority of its water supply. The river began to become contaminated after the construction of significant companies like M/s CSTPS and Western Coalfields Limited (WCL), and it is currently struggling for air. The population of Chandrapur increased from about 50,000 when the drinking water delivery scheme from the Erai was started to more than 3 lakhs today.The environmental aspects of the earth are linked in a closed loop of which water is the essential component in the sustenance of the living organism. Water occurs on earth in various forms, one of which is liquid. The purest form being rain makes its way towards water bodies increasing their level when falls on the earth and provides moisture to the crops for cultivation. The Erai River in Maharashtra's Chandrapur district was the subject of a study to ascertain the quality of the river's water over a two-month monsoon period (July–August). Numerous physico-

chemical factors, including rainfall, pH, turbidity, colour, TDS, and DO, were measured, and the final outcome was assessed using the average over a two-month period. The samples came from five distinct Erai River areas.Erai River is the tributary river of the Wardha River which meets to Erai River at Hadasti village. The turbidity was found greater and Dissolved oxygen was found almost negligible in the water. This indicates the river was polluted during monsoon which is a serious threat to aquatic life. Erai River, which is the backbone of the Chandrapur Super Thermal Power Station (CSTPS), lifts 304 MLD of water daily from the river for its operation. Further, 54 MLD of whole water is supplied to the city and surrounding villages for domestic activities. A part of it is also used by commercial institutions and religious establishments. As the city does not possess any treatment plant to treat the incoming sewage, a large amount of effluent has been discharged into the river, making the river most polluted and contaminated for aquatic life as well as for local people. The entire home waste stream as well as a portion of the CSTPS's processed waste are dumped into the river. In addition to this, further M/s WCL opencast mines use river water. In order to ensure that there is enough drinking water for the city throughout the summer, the industries, particularly CSTPS, must restrict their water use. Additionally, to being utilised for irrigation, the water is also used for washing clothes and bathing animals. The water quality has decreased as a result of agricultural runoff polluting river water.

4.2 EXPERIMENTAL STUDY

4.2.1 Physico-Chemical parameters:

The following properties of Erai River were evaluated:

1. Rainfall
2. Temperature
3. pH
4. Calcium
5. Alkalinity
6. Color
7. Conductivity
8. Turbidity
9. Hardness
10. Taste
11. TDS
12. Odor
13. Chlorides
14. DO
15. Nitrates
16. BOD
17. Phosphates
18. COD
19. Sulphate
20. Free CO_2
21. Fluoride

4.2.2 Sampling Sites

The samples were collected from five different places at five different locations of Erai River. The tests were performed using standard methods of APHA and Indian Standard. The sampling stations were selected based on the criteria of incoming load in to the river due to population density, industrial areas as well as anthropogenic activities such as mining and also ease of collection of water samples. Many regions within 10 km buffer zone were dense forest and there was also no human settlement and hence less discharge. The total path traced for all sampling stations was 23.3 km. Hence, the first sampling station (S1) was the starting point of the path upstream and located near Datala road, approx. 6.7 km from Erai River. The second station (S2) was near Wadgaon Bridge and located 2.9 km from Erai River. The third sampling station (S3) was 7.9 km downstream of Erai River near Balaji Ward (Bimba Gate), the fourth station (S4) was taken near son chafamahadev mandir (charwatgaon) 12.3 km downstream, and the last and fifth station (S5) was at the Hadasti village 16.6 km from Erai River and was the location from where the Wardha river flows towards Erai River.

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[Fig.4.1: Datala Road, Station 1]

[Fig.4.2: Wadgaon Bridge, Station 2]

[Fig.4.3: Balaji Ward, Station 3]

[Fig.1.4: Chafamahadev mandir, Station 4]

[Fig.1.5: Wardha river flows towards Erai River, Station 5]

4.2.3 Sample Collection

The samples were taken from five different locations and were collected during day time for a time period of 2 months. The method of collection was as per APHA.

