

Seasonal Variation in Physico-Chemical Parameters of Water of Pani Ki Dharamsala, Jhansi, India

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ABSTRACT: Growing populations may put stresses on natural waters by impairing both the quality of the water and the hydrological budget. The present study was carried out to determine the physico-chemical characteristics and heavy metals in water in Pani Ki Dharamsala situated in Jhansi city, India during August 2014 to May 2015. The influence of seasonal changes on the properties of water from pani Ki Dharamsala was investigated. The Result showed the variations of the analyzed parameters in water sample as follows: environmental temperature 12.8-44.5, water temperature 9.1- 38, pH 7.9- 9.56, electrical conductivity 410- 449 uH, salinity 216-221mg/l, turbidity 88-103 NTU, total dissolved solids 317-360 mg/l, total solid 8680-9600mg/l, total suspended solid 8363.0-9240mg/l, alkalinity 184-198 mg/l, total hardness 270-310mg/l, calcium hardness 53.5-69 mg/l, Magnesium hardness 187-223.5mg/l, free CO₂ 26.6-36mg/l chloride 67.4-81.6mg/l, DO 3.2-4.7 mg/l, BOD 66-75 mg/l, COD 107-110.2 mg/l, TOC 46.6- 49 mg/l and heavy metals such as zinc 0.45-0.60mg/l, lead zero and iron 0.68- 0.77mg/l respectively. The overall implication of this observation calls for an urgent water resources management strategy in the pond in order to circumvent the fast deteriorating water resources quality, which may pose associated health risk and environmental hazards.

KEYWORDS: Seasonal variation, physicochemical parameters, Heavy metals Water quality, TOC, COD

I. INTRODUCTION

Approximately 71% of the earth's surface is covered with water. Water is the elixir of life and its importance can be traced back to the beginning of the earth, as earth is the only higher to known planet in the solar system processing water and Oxygen, the basic raw material to support life. The ground water has long been considered as one of the purest forms of water available in nature to meet the overall demand of rural and semi urban . The physico-chemical characteristics of the aquatic environment directly influence the life inhabiting it. Fluctuation in these constituents often create an adverse environment to organisms, limiting their growth and interfering in the physiological processes, which reduce their ability to compete with other populations within the environment, ultimately changing the community structure(Kedar and Patil, 2011).

The fate and transport of many anthropogenic pollutants are determined by not only hydrological cycles, but also physicochemical processes. Untreated discharge of pollutants to a water resource system from domestic sewers, storm water discharges, industrial wastewaters, agricultural runoff and other sources, all can have short term and long term significant effects on the quality of water system (Singh, 2007). Bellingham (2012) explained that in order to mitigate the impact human societies have on natural waters, it is becoming increasingly important to implement comprehensive monitoring regimes. He further highlighted that monitoring water resources will quantify water quality, identify impairments and help policy makers make land use decisions that will not only preserve natural areas, but improve the quality of life. Water quality deals with the physical, chemical and biological characteristics in relation to all other hydrological properties. Any characteristic of water that effects the survival, reproduction, growth

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and production of aquaculture species, influences management decisions, causes environmental impacts or reduces product quality and safety can be considered a water quality variable

For optimum development and management for the beneficial uses, current information is needed which is provided by water quality programmes (Lloyd, 1992) Unequal distribution of water on the surface of the earth and fast declining availability of useable fresh water are the major concerns in terms of water quantity and quality (Boyd & Tucker, 1998).

A continuous monitoring of water quality is very essential to determine the state of pollution in our all water system. This information is important to be communicated to the general public and the Government in order to develop policies for the conservation of the precious fresh water resources (Ali *et al.*, 2000). Several empirical and theoretical literatures on the physico-chemical and bacteriological aspects of natural and drinking water quality exists Ugbaja and Edet (2004), Igbokwe (2005) Badmus (2008) and Rimonsen (2008), Adejuwon (2012)

Many researches are being carried out till present (Rajesh *et al.*, 2002, Sharma & Gupta 2004, Sridhar *et al.*, 2006, Prabu *et al.*, 2008; Pradhan *et al.*, 2009, Prasanna and Ranjan, 2010). In order to assess water quality index we have carried out the physicochemical analysis of water in Pani ki Dharamsala.

The present study deals with the seasonal variation in the physico-chemical parameters of this Taal from August 2014 to May 2015 to investigate limiting factors, which could adversely affect the plants and animals

II. MATERIAL AND METHODS

1. Study site

Pani Ki Dharmashala is a small pond and now it is polluted so the water is of no use. It is located between latitude 25°27'44"N and longitude 78°34'32"E in Jhansi city, Bundelkhand region, Central India. Taal is shallow and is surrounded by residential houses in all sides.

