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# Study of Physicochemical Parameters to Analyse the Quality Status of A Few Water Bodies of Pali District, Rajasthan

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## Abstract

Study has been conducted to determine the water quality of various physico-chemical parameters. 54 samples were taken during the course of study from January 2018 to December 2018 from different sampling site and analyzed for physicochemical parameter such as pH, temp, conductivity, BOD, DO, COD, Hardness, Conductivity, TDS, Chloride, phosphate, nitrate etc. The study reveals that value of some parameters were above the maximum permissible level. The data was compared with standard value prescribed by WHO and BSI.

**Keywords**: Physicochemical Parameter, Conductivity, Hardness Etc.

## Introduction

Water is most important component of ecosystem which is essential for survival of all organism and sustains life on the earth[1]. Freshwater bodies are generally semi natural ecosystems constructed by man for water storage located along with human habitations[2]. Different Contaminants such as heavy metals, chemicals, salt bacteria, viruses have polluted water supply system[3]. River Pollution is most severe problem world wide due to industrial and agriculture effluent. Approx 70% of total available water is polluted mainly by sewage and industrial waste[4]. Water resources are continuously being polluted by increased industrialization, human activities chemical fertilizers used in the agriculture. Waste water due to anthropological avctivities release into the water bodies, causing contamination that affects flora and fauna of aquatic ecosystem.

Polluted aquatic ecosystem change the water quality status, which destroy biotic community present within ecosystem, hence use of contaminated water creates health

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hazard effects, cause of infection and water borne diseases in human population such as dysentery, typhoid, cholera etc[5]. Therefore the drinking water quality should be necessarily analysed at regular intervals.

Interdisciplinary work by Various scientific departments can helps to analyse the pollutant status of water bodies including river, lake, dam, pond, canal etc[6]. Management and maintenance of water bodies requires latest information of water quality, so that quality improvement planning can be regualte before their complete destruction. Analysis of various physicochemical parameters and their correlation are required for the physico-chemical indices[7].

Aquatic organism and their growth is influenced by seasonal variation in some important factors such as Temperature, pH, nutrients, hardness, dissolved oxygen etc[8]. Hence analysis of physico- chemical, biological and microbiological parameters are important for assessment of water quality[9]. Present study includes the assessment of different physicochemical parameters of few water bodies of Pali district, Rajasthan.

## Material and method

Selected area for present study is Pali District (latitude 25.771315, 73.323685) located in western part of state Rajasthan. a few water bodies of pali district were selected as sampling stations I, II, III.

## Sample collection

Three different sampling stations were identified in selected Study area from where samples were taken during different seasons (summer, winter and monsoon) continuously from January 2018 to December 2018. BOD bottles and other plastic bottles (500ml) were used for collection of samples. After proper labeling sample were brought to the research lab in ice box.

## Physico-chemical study

Measurement and analysis of some factors like pH, dissolve oxgen, temperature was done on site immediately after collections. Some samples were fixed in separate BOD sample bottles for Dissolved Oxygen (DO). following parameter were studied at host institute using standard protocol[10-12]. Analytical grade chemicals were used for measurement of certain parameters. Water pH, Temperature, electrical conductivity, hardness, total dissolved solids, B.O.D., C.O.D., total suspended solids, dissolved oxygen, free $CO_2$, alkalinity, chloride, magnesium (mg/l), sodium (mg/l),

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potassium (mg/l), carbonate (mg/l), bicarbonate (mg/l).

## Result and discussion

The results obtained by analysis of collected water samples for the study of variations in physicochemical Characteristics during different seasons are shown in table-1. There mean values are represented in Graph–1, 2 and 3.These are the value of water samples collected in different seasons and the value indicate change in quality of water from different location. These Results are discussed here with respect to the following parameters.

**Temperature** is a major factor for aquatic life[13]. Water temperature is important because it determines various abiotic characteristics of aquatic ecosystem. It directly affects properties of water and hence the activities of aquatic organisms. Measured values of temperature in present study ranged from 18º(Dec. and Jan.) to 38.6°C (June) .Value of temperature showed upward from winter to summer season than downward from rainy season onwards.