Table 4.1: Latitudes and Longitudes of Sampling Stations

Stations	Latitude	Longitude	Remarks
S2	19°57'47.84"N	79°16'40.65"E	Upstream
S2	19°59'27.64"N	79°15'48.44"E	Upstream
S3	19°56'32.25"N	79°16'56.46"E	Downstream
S4	19°54'17.81"N	79°17'43.85"E	Downstream
S5	19°52'28.33"N	79°17'16.98"E	Downstream
Wardha &Erai River	19°52'31.24"N	79°18'10.30"E	Confluence point at village Hadasti

Table 4.2: Parameters and Test methods

Parameters (Units)	**Methodology**	**IS Code**	**Equipment Used**	**Detection Limit**
Rainfall (mm)	Physical Method	IS 4986: 2002	-	-
Color	Visual comparison	IS 3025 (Part 4)	Platinum cobalt	-
Taste	Physical Method	IS:3025 (Part 7&8)	-	-
Odor	Quantitative Human Receptor	IS:3025 (Part 5)	-	-
Turbidity	Nephelometric	IS:3025 (Part10)	Nephelo	0.1

(NTU)			turbidity meter	
Temperature (ºC)	Mercury Thermometer	APHA	Thermometer	0.001
pH	Potentiometric	IS:3025 (Part 11)	pH meter	0.1-12
Alkalinity (mg/L)	Titrimetric	IS:3025 (Part 23)	Burette	1.0
Conductivity (µs/cm)	Conductivity cell potentiometric	APHA	Conductivity meter	10
Total Hardness (mg/L)	EDTA titrimetric	IS:3025 (Part 21)	Burette	1.0
Total Dissolved Solids (mg/L)	Gravimetric method	IS:3025 (Part 16)	Desiccator	1.0
Dissolved Oxygen (mg/L)	Winkler's titrimetric method	IS:3025 (Part 38)	Burette	0.1
BOD (mg/L)	Bottle incubation at 27ºC	IS:3025 (Part 44)	Incubator	0.1
COD (mg/L)	Open Reflux	IS:3025 (Part 58)	Digester	0.01
Free CO2	Titration	APHA	Conical flask	0
Chloride (mg/L)	Argentometric Titration	IS:3025 (Part 32)	Burette	1.0
Fluoride (mg/L)	Electrochemical probe method	IS:3025 (Part 60)	Millivolt meter	0.001
Sulphate (mg/L)	Gravimetric method	IS:3025 (Part 24)	Desiccator	1.0
Phosphate (mg/L)	UV Spectrophotometric	APHA	Visible spectrophotometric	0.1
Nitrate (mg/L)	UV Spectrophotometric	IS:3025 (Part 34)	Colorimeter	0.001
Calcium (mg/L)	EDTA titrimetric	IS:3025 (Part 40)	Hot plate	1

4.3 TEST ANALYSIS

Sampling was carried out for a period of two months i.e., July and August 2022 and results were obtained concerning each parameter in order to evaluate the final result based on the average calculated for the respective time period. The water analysis was done in the laboratory for selected parameters and precautions were taken such as addition of preservatives during transit of samples.

V. RESULTS AND DISCUSSION

5.1 RESULTS

Table 5.1: Analysis Result of Surface Water at 5 stations

Parameters (Units)	Station 1	Station 2	Station 3	Station 4	Station 5
Rainfall (mm)	37.1	35.6	68.2	71.8	119.18
Color	Turbid	Turbid	Turbid	Turbid	Turbid
Taste	Objectionable	Objectionable	Objectionable	Objectionable	Objectionable
Odor	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
Turbidity (NTU)	40	45	50	50	55
Temperature	30	30	29	29	28

(ºC)					
pH	7.83	7.84	7.86	7.84	7.86
Alkalinity (mg/L)	128	129	130	130	131
Conductivity (µs/cm)	0.46	0.47	0.47	0.47	0.49
Total Hardness (mg/L)	152	155	156	157	157
Total Dissolved Solids (mg/L)	158	138	172	184	196
Dissolved Oxygen (mg/L)	0.4	0.4	0.5	0.5	0.6
BOD (mg/L)	9.9	9.3	10	9.5	8.6
COD (mg/L)	29	31	30	32	35
Free CO2	2.26	2.5	2.50	2.76	3.25
Chloride (mg/L)	119	120	120	121	122
Fluoride (mg/L)	0.2	0.2	0.3	0.5	0.5
Sulphate (mg/L)	56	56	57	58	58
Phosphate (mg/L)	1.2	1.2	1.3	1.4	1.5
Nitrate (mg/L)	1.99	2.0	2.1	2.1	2.2
Calcium (mg/L)	36	37	38	38	39

Rainfall: Rainfall is one of the factors which are essential for all forms to sustain life. Rain water is the purest form of water but as it comes down and finds its way towards the water bodies, it carries many impurities such as sand, clay, etc. with it, thus deteriorating the quality of the water bodies. It is the important source for agriculture and for daily domestic activities. Hence it is important to measure the quality and quantity of rainfall. During the study, the rainfall in the month of July was found in the range of 0 – 71.9 mm, 71.9 mm being the maximum precipitation recorded on 14th July, 2022. Whereas another highest precipitation was recorded on 3rd August, 2022 as it ranged between 0 – 119.9 mm.

