# *Study of Physico-Chemical Characteristics of Water Ponds of Rajnandgaon Town, Chhattisgarh*

Hemlata Mahobe
Retd. Principal, Govt Digvijay College, Rajnandgaon
Purnima Mishra
Chemist, P.H.E, District-Rajnandgaon

**ABSTRACT:-**

Physical Chemical qualities of water samples from six major ponds situated in Rajnandgaon district of Chhattisgarh have been evaluated on seasonal basis from January to December 2012. Samples were analyzed for various physico-chemical characteristics like temperature, colour, Turbidity, pH, Electrical conductivity, Total alkalinity, Chloride, Total Hardness, Calcium ion, Magnesium ion, Total dissolved solid, Fluoride, Sulphate, Nitrate, Dissolved oxygen, BOD and Total coliform. Out of these six ponds Lakholi talab is most polluted. The nitrate content of sample 3 is above prescribed limit of BIS. All these six water bodies are not suitable for domestic and drinking purposes, proper treatment is necessary before their use for drinking purpose.

**KEYWORDS :-**

Physico-chemicals, Water ponds, Water quality, Drinking Water standard, Pollutants, sewage.

**INTRODUCTION :-**

Water plays an important role in the development of healthy society. It is the most abundant and most useful compound in the world and hence it is called 'Jeevan' in Sanskrit. Life is not possible without water . 70% surface of earth is covered by water, Majority of water available on the earth is saline in the nature only 3 % of exists as fresh water. Fresh water has become a scare commodity due to over exploitation and pollution (Ghosh and Basu 1968: Gupta and Shukla 2006, Patil and Tijare 2001; Singh and Mathur, 2005)

Ponds have been used since time immemorial as a traditional source of water supply in India. A pond is referred to as a man made or natural water body which is between 1 $m^2$ and 2 ha in area, which hold water for four month of the year or more. The water of ponds are polluted mainly due to discharged water waste, water from residential area, sewage outlets. Solid wastes, detergents, automobiles oil

waste (Bhuiyan, J.R., Gupta S.A. 2006) Pollution of surface and ground water is great problem due to rapid urbanization and industrialization. Rajnandgaon is the primary town of Rajnandgaon District in the state of Chhattisgarh. It is on the Bombay Howrah line of South Eastern railways. The town is surrounded by ponds and rivers and is known for its small scale industries and traders. The National Highway six also passes through the town of Rajnandgaon.The normal rain fall of the district is 1273.4 mm.(www.cgwb.gov.in)

**MATERIAL AND METHODS :-**

**2.1 Sample Collection -**

Water samples were collected from six different ponds located in Rajnandgaon town. The sampling sites are Budha Talab. (S-1), Rani Sagar (S-2), Motitalab (S-3), Indira Sarover (S-4), Shankarpur Talab (S-5) and Lokholi Talab (S-6). The samples were collected in pre-cleaned and sterilized polyethylene bottles and collected with a column water samples from at least five spots in each experimental pond between 8.00 to 9.00 am at a depth of 30 cm below the water surface. The samples were mixed together in a plastic container and brought into Laboratory and were stored in $4^0$C for further analysis.



**2.2Analytical Methods -**

Samples for analysis with standard procedure in accordance with standard method of American Public Health Association APHA 1996 and National Environment Engineering and Research Institute. (NEERI) Nagpur. Analytical regents, chemicals were employed for the preparation of all solution. Freshly prepared double distilled water was used in all experiments. The pH of samples were measured with the help of wagtech international Potatest pH meter. Turbidity was measured by Digital Turbidity meter model 33I EI, Electrical conductivity was measured b conductivity meter. [Esico Microprocessor based conductivity meter, Model 1601], TDS was measured with the help of Digital TDS meter, E.I., model 651.

Nitrate, Sulphate, Flouride and Iron measured by spectrophotometer. [Double Beam Spectrophotometer EI Model 2375]. The total hardness, Ca ion, Mg ion has measured titrimetricly by using EDTA. Chloricle by Mohr's Argentrometric titration and $K_2CrO_4$ as indicator. Dissolved oxygen by Winklor's method. Total alkalinity was determined by titrimetric method using phenolphthalein and methyl orange indicator. Presumptive test using macconkey Broth was performed for water sample to detect the presence of total coliform.