**pH** determines acidic or basic character water at a particular temperature. The pH value ranges between 7.33 to 10.65 in water samples. For drinking water the permissible limit of pH is within 6.5 – 8.5 as suggested by Bureau of Indian Standard (BIS). The maximum pH obtained in summer is due to Decrease in photosynthesis hence low oxygen, more carbon dioxide and bicarbonates accumulation are reason for increase in pH during the summer month[14] and minimum was during monsoon due to the dilution of water by addition of rain water[15]. pH is also related to conductivity and alkalinity[16].

**Dissloved Oxygen (DO)** contend was found very lesser than the desired value 3-5mg/L as per BIS guideline which indicates high level of pollution. Maximum value of DO were found in rain season and minimum in summer season.

**Hardness** is a specific parameter of water body that depends upon ions like magnesium and calcium. Calcium ions make major contribution to the hardness of river water. The total hardness ranged from 192 to 332 mg/L in which maximum value recorded in summer season and lowest value in the winter season.the permissible limit for hardness is 300 mg/l according to APHA[17].

**Biochemical Oxygen Demand (BOD)** is key factor for the analysis of water quality and he are indirect measurement of organic material present in water. BOD is the amount of oxygen required to decompose

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organic substance present in water. maximum value of BOD was 688 mg/l recorded in monsoon season.

**Chemical Oxygen Demand** (COD) is COD can be defined as quantity of dissolved oxygen required to oxidise organic material present in water. COD value ranged from 510mg/l to 1788mg/l. The minimum C.O.D. was observed in monsoon season and maximum was in summer.

**EC (Electrical Conductivity)** is defined as capacity of water to conduct electric current and it indicated the purity of water[18]. The prescribed limit of EC in drinking water is 1.500 µs/cm. The EC value ranged from 7500 to 18500 Ω/cm. The maximum conductivity was shown in monsoon season. After that conductivity decreased so conductivity was minimum in winter season. EC values are useful for estimation of the dissolved solids. Higher conductivity values indicate highest dissolved solids (acid, base, salts etc) concentration in water and vice versa[19].

**Total Solids** includes both suspended solid and dissolved form. And they contributes to enhance productivity in the water body. **Total dissolved solids (TDS)** indicates the differnt kinds of minerals present in water. TDS in the sampled water ranged from the 2340 to 4365 mg/L. The highest TDS reported maximum 540.68 mg/l in summer season and minimum in rainy season. The permissible value for TDS is 500 mg/l recommended by IS and BIS, FAO.

**Total Suspended Solid** is the amout of solid left behind after removal of dissolved solids from total solids. Its value ranged 320 to 844mg/L and showed variation in differen seasons. Minimum Mean value of TSS was in monsoon and maximum was in summer.

P**hosphate** concentration is major limting factor in aquatic ecosystem. Phosphate concentration was highest in summer season (21 mg/L) and lowest in monsoon season. (6.40 mg/L). Phosphate concentration increased in water bodies may be due to the release of sewage and high rate of evaporation in thar desert.

**Nitrate** concentration is determined by activity of nitrifying microbes. Maximum value of nitrate (149 mg/L) was observed in summer season and minimum (0.0115mg/l) was in monsoon season.. Major source of Nitrates are sewage discharge, water from agricultural fields and industrial effluent input[20].

**chloride** concentration is an important parameter for study of contamination by sewage. It can be measured by titrating sample water with standard solution of

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silver nitrate. Observed value of Chloride concentration ranged from 1150-1890 mg/L. The prescribed limit of chloride is 250 mg/l. Highest chloride concentration recorded in summer and The lowest value of chloride recorded during monsoon due to the addition of rain water[21].

**Carbonate and bicarbonate** are important because their concentration determines alkalinity. They are measured by titrating water sample with standard hydrochloric acid. Bicarbonate concentration observed from 62mg/L in rainy season to 267mg/L in summer season where as the $CO_2$ concentration ranges from 84 to 406mg/L.