Color: Color is one of the physical parameters in determining the quality of water. It ranges from 5-20 mg/L. It was observed that the color of water samples at all sample locations was turbid due to presence of more clay and silt content during monsoon.

Taste: Taste in water is due to presence of dissolved minerals and dissolved inorganic salts. It is essential to maintain the temperature of laboratory and free from other disturbing odors while determining the taste of water. From the result, it was found that the taste of all water samples was objectionable due to high turbidity.

Odor: Odor in water bodies is due to dissolved gases like H2S, CO2, and NH3 and can also be due to the presence of decayed vegetation matter or aquatic organisms. The type of odor should be described by judging the degree of sweetness, pungency, smokiness and rottenness of the odor such as rotten egg, burnt sugar, soapy, fishy, septic, aromatic, chlorinous, alcoholic odor or any other specific type. Hence, the odor of water samples was quite unobjectionable as a large quantity of rain water had been mixed with it.

Turbidity: Turbidity in the water is due to presence of suspended solids like clay, silt, etc. and also due to presence of decayed vegetational matter. It is expressed in NTU. The instrument used to measure turbidity is Nephelometers and it is very precise method, and measures turbidity up to 0-1 NTU. This method is based on principle of scattering of light. The results for turbidity were beyond the desirable limit as prescribed by the BIS. The turbidity of water samples ranged from 40-55 NTU and was very high.

Temperature: Temperature is one of the factors influencing physico-chemical parameter of water. The temperature of water should be in the range of 20-35 ºC for adequate biological growth. An increase in temperature of 10 ºC doubles the biological activity. Temperature also affects the amount of oxygen that can be dissolved in water, rate of photosynthesis of plants, metabolic rates of animals, and the sensitivity of organisms to toxic wastes, parasites and diseases. The temperature was within the range of BIS i.e. from 28 – 30°C and was suitable for aquatic life.

pH: The pH is one of the most important parameters to be determined and is defined as the negative logarithmic of hydrogen ion concentration. For aquatic organisms to thrive, the pH of water should be in the range of 6.5- 8.2. The permissible limit given by BIS is also from 6.5-8.2. Low pH indicates high acidity which causes corrosion in pipes and increases solubility of certain heavy metals. High pH indicates high alkalinity; they induce formation of tri-halomethanes which are toxic. The results of pH were observed within range i.e. 7.82-7.86 as prescribed by the BIS. Hence, the water was suitable for aquatic life to survive.

Alkalinity: Alkalinity is defined as ability of water to neutralize acid without change in pH. The pH and alkalinity are closely related. High alkalinity shifts pH to the right and helps to remove dissolved carbon dioxide from water. Alkalinity in water is due to presence of carbonate, bicarbonate, silicate, phosphate and hydroxyl ions in water. If alkalinity of carbonate ion is present in water, then it is known as carbonate alkalinity and alkalinity of HCO3 - is present then it is bicarbonate alkalinity and if OHis present, then it is caustic alkalinity. The presence of alkalinity in water causes incrustation of pipelines and formation of white deposits. When CO2 reacts with water, it forms carbonic acid (H2CO3). The reaction obtained is reversible. Alkalinity is measured in terms of calcium carbonate due to presence of minerals in water. The results of alkalinity were desirable i.e. from 128 – 131 mg/L which indicates water is good for aquatic life.

Conductivity: Electrical conductivity indicates the amount of ions or dissolved solids present in water. More is the salinity of water, higher is the conductivity. It is expressed in micromoles/cm. It is related to the sum of the cations or anions, and is correlated, with the total salt concentration. Electrical conductivity is a rapid and precise method and is always expressed at a standard temperature of 25°C to enable comparison of readings taken under varying climatic conditions. The conductivity of water samples was observed very low i.e., from 0.45 – 0.49µm/cm. This is because the study was conducted during monsoon and rainfall dilutes the water.