## 3 RESULT AND DISCUSSION

The result obtained by physico-chemicals analysis of all parameters for two season are given in table 1.

### 3.1 Temperature :-

Temperature varies in the range of between 27.4$^0$C to 28.3$^0$C and 18.4 to 19$^0$C in summer and winter respectively. The temperature of water is one important parameter which directly influence some chemical reactions in aquatic ecosystem the significant correlation between ambient temperature was studied by (Ganpati 1943, 1962 and Verma 1967).

### 3.2 pH -

pH was measured by pH meter. pH value of pond water varies between 7.1 to 7.9 and 6.8 to 7.3 during summer and winter season respectively indicating well permissible limits. The pH of (sample-6) Lokholi Talab is highest it is slightly alkaline.



### 3.3 Electrical Conductivity -

Electrical conductivity indicates the capacity of electrical current that passed through the water. Which in turn is related to concentration of ionized substances present in it. E.C. varried from 601 to 1220 and 540 to 980 micro mhos./cm in summer and winter season respectively. It is maximum for sample No. 6.

### 3.4 Dissolved Oxygen –

The dissolved oxygen varries from 2.5 to 4.5 and 3.4 to 5.4 in summer and winter season. Quality of water depends on D.O. Occurance of low DO value has been attributed to the process of decomposition of organic matter involving the utilization of oxygen. The DO level in sample-6 is lowest.

### 3.5 Biological Oxygen Demand -

BOD is a measure of the dissolved oxygen consumed by microorganisms during the oxidation of reduced substances in water. It is a good index of pollution and therefore helps in deciding the suitability of water for consumption. The BOD level in sample 6 is highest in both season it may be due to human / animal activities in the pond e.g. washing, defection etc.

### 3.6 Total Dissolved Solid :-

The Electrical conductivity of water samples correlates with the concentration of TDS of water. The range of TDS of analysed water samples varried between 390.7 to 793 mg/l & 351 to 657 mg/l in summer and winter season. The highest TDS value was observed at sample No. 4 in summer season. All samples are non saline as per the salinity classification. (Table-2) suggested by Robinove et al (1958).

**Table 2 Classification of water on the basis of salinity value**

| TDS (ppm) | Description |
|---|---|
| <1000 | non saline |
| 1000-3000 | slightly saline |
| 3000-10,000 | Moderately saline |
| >10,000 | Very Saline |

**3.7 Turbidity -**

Suspension of particles in water interfering with passage of light is called turbidity. Turbid water is undesirable from aesthetic point of view in drinking water supplies and may also affect product in industries. The range of turbidity of analyzed water samples varied between 2.6 to 24 N.T.U. and 1.1 to 10 N.T.U. in summer and winter season.



**3.8 Total Alkalinity -**

Alkalinity is the buffering capacity of water. It is constituted principally by carbonates and bicarbonates of calcium, Magnesium, Potassium and Sodium, which appear in the water in the form of natural salts.

Hydroxide or caustic alkalinity seldom exists in the samples. In the summer, the alkalinity varies from 225 Mg/L to 360 mg/l while in winter it varies from 185 mg/l to 341 mg/l.

**3.9 Total Hardness -**

Hardness is the soap destroying property of water which is largely produced as result of prevalence of carbonate of Calcium. In present study the total hardness of summer water ranges between 140 mg/l to 460 mg/l in winter while it varies from 170 mg/l to 540 mg/l in summer season. Upadhyaya (2013) was reported total hardness was high during summer similar result were observed in the present study. On increasing temperature rate of evaporation of water also increases which increase the hardness.

**3.10Chloride -**

The chloride ranged from 53.3 to 160.8 mg/l in summer and 48 to 124 mg/l in winter. Chloride of all samples was below the permissible limit. The maximum $Cl^-$ concentration was observed at S-2 (166.8 mg/l) in summer Excessive prevalence of chlorides in the raw water may be indicative of pollution from human and animal wastes.

**3.11 Fluoride -**

Fluoride is a health related water quality parameter because it forms the principal part in the human's dietary intake. In present study Fluoride concentration in all these samples found to be almost free from Fluoride ions.