## Conclusion

Study of various physicochemical parameters in aquatic system reveals information and present status to formulate schemes and planning for safe civil supply of drinking water. It also develop public awareness towards the interrelationship of different parameters with changing climatic conditions.

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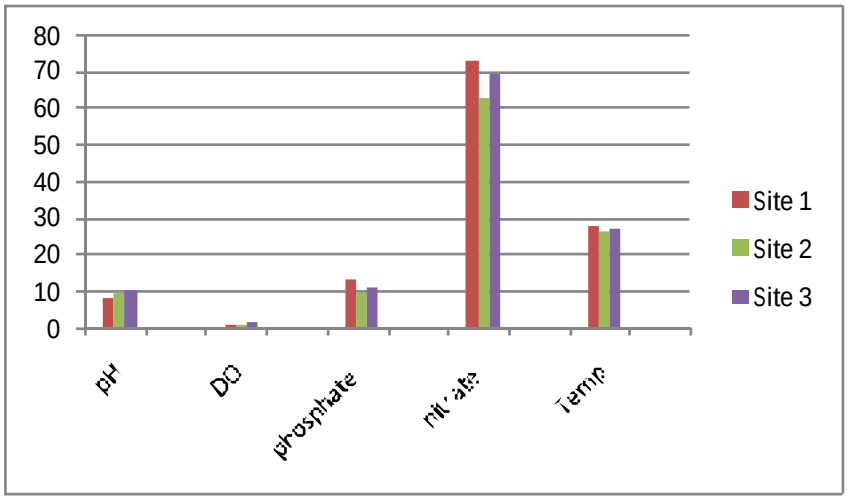


**Graph 1.showing mean value of pH, DO, Phophate, Nitrate and Temperature**

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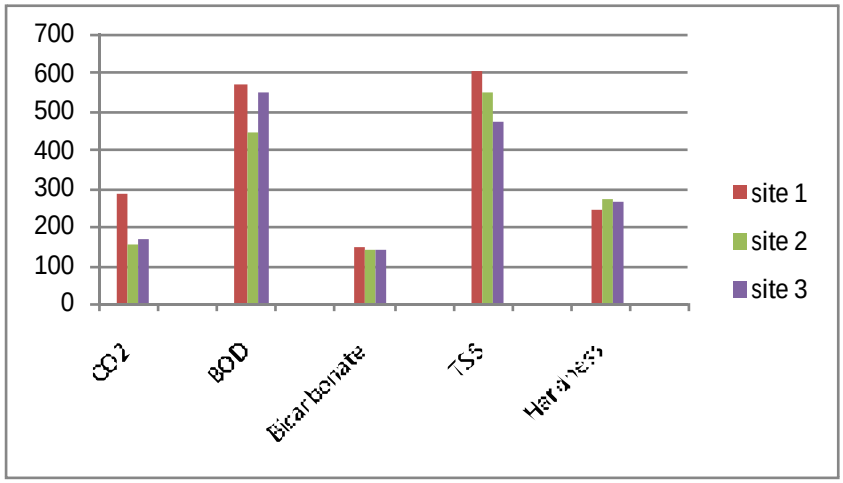