2. Sampling

In the present work we report quality of water taken from Pani ki Dharamsala during before Monsoon, After monsoon, Spring and Summer seasons for the period the years Aug 2014 – May 2015 Thus the present study was carried out the over periods of one year. The sampling period of four different seasons like pre-monsoon (August) post monsoon (November) Spring (February) and summer (May) for the convenience and easy interpretation of results. The samples were collected in plastic containers they were cleaned with dilute nitric acid and rinsed several times with tap water, and finally rinsed once with sample water and finally collected from the habitat. The samples were stored in a refrigerator. Samples were preserved and analyzed by adopting the procedures outlined by standard methods for various parameters APHA (1989). Two liters of water samples were collected in these containers and tested the physicochemical parameters at industrial microbial laboratory in the department of Botany Bipin Bihari College Jhansi.

3. Physico-chemical analysis

Water samples were collected from Pani Ki Dharamsala during pre-monsoon, post monsoon season spring and summer season. Analysis was carried out for various water quality parameters such as environmental temperature and water temperature, pH, electrical conductivity, salinity, turbidity, total solid, total dissolved solid, total suspended solid, alkalinity, total Hardness, Ca⁺⁺hardness, Mg⁺⁺hardness, chloride, free CO₂ Chloride, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total organic carbon and heavy metals using standard method. (Trivedy and Goel 1986, Manivaskam 2005). pH and temperature were determined immediately at the place of collection.

III. RESULT AND DISCUSSION

1. Environmental temperature and water temperature

Temperature Plays an Important Factor which Influences the chemical, Biochemical and Biological characteristics of water body. Atmospheric and water temperature varied from 26 to 35⁰C and 25 to 33.5⁰C, respectively at the two stations. In the present study of the environmental temperature and water temperature varied from 12.8⁰C to 44.5⁰C and 9.1⁰C to 38⁰C respectively. The Maximum (44.5⁰C) environmental temperature was recorded in the Month of May (summer) and minimum (12.9⁰C) in the month of February.

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2. pH

According to Fakayode (2005), the pH of a water body is very important in determination of water quality since it affects other chemical reactions such as solubility and metal toxicity. The pH of the water was given by the WHO standard is 6.50-8.50. But in our observation pH ranged from 9.5 in August to 7.9 in November.

3. Electrical conductivity

Electrical conductivity is viewed as a valuable indicator of the amount of dissolved materials in water (Olajire and Imeokparia, 2001). Potable water should not have high electrical conductivity (Hutton, 1983). Electrical conductivity ranged between 410-449 μ S/cm. In the present investigation seasonally maximum conductivity was recorded during premonsoon (August) and minimum Recorded during post monsoon season or winter.

4. Salinity

Decrease or increase of pH is directly related to salinity. In our investigation salinity value varied from 216ppt to 221ppt. It was maximum in August and minimum in February.

5. Turbidity

In the present study water turbidity values ranged from 88 to 103 NTU. The results have also reported high turbidity during rainy season. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity. But in our result in the Month of May, turbidity was found maximum due to heavy rain in summer 2015.

6. Total Solid, Total dissolved solid, Total suspended solid

Total dissolved solids test provides a quantitative measure of the amount of dissolved ions. It is used as indicator test to determine the general quality of water (De Zuane, 1977). TDS indicate the total amount of inorganic chemicals in solution. The concentration of total dissolved solids in Pani Ki Dharamsala was noted higher (360 mg/l) in November and lower (317mg/l) in August. This is consistent with the findings of Efe *et al.*, (2005). TS and TSS were varied from 8680 mg/l and 8363mg/l to 9500mg/l and 9240mg/l respectively.

7. Alkalinity

Alkalinity of water is a measure of its capacity to neutralize acids. Natural alkalinity to water sources is imparted mainly by salts of weak acids such as bicarbonates, carbonates, borates, silicates, phosphates and the salts of humic and fulvic acids. Few industrial effluents such as calcium hydroxide from cement factory, sodium hydroxide from soap manufacturing, textile dyeing, rubber reclaiming and tanneries also contribute to the water alkalinity. Total alkalinity is the combined activity of the values of carbonates and bicarbonates in water. The observed values of alkalinity ranged between 184.5 to 198mg/l. The higher values of alkalinity during February and May, may be due to the presence of excess free CO₂. Alkalinity of drinking water has not been reported to be harmful but generally 100 mg/l is desirable for drinking water.

8. Total hardness, Ca⁺⁺hardness, Mg⁺⁺hardness

In present study total hardness was varied from 270 to 310 mg/l. It was maximum in the month of May and minimum in November. Calcium and magnesium, when combined with bicarbonate, carbonate, sulphate and other species, contribute to the hardness of natural waters. The effect of this hardness can be seen as deposited scale when such waters are heated. Normally hardness due to calcium predominates although in certain regions, magnesium hardness can be high. In this investigation maximum Ca⁺⁺ in August was 69mg/l and minimum in February was 53.5mg/l. Mg⁺⁺ varied from 187 to 223.5mg/l

9. Chloride

A high concentration of chlorides affects growth of vegetation and imparts an increase in corrosiveness of metals. Chloride in excess of 100mg per litre imparts a salty taste and may cause physiological damages. Chloride imparts a permanent hardness to the water. Although hardness does not have adverse health effect. They make water unsuitable for general domestic purposes and for certain industries such as textiles, food industry etc. The effect of chloride on taste may be critical to water use. Some water containing up to 250mg/l of chloride may have detectable salty taste if the predominant cation is sodium (Hutton, 1983, Ademoroti, 1996). We found chloride ranged from 67.4 to 79mg/l.