**3.12 Nitrate -**

The nitrate ranged from 0.0 to 47.84 mg/l and 0.00 to 42.4 mg/l in winter. The maximum nitrate content was found in S-3 in summer.

Nitrate represents the final stage of mineralization of nitrogenous organic matter such as dead green plants and animals. As such higher value of nitrate in the water may be indicative of sewage pollution.

**3.13 Sulphate -**

The sulphate concentration are varied from 21.1 to 114.1 mg/l during summer where as 12.2 to 80.2 mg/l in the winter season. The result showed that the Pond Water have permissible range of Sulphate ions.



**3.14 Iron -**

Iron is biologically on important element which is essential to all organisms. In present study Iron concentrate in all these samples found to be negligible.

**3.15 Total Coliform -**

The maximum numbers of total coliform were found to be 2400 MPN per 100 ml of water in S-6 during summer season and the minimum number of Total Coliform is found in S-4 i.e. 1609 MPN/ 100 ml. in winter. The fairly high values of total coliform is indicative of increasing pollution of the ponds by organic means particularly through the discharge of sewage and domestic effluents into the ponds.

**4. Conclusion -**

With increase in industry more waste is generated which causes both surface and groud water pollution. Bacteriological pollution in drinking water causes different types of health problem like diarrhea, skin disease and etc. More than 70% of the disease is water borne in nature.

All ponds are polluted but Lakholi Talab more polluted because of Colliform bacteria.

**5. Acknowledgement -**

The authors are thankful to the Dr. Alok Mishra head, department of chemistry D. M.V. Rajnandgaon and Principal Dr. R.N.Singh for providing necessary Laboratory Facilities.