**Graph 2.showing mean value of CO2, BOD, bicarbonate, TSS and Hardness**

**Table 1.showing measured value of various physicochemical parameter**

| Parameters | Sampling station | Jan 2018 | Feb 2018 | Mar 2018 | Apr 2018 | May 2018 | Jun 2018 | July 2018 | Aug 2018 | Sep 2018 | Oct 2018 | Nov 2018 | Dec 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.pH | I | 7.86 | 8.62 | 7.57 | 8.4 | 8.78 | 7.72 | 7.33 | 8.1 | 8.79 | 8.69 | 9.02 | 8.86 |
| | II | 9.2 | 9.3 | 9.5 | 10.2 | 10.9 | 10.4 | 9.9 | 9.4 | 9.0 | 9.7 | 9.9 | 10.4 |
| | III | 9.6 | 9.8 | 10.2 | 10.6 | 10.7 | 11.1 | 10.6 | 9.9 | 9.6 | 9.9 | 10 | 10.4 |
| 2.Temp | I | 20 | 22 | 29 | 31 | 35.5 | 39 | 31 | 30.4 | 28 | 25 | 21 | 18 |
| | II | 18 | 22 | 24 | 27 | 33.4 | 36.5 | 33 | 32.6 | 28 | 23 | 20.4 | 18.6 |
| | III | 19 | 21 | 24.2 | 29 | 35 | 38.6 | 30 | 32 | 27 | 26.4 | 21.4 | 20 |
| 3. Dissolved Oxygen (mg/l) | I | 0.88 | 0.84 | 0.78 | 0.70 | 0.50 | 0.22 | 1.95 | 2.20 | 1.88 | 1.20 | 0.92 | 0.82 |
| | II | 0.76 | 0.70 | 0.66 | 0.64 | 0.56 | 0.34 | 1.90 | 2.16 | 1.79 | 1.44 | 0.87 | 0.80 |
| | III | 0.94 | 0.88 | 0.82 | 0.80 | 0.68 | 0.58 | 2.00 | 2.32 | 1.97 | 1.86 | 1.12 | 1.02 |
| 4. TSS (mg/l) | I | 536 | 580 | 712 | 798 | 822 | 844 | 320 | 465 | 486 | 514 | 532 | 602 |
| | II | 592 | 564 | 588 | 640 | 728 | 704 | 346 | 412 | 404 | 466 | 506 | 595 |
| | III | 544 | 510 | 542 | 598 | 568 | 562 | 325 | 360 | 384 | 406 | 420 | 436 |
| 5.Hardness (mg/l) | I | 217 | 239 | 236 | 262 | 274 | 281 | 292 | 248 | 224 | 216 | 192 | 204 |
| | II | 298 | 273 | 296 | 314 | 328 | 323 | 264 | 238 | 195 | 222 | 236 | 258 |
| | III | 262 | 284 | 318 | 323 | 328 | 332 | 240 | 232 | 189 | 196 | 218 | 226 |
| 6.COD (mg/l) | I | 1140 | 1370 | 1530 | 1576 | 1720 | 1778 | 572 | 490 | 524 | 682 | 794 | 898 |
| | II | 928 | 886 | 1124 | 1380 | 1460 | 1530 | 780 | 510 | 545 | 502 | 712 | 886 |
| | III | 1234 | 1322 | 1296 | 1640 | 1275 | 1476 | 756 | 638 | 590 | 685 | 802 | 848 |
| 7.BOD (mg/l) | I | 496 | 530 | 580 | 500 | 600 | 650 | 688 | 668 | 560 | 540 | 520 | 480 |
| | II | 452 | 525 | 490 | 486 | 424 | 454 | 444 | 400 | 390 | 422 | 440 | 420 |
| | III | 520 | 580 | 518 | 570 | 490 | 486 | 522 | 530 | 560 | 532 | 590 | 646 |
| 8.Electrical conductivity (µmhos/cm) | I | 7500 | 8000 | 9050 | 10750 | 13500 | 17000 | 18500 | 14800 | 14400 | 12090 | 10900 | 10000 |
| | II | 8250 | 7900 | 9800 | 13000 | 14000 | 18080 | 17000 | 14900 | 14500 | 13900 | 12100 | 12000 |
| | III | 9100 | 8400 | 9200 | 9500 | 10900 | 16500 | 15800 | 14000 | 13800 | 12300 | 10100 | 9500 |
| 9. Chloride Concentration (mg/l) | I | 1325 | 1550 | 1470 | 1580 | 1690 | 1810 | 1700 | 1490 | 1380 | 1470 | 1500 | 1680 |
| | II | 1580 | 1700 | 1685 | 1730 | 1834 | 1890 | 1645 | 1500 | 1420 | 1300 | 1420 | 1600 |
| | III | 1520 | 1670 | 1610 | 1700 | 1800 | 1880 | 1600 | 1480 | 1290 | 1150 | 1320 | 1580 |
| 10. phosphate | I | 11.10 | 12.80 | 17.10 | 17.40 | 20.10 | 21.00 | 8.76 | 7.34 | 8.78 | 8.90 | 9.80 | 10.60 |