Total Hardness: Hardness is defined as the soap consuming capacity of water. It has two types: Temporary hardness and Permanent hardness. Temporary hardness is mainly due to presence of bicarbonates and carbonates salts of calcium and magnesium which can be removed through boiling whereas Permanent hardness occurs due to presence of sulphates and chlorides of calcium and magnesium ions which cannot be removed by boiling and requires treatment processes such as ion exchange resin method for their removal. The permissible limit for hardness is 600 mg/L and consumption above the limit can cause diseases such as heart attack and scaling in water distribution pipes. The study found that the amount of total hardness was in the range of 152 – 157 mg/L which indicates that water can be used for domestic purposes.

Total Dissolved Solids (TDS): It is due to presence of solids in water which changes color of the water, and is the sum of cations and anions concentration. A high content of dissolved solids elevates the density of water, influences osmoregulation of fresh water organism, and reduces solubility of gases like oxygen and also utility of water for drinking, irrigation and industrial purposes (Maiti, 2004). High levels of TDS results in excessive scaling in pipes and low levels may be unhealthy for plants and fish. A large number of solids are found dissolved in natural waters, the common ones are carbonates, bicarbonates, chlorides, sulphate, phosphate and nitrates of calcium, magnesium, sodium, potassium, iron etc. The test results obtained from the experiment predicts that water was rich in solids i.e., from 138 – 196 mg/L. This was due to the heavy precipitation in the month of July and August which influences surface run-off.

Dissolved Oxygen (DO): DO is the presence of oxygen that is dissolved in water and which helps aquatic plants and animals to grow and breathe. Due to presence of sewage in water, microorganisms consume that oxygen to breakdown organic content in wastewater. As a result, its amount decreases leaving aquatic animals devoid of it. For water to be fresh, DO should be above 5 mg/L. From the study, it was observed that the results of the DO were very low i.e. from 0.4 – 0.6 mg/L. These indicate that the water is almost devoid of oxygen which increases threat to aquatic life.

Biochemical Oxygen Demand (BOD): It is defined as the amount of oxygen required by the microorganisms such as bacteria to completely decompose organic matter under aerobic condition. It is most important parameter in determining the water quality. A BOD value between 4-6 mg/L is recommended. More the BOD more is the pollution. The incubation period for this test is generally 5 days starting from day 0 to day 5 at 20ºC.

From the study, it was observed that the BOD values were high, and ranged from 8.6 to 10 mg/L which indicates the water was not healthy for aquatic life to survive and it could cause fish death.

Chemical Oxygen Demand (COD): It can be defined as the amount of oxygen required to oxidize organic and inorganic matter in presence of strong oxidizing agent such as KMnO4. It is expressed in mg/L and is time efficient process. COD values should always be 2.5 times greater than BOD values because COD measures the total matter decomposed. The permissible limit is 10 mg/L for domestic purposes. As the BOD and COD are corelated, the COD of water samples was also high and beyond permissible limit as it ranged from 29 – 35 mg/L.

Free CO2: Carbon dioxide is readily soluble in water and is present in the water bodies in dissolved gas form. Free CO2 is the major dominant acid present in the water bodies and its quantity above 15 mg/L is the indicator of pollution in the water bodies. The ratio of the carbon dioxide to carbonate and bicarbonate ions acts as a major control for pH in the water bodies. At a temperature range of 0-30°C, the solubility of CO2 is 200 times more than that of oxygen. This increased level of CO2 makes aquatic life difficult to utilize the limited amount of O2 and make their survival strenuous. Hence, it is important to determine the quantity of free CO2 in water. The amount of free CO2 in the water samples was within the range of 2.25 – 3.25 mg/L and was low.

Chloride: Main sources of chloride in river water are from industrial effluents, agricultural run-off, pesticides, insecticides, etc. if present. Excessive chloride concentration increase rates of corrosion of metals in the distribution system, and can lead to increased concentration of metals in the supply (WHO, 1996). It may be injurious to some people suffering from diseases of hearts and kidneys. Taste, indigestion, corrosion and palatability are affected. The permissible limit is 1000 mg/L and desirable limit is 250 mg/L. The results from the study showed that the chloride content in the water was within desirable limit i.e. from 119 – 122 mg/L.

Fluoride: Fluoride is present naturally in all water bodies and ingestion of excess fluoride, most commonly in drinking-water, can cause fluorosis which affects the teeth and bones. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems. The desirable limit of fluoride is 1.0 mg/L and permissible limit is 1.5 mg/L as per Indian standards. The study found that the results of fluoride were within desirable limit and ranged from 0.2 – 0.5 mg/L which indicate fluoride content was low in water.