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Comparison of two seasons

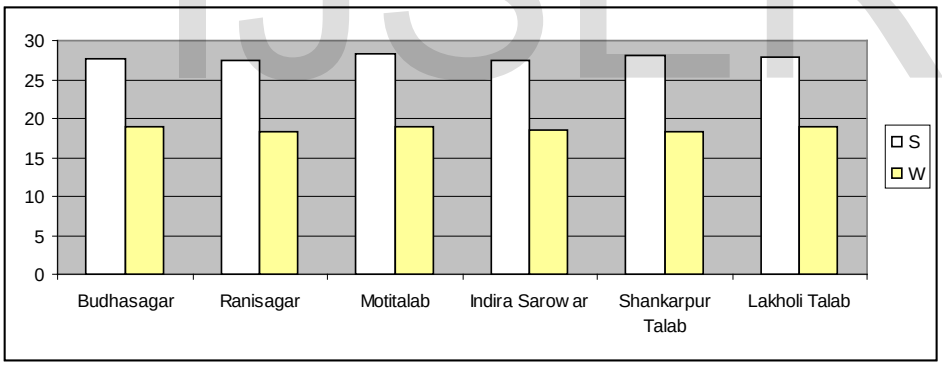


***Fig 1 – Analysis of Temperature***

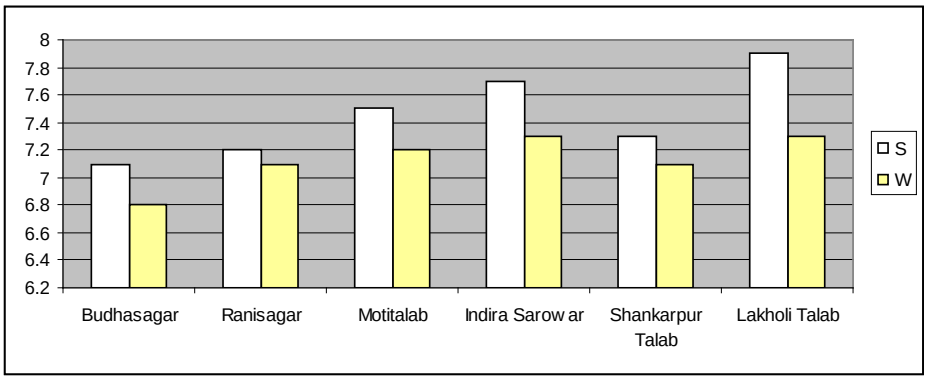


***Fig 2 – Analysis of pH***

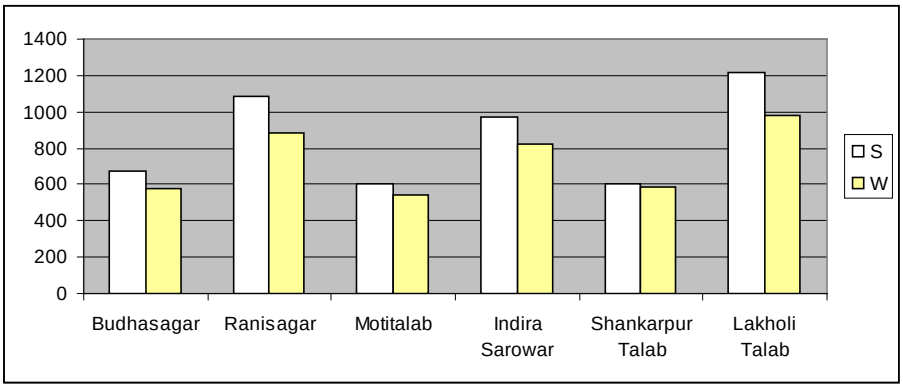


***Fig 3 – Analysis of EC***

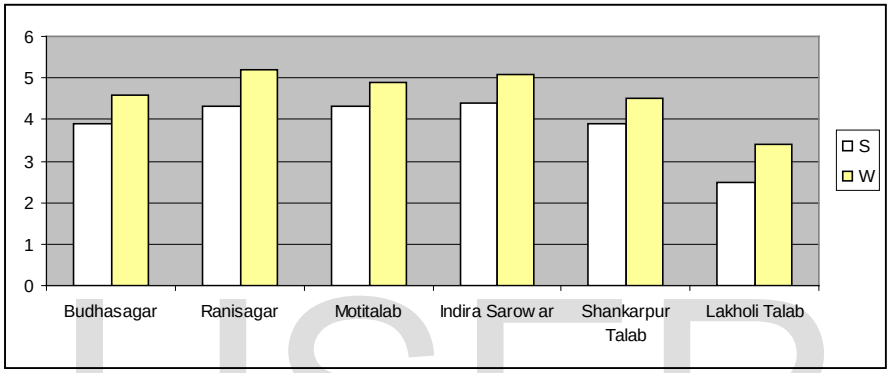


***Fig 4 – Analysis of DO***

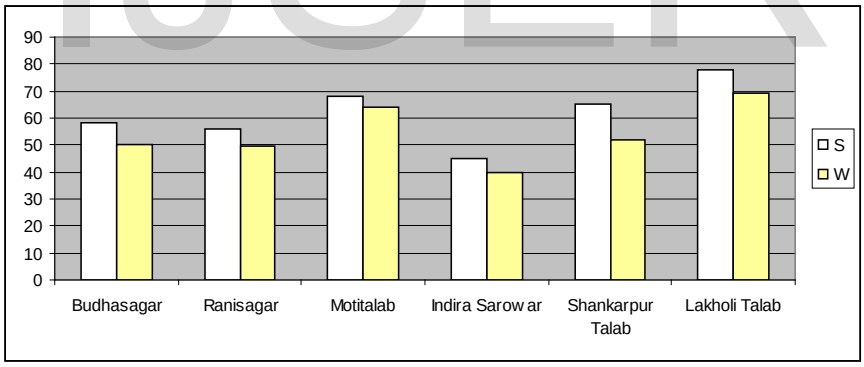


***Fig 5 – Analysis of BOD***

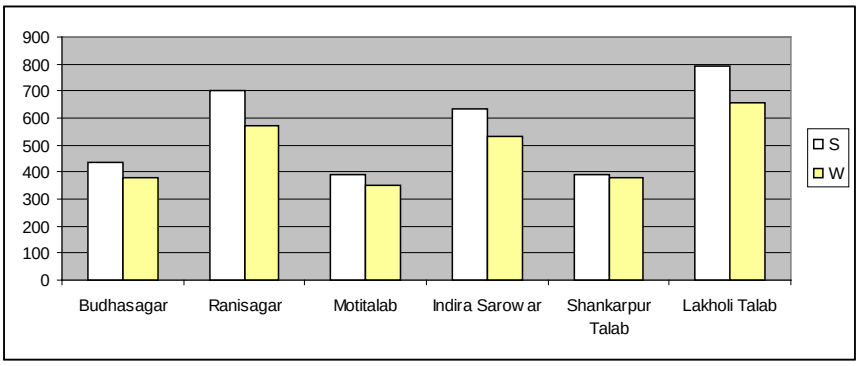


***Fig 6 – Analysis of TDS***

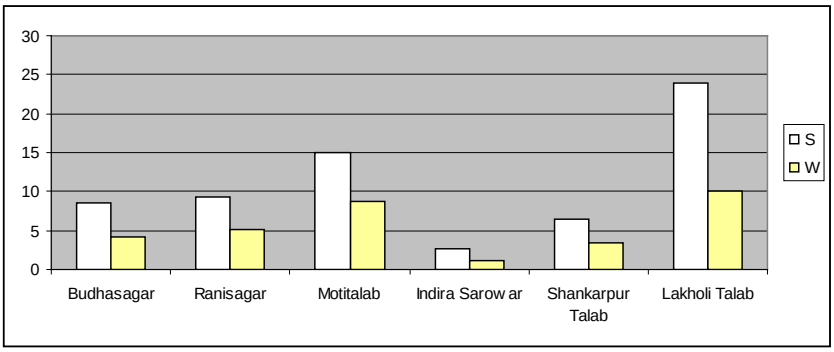


***Fig 7 – Analysis of Turbidity***

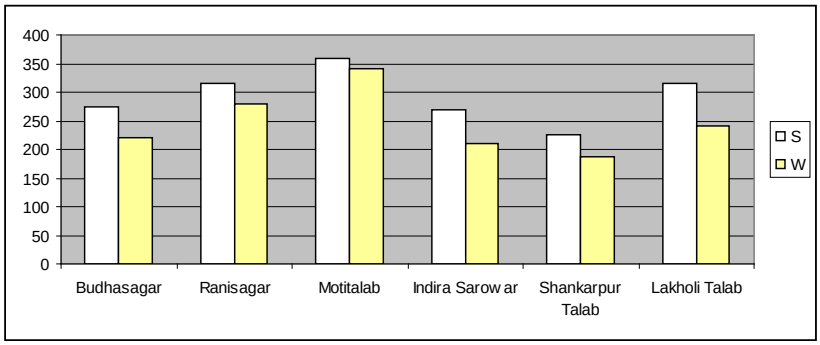


***Fig 7 – Analysis of Total Alkalinity***



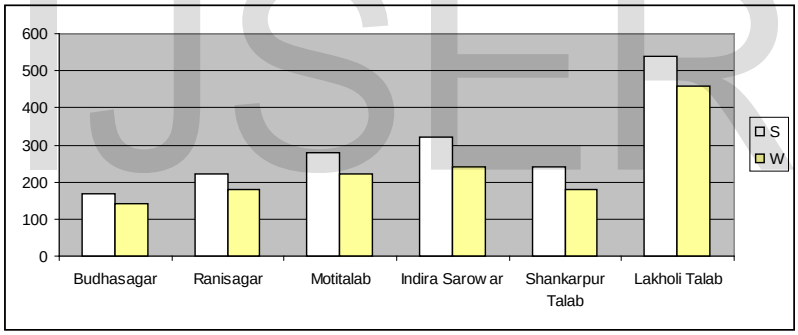


***Fig 8 – Analysis of Total Hardness***

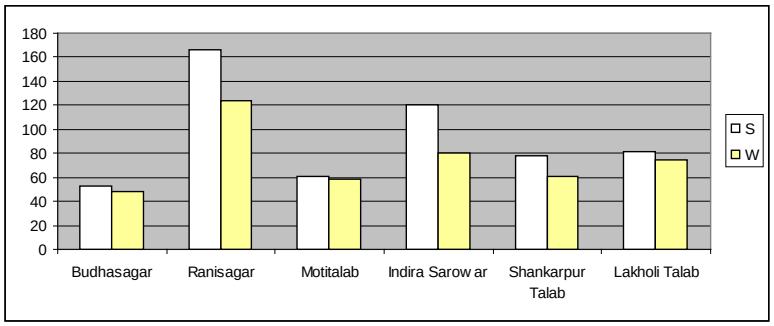