10. Free CO₂

The value of free CO₂ ranged from 26.6 mg/l to 36 mg/l. The maximum value was recorded in the month of November (winter) and minimum value in the month of August. This may be depends upon alkalinity and hardness of water body.

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11. Dissolved oxygen

Dissolved oxygen levels are considered as the most important and commonly employed measurement of water quality and indicator of a water body's ability to support desirable aquatic life. Like terrestrial animals, fish and other aquatic organisms need to live. In the present investigation the values of dissolved oxygen recorded ranged between 3.2 mg/l to 4.7 mg/l.

12. Biological oxygen demand

In the present investigation, the maximum biochemical oxygen demand value is recorded during summer and minimum during the monsoon season. Patel (1999) reported higher biochemical oxygen demand values in summer and stated that it may be due to higher microbial activities.

BOD was maximum in the month of May and minimum in August which was recorded From 66 to 75 mg/l

13. Chemical oxygen demand

The chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compound in water. Most applications of COD determine the amount of found in surface water making COD a useful measure of water quality. In the present investigation, the chemical oxygen demand values recorded are 107mg/l to 110.2 mg/l.

14. Total organic carbon

TOC recorded as range from 46.6 to 49.0 mg/l. It was maximum in summer and minimum in pre monsoon

15. Heavy metal

Value of Zinc, lead and iron were recorded maximum as 0.60mg/l, 0.0mg/l, and 0.77mg/l and minimum as 0.45mg/l, 0.0mg/l and 0.68mg/l respectively. Water containing iron does not show deleterious effect on human health, its presence in drinking water is not desirable for various reasons. Excessive iron content makes the water turbid, discolored and imparts an astringent taste to water.

Table -1. Physicochemical parameters of water from Pani Ki Dharamsala during 2014-15. This table contains all physicochemical parameters of water taken from Pani Ki Dharamsala excluding heavy metals. Some parameters are observed at sampling site such as pH, temperature, conductivity, salinity and other are observed in laboratory.

S.No.	Parameters	Aug. (2014)	Nov.(2014)	Feb. (2015)	May. (2015)
1.	Envir. tem(Tc)	36.5	34.5	12.8	44.5
2.	Water tm(T ⁰ C)	38	27	9.1	32
3.	PH	9.56	7.9	9.1	9.0
4.	Conductivity(uH)	449.0	421.0	410.0	436.0
5.	Salinity	221.0	219.0	216.0	220.0
6.	Turbidity(NTU)	100.0	96.0	88.0	103.0
7.	TDS(mg/L)	317.0	360.0	347.0	341.0
8.	TS(mg/L)	8680.0	9600.0	9480.0	9500.0
9.	TSS(mg/L)	8363.0	9240.0	9133.0	9235.0
11.	Alkalinity(mg/L)	184.5	186.0	195.0	198.0
12.	Hardness(mg/L)	301.0	270.0	276.5	310.0
13.	Ca ⁺⁺	69.0	55.0	53.5	65.0
14.	Mg ⁺⁺	187.0	223.5	189.0	215.0
15.	Free CO ₂ (mg/L)	26.6	36.0	34.5	33
16.	Chloride(mg/L)	67.45	81.65	74.0	79.0
17.	DO(mg/L)	4.64	4.25	4.70	3.20
18.	BOD(mg/L)	66.0	74.0	69.0	75.0
19.	COD(mg/L)	108.6	110.2	107.0	110.0
20.	TOC(mg/L)	46.68	46.80	48.35	49.0

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Table-2. Determination of trace element of water from Pani Ki Dharamshala during 2014- 15. This table contains various heavy metals found in water taken from Pani Ki Dharamshala. Lead concentration is not found in all season but iron and zinc are found in different concentration in different seasons.

S.No.	Parameters	Aug. (2014)	Nov.(2014)	Feb. (2015)	May. (2015)
1.	Zn(mg/L)	0.60	0.45	0.55	0.52
2.	Pb(mg/L)	0.0	0.0	0.0	0.0
3.	Fe(mg/L)	0.68	0.71	0.77	0.74

IV. CONCLUSION

The physico- chemical parameters of water Taken from Pani Ki Dharamshala was observed during August 2014 to May2015. Some physico -chemical parameters such as temperature, pH, salinity and EC of water are maximum in August and minimum in February. But turbidity TDS, Alkalinity, Hardness was increased in the month of May. Free Co2 and chlorine concentration in water varied and maximum in November and minimum in August. DO and BOD have different variation during season in which DO maximum in February and minimum in May and BOD maximum in May and minimum in August.COD and TOC increased in summer season. Lead was not found in water but concentration of zinc and iron were found in different concentration during study.

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