Sulphate: The desirable limit for sulphate is 200 mg/L and permissible limit is 400 mg/L according to Indian standards for drinking. Beyond the desirable limit may cause gastrointestinal irritation when Mg or Na is present. The sulphate content in drinking water exceeding the 400 mg/L impart bitter taste and may cause gastro-intestine irritation and catharsis (Kakar 1989). The sulphate ranged from 56 – 58 mg/L in the water sample and was within desirable limit.

Phosphates: The major sources of phosphate are domestic sewage, detergents, agricultural runoff with fertilizers and industrial waste water. High concentration of Phosphate may cause vomiting and diarrhea and can stimulate secondary hyperthyroidism and bone loss. Its higher concentration indicates pollution and is due to industrialization and urbanization. The desirable limit for phosphate is 0.5 mg/L and permissible limit is 1.0 mg/L according to Indian standards for drinking water. Beyond the desirable limit eutrophication and kidney stone with calcium may take place. The results of the phosphates from the study showed that it was beyond permissible limit i.e. from 1.2 – 1.5 mg/L and is the cause of eutrophication in the water body.

Nitrates: The desirable limit for nitrate is 45 mg/L and permissible limit is 100 mg/L. Presence of nitrate is the main cause of water pollution. Excessive amount of nitrate can lead to methemo-globinemia. The nitrate ranged from 1.9 – 2.2 mg/L in the water sample which indicates it is within permissible limit and was low.

Calcium: Calcium is present on earth's crust in abundance and occurs in various forms some of which are calcium carbonate, calcium sulfate, calcium fluoride, etc. It is one of the important sources of mineral and is also important for human body. Excessive amount of calcium make water hard and unfit for drinking. A desirable limit of up to 60 mg/L is considered good for consumption. The calcium ranged from 36 – 39 mg/L in the water sample and was not hard for consumption.

5.2 SUMMARY

The study shows that the turbidity of the water samples is very high, maximum at village Hadasti. Here, the Wardha River meets Erai River; Wardha River being the major river of Chandrapur city is greater in wide and length. Also the study was carried during monsoon, when there is an increase in the level of the River water due to precipitation falling directly into the river. When the precipitation occurs on land, the rain water finds its way to the water bodies mixing with the surface pollutants and deteriorating the quality of the river. The DO level was extremely low and almost

negligible which present a serious threat to aquatic life. The study also found that the phosphate range is beyond permissible limit as prescribed by the BIS. Thus, from the present study it can be concluded that the water cannot be used directly for domestic activities and also for irrigation due to large phosphate content and BOD values. These may contaminate the agricultural soil making it uncultivable.

VI.CONCLUSION

The water quality is dependent on the type of pollutant added. River water quality is poor in summer season than winter Season. This could be due to the fact that the microbial activity get reduced due to low temperature, thereby keeping DO level at a very satisfactory range during entire winter season. The physic-chemical parameters are varying with sources of pollutants.Because Chandrapur city is bordered by numerous industries, it is certain that the population would grow over the next few decades. Water availability and demand will rise, encouraging the consumption of high-quality water for drinking. Designing an appropriate treatment facility and sewage system to handle incoming waste will help to lessen the river's pollution burden. Since the rainy seasons are often modest, water must be conserved by installing a rainwater collection system. Although there is relatively little chance of flooding in the city or the surrounding area, having dams could help to safeguard the city. Additionally, a lot of enterprises use the river's water, making it the most valuable water supply.

VII.FUTURE SCOPE

The study emphasizes the need to regularly monitor groundwater quality in order to assess pollution activity from time to time and take appropriate control measures in a timely manner to reduce the severity of pollution activity. Analytical reports show that water levels around the industrial zone have already reached alarming levels with health implications. Large industrial sampling points nearby should provide safe drinking water for people surrounded by industry or rehabilitate people from this point on as they are a major source of pollution. Urban areas, a lot of industrial activity takes place, especially in congested and densely populated areas. They may represent threshold limits and therefore require treatment for safe human consumption. may spread over the study area. Results from early epidemiological studies indicate that even low concentrations of TDS in drinking water have beneficial effects. However, the presence of high concentrations of TDS in water can be objectionable to consumers due to its taste and excessive skin deposits on water pipes, heaters, boilers and household appliances. Water with extremely low TDS levels may also be unacceptable to consumers because it is bland and tasteless. It also often corrodes the water supply system.

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