***Fig 9 – Analysis of Chloride***

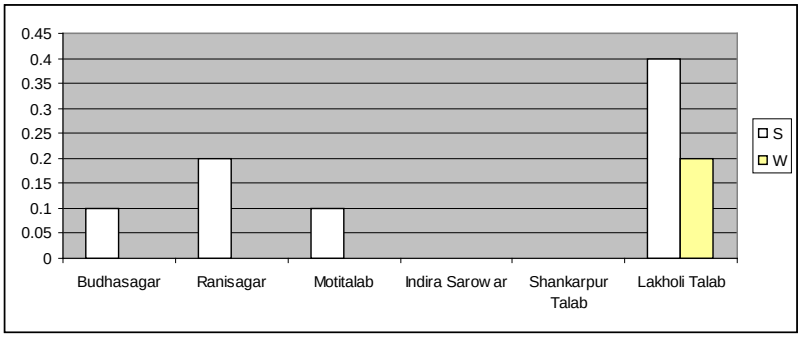


***Fig 10 – Analysis of Fluoride***

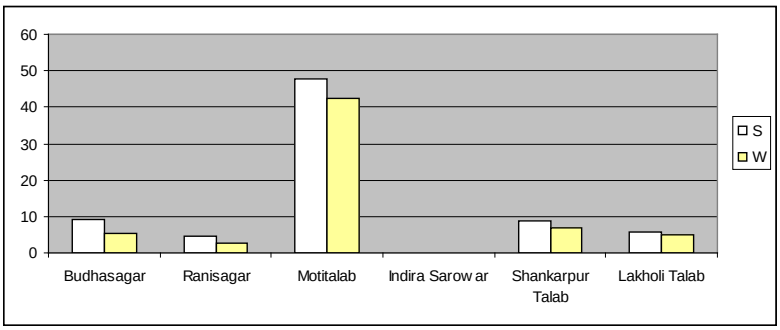


***Fig 11 – Analysis of Nitrate***

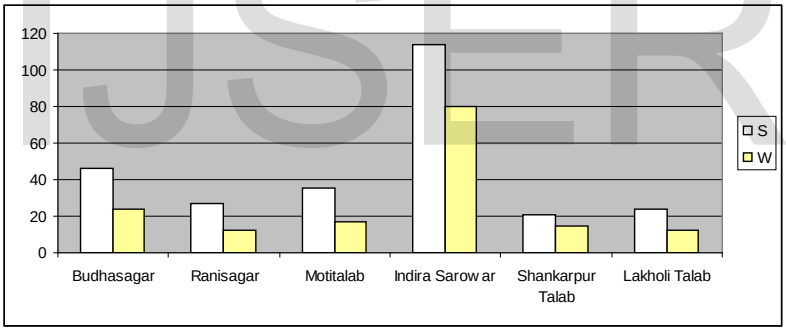


***Fig 12 – Analysis of Sulphate***

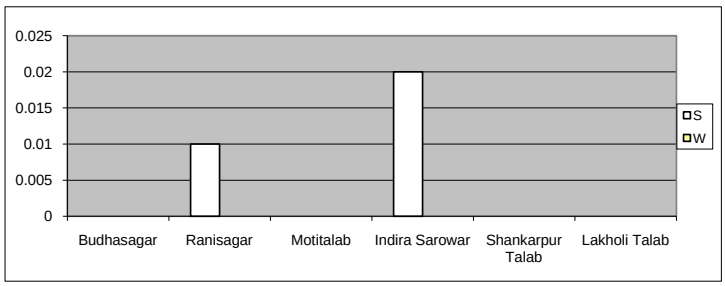


***Fig 13 – Analysis of Iron***

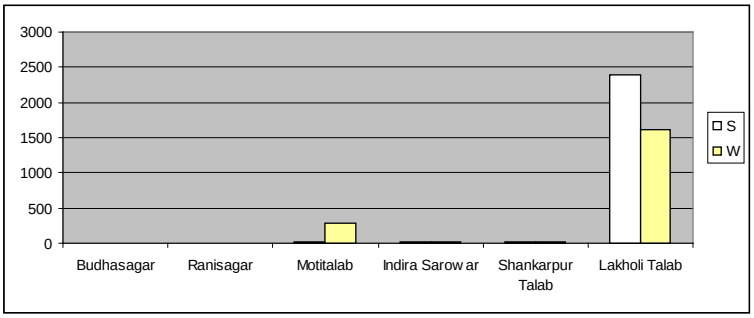


***Fig 14 – Analysis of Total Coliform***

***Table 1:-Values and concentration of various parameters in Pondwater samples of Rajnandgaon town***

| Sr no. | Parameters | Sample 1 | | Sample 2 | | Sample 3 | | Sample 4 | | Sample 5 | | Sample6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | s | w | s | w | s | w | s | w | s | w | s | w |
| 1 | Temperature$^{o}$c | 27.6 | 19 | 27.4 | 18.4 | 28.3 | 19 | 27.4 | 18.6 | 28 | 18.4 | 27.9 | 18.9 |