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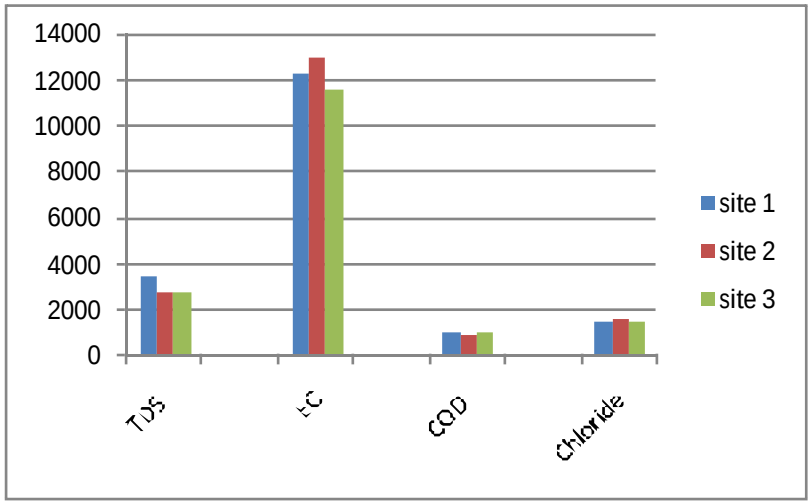
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| concentration (mg/l) | II | 10.50 | 9.50 | 9.42 | 10.32 | 11.00 | 12.90 | 8.00 | 7.54 | 6.40 | 8.10 | 8.46 | 9.20 |
| | III | 11.90 | 12.10 | 12.88 | 13.40 | 14.24 | 15.00 | 8.70 | 8.24 | 8.34 | 9.00 | 9.98 | 11.00 |
| 11. nitrate concentration (mg/l) | I | 79 | 91 | 93 | 99 | 109 | 149 | 39 | 40 | 32 | 35 | 47 | 59 |
| | II | 65 | 65 | 74 | 86 | 93 | 104 | 48 | 38 | 37 | 40 | 44 | 55 |
| | III | 79 | 79 | 81 | 83 | 109 | 105 | 43 | 58 | 39 | 43 | 54 | 57 |
| 12. $CO_2$ concentration (mg/l) | I | 365 | 332 | 318 | 386 | 406 | 362 | 150 | 138 | 163 | 206 | 248 | 297 |
| | II | 162 | 148 | 178 | 220 | 240 | 218 | 115 | 98 | 84 | 116 | 122 | 128 |
| | III | 192 | 214 | 184 | 243 | 243 | 216 | 104 | 116 | 88 | 106 | 117 | 138 |
| 13. Bicarbonate concentration (mg/l) | I | 166 | 174 | 145 | 195 | 259 | 267 | 84 | 63 | 78 | 89 | 103 | 128 |
| | II | 133 | 119 | 157 | 191 | 196 | 212 | 98 | 88 | 85 | 101 | 127 | 159 |
| | III | 156 | 178 | 148 | 178 | 205 | 198 | 85 | 65 | 62 | 98 | 122 | 148 |
| 14. TDS (mg/l) | I | 3200 | 3460 | 3680 | 3910 | 4220 | 4365 | 3640 | 3148 | 3045 | 2860 | 3268 | 3376 |
| | II | 2965 | 2798 | 2982 | 3024 | 3088 | 3198 | 2660 | 2490 | 2356 | 2248 | 2436 | 2748 |
| | III | 3012 | 2896 | 2776 | 2844 | 2990 | 3014 | 2550 | 2510 | 2340 | 2480 | 2642 | 2824 |




**Graph 3.showing mean value of TDS, EC, COD and Chloride**

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