| 2 | p$^{H}$ | 7.1 | 6.8 | 7.2 | 7.1 | 7.51 | 7.2 | 7.7 | 7.3 | 7.3 | 7.1 | 7.9 | 7.3 |
| 3 | Electri.cond.(micromho/cm) | 670 | 580 | 1084 | 880 | 601 | 540 | 974 | 820 | 603 | 585 | 1220 | 980 |
| 4 | Dissolved oxygen (mg/l) | 3.9 | 4.6 | 4.3 | 5.2 | 4.3 | 4.9 | 4.4 | 5.1 | 3.9 | 4.5 | 2.5 | 3.4 |
| 5 | BOD (mg/l) | 58.4 | 50.2 | 56.07 | 49.87 | 68 | 64 | 45 | 40 | 55 | 52 | 78 | 69 |
| 6 | TDS (mg/l) | 436 | 377 | 704.6 | 572 | 391 | 351 | 633.1 | 533 | 392 | 380 | 793 | 657 |
| 7 | Turbidity (NTU) | 8.6 | 4.2 | 9.3 | 5.2 | 15 | 8.8 | 2.6 | 1.1 | 6.4 | 3.4 | 24 | 10 |
| 8 | Total Alkalinity (mg/l) | 275 | 220 | 315 | 280 | 360 | 341 | 270 | 210 | 225 | 186 | 315 | 240 |
| 9 | Total hardness (mg/l) | 170 | 140 | 220 | 180 | 280 | 220 | 320 | 240 | 240 | 180 | 540 | 460 |
| 10 | Ca ion (mg/l) | 48.1 | 34 | 72.14 | 40.08 | 88.2 | 64.1 | 112.2 | 72.1 | 40.1 | 48.1 | 136.3 | 104.2 |
| 11 | Mg ion (mg/l) | 12.2 | 14 | 9.72 | 19.44 | 14.6 | 14.6 | 9.72 | 14.6 | 34 | 14.6 | 48.6 | 48.6 |
| 12 | Chloride (mg/l) | 53.3 | 48 | 166.8 | 124 | 60.4 | 58.2 | 120.7 | 80.4 | 78.1 | 60.2 | 81.65 | 74.2 |
| 13 | Fluoride (mg/l) | 0.1 | 0 | 0.2 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0.2 |
| 14 | Nitrate (mg/l) | 9.2 | 5.5 | 4.6 | 2.6 | 47.8 | 42.4 | 0 | 0 | 8.9 | 6.8 | 5.9 | 4.8 |
| 15 | Sulphate (mg/l) | 46.2 | 24 | 27.2 | 12.2 | 35.5 | 16.8 | 114.1 | 80.2 | 21.1 | 14.4 | 23.6 | 12.2 |
| 16 | Iron (mg/l) | 0 | 0 | 0.01 | 0 | 0 | 0 | 0.02 | 0 | 0 | 0 | 0 | 0 |
| 17 | Total Coliform (MPN/100 ml) | 5 | 8 | 4 | 6 | 10 | 278 | 24 | 26 | 17 | 21 | 2400 | 1609 |