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Research Article

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Physico-chemical analysis of Daha *River* water and soil in different months of the year

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Abstract
Pure water to be used for domestic use, for animals and for irrigation is essential as per the policy of Government of India. Because Daha River passes just to the periphery of the Siwan town so water health of the river water must be analysed. The temperature of the river water ranged from 11^0C – 29^0C from January to December, pH 7.75 to 9.30 from January to December, Transparency from 18 cm to 66 cm, conductivity 110-172 µm hols/c, Dissolved oxygen 4.56 to 8.36 mg/l, free carbon dioxide 3.25 to 10.86, phosphate alkalinity from 8.20 to 28.50, MO alkalinity from 130.50 to 316.00, chloride 17.80 to 52.36 mg/l, Total hardness 15.85 to 156.36 and magnesium 6.46 to 28.72 mg/l respectively from January to December.

Keywords: Daha River, Irrigation, Domestic application, Water health, Physico-chemical, Alkalinity and Transparency

1. Introduction

Water is one of the most important precious natural resources in the world. Although water is pure where there are no human's activities, but due to anthropogenic products most of the water bodies are polluted. We know that access to safe drinking water is the key to sustainable development and essential to food production, quality health and poverty reduction. Pure water has become a crucial factor for healthy life in many countries- The WHO (2000) revealed that seventy five percent of all diseases in developing countries arise from polluted drinking water. Therefore, water intended for human consumption must be free from pathogen germs or harmful chemicals. In this pure drinking water is not a luxury rather one of the most essential requirements of life itself [1]. International and local agencies have established parameters to determine *physico-chemical* and biological quality of drinking water [11]. Most common problems in pond and *River* water are hardness, iron, sulfides, chloride, alkalinity, acidity, and water born disease causing pathogens. Physico-chemical analysis of different water bodies have been done by many researchers [5,12-16,18,21,23-29]. From these works it has been concluded that anthropogenic activities affect the *river's* water as well as pond water respectively.

Materials & Methods

Sample collection for the entire work was done from the Daha *River* near Siwan from different point. Before collection of the water sample all the plastic containers' bottles, were cleaned with detergent. Then the bottles and

jars were used. The temperature, pH, transparency were determined at the site, while dissolved oxygen, biological oxygen demand, chemical oxygen demand, total dissolved substances, chloride, nitrate, calcium, total harness, electrical conductivity etc. were determined in the laboratory as per the methodology mentioned in American Public Health Association [2]. All the experiments were done in triplicate and mean of the data was tabulated in Table-1.

Table 1

Month	Temp. (^{0}C)	Transparency (cm)	Conductivity µS/cm	pH	DO mg/l	Free Co_2 mg/l	P-alkalinity mg/l	MO-Alkalinity mg/l	Chloride mg/l	Total hardness mg/l
Jan	11.00	51.00	132.00	7.75	8.36	3.25	15.00	220.00	40.00	132.00
Feb	13.80	56.00	142.00	7.68	7.50	6.70	17.00	232.60	43.00	156.36
Mar	19.30	56.60	164.00	7.80	6.70	10.86	15.20	316.00	44.25	152.00
Apr	22.60	66.70	168.00	7.78	6.30	9.25	13.60	312.00	43.00	132.00
May	28.70	52.25	172.00	8.25	5.40	6.80	28.50	130.50	52.36	28.40
Jun	29.00	29.30	160.00	8.10	4.56	6.70	15.60	240.00	46.00	31.60
Jul	27.60	18.00	124.00	7.82	4.80	10.80	15.00	210.00	32.40	29.20
Aug	26.40	24.60	112.00	7.58	5.50	5.60	8.20	181.00	36.50	15.85
Sep	24.30	38.58	141.00	9.30	5.80	5.80	10.40	178.00	21.50	98.00
Oct	19.30	42.60	150.00	9.28	6.25	4.70	9.00	198.00	17.80	98.60
Nov	16.40	51.50	158.00	8.40	6.72	.6.50	10.00	230.00	42.00	112.00
Dec	11.15	55.40	142.00	8.10	8.10	6.40	12.40	244.00	56.00	113.00
Mean	20.80	45.21	144.75	8.153	5.49	6.95	14.16	224.68	39.98	99.67

Results and Discussion

pH- The measurement of pH was done from January to December. From the table, it may be noted that there was variation in pH of the water from January to December. The maximum value of pH was in the month of September which was 9.30, while the minimum number was in the month of August that was 7.58. Mean of the pH is 8.153 which is slightly basic. This indicates that there is disposal of some washing soda or detergents. pH of drinking water should be between 6.5 to 7.5. In municipal water it is 7 to 7.5. In Daha *River* water it was observed that pH varied from 7.58 to .30. During September it may be due to run off water containing different matter, particularly alkaline. Similarly, acidic pH was not found in any month. Above findings are supported by many researchers [22,30].

Temperature- Temperature of Daha *River* was also measured in different months of the year. It was observed that highest temperature that is 29^{0}C was in the month of June, while lowest that was 11 °C in the month of January. In North Bihar January is the coldest month of the year, while June is the hottest one. Further in June the water level comes down therefore, highest temperature may be expected. From January to June there was rise in temperature while there after, it gradually decreased. This may be due to the fact that during this period raining starts and gradually the level of the water increases. Further, water current is high during rainy season. The mean temperature was 20.80 °C which is suitable for use. Monthly variations in temperature have been also reported by many researchers [9,20,31]. Present findings corroborate with the findings of the above authors.

Transparency- Transparency of water indicates the constituent of water which hinders the penetration of light. So more clear water the high is the transparency. Transparency of Daha *River* varied from 66.70 cm to 18.00 cm during different months of the year. Highest 66.70 cm was noted in the month of April during which water remains much clear, while the minimum 18.00 cm in July means due to input of water containing silt and sands and other debris. The mean transparency was 45.21 which indicate the water has more suspended particles. Variations in transparency

in different seasons have also been reported by many researchers [3,8,10,33]. Findings of the above workers agree with the present work.

Conductivity- Here the dissolved salts and other inorganic chemicals conduct electric current. The conductivity increases as salinity of water increases, conductivity water indicates as how much dissolved substances, chemicals and minerals are present in the water. Higher amount of these impurities will lead to a higher conductivity. In the present work, conductivity of Daha *River* was studied in different month. Higher conductivity 172 µm hols/cm was noted during May, while the lowest during rainy season. The mean of the electrical conductivity of Daha *River* was 144.75 µm hols/cm. Electrical conductivity of pond water has been studied by different workers [34]. Their findings are in agreement of the present findings. Balakrishnan *et al*; (2017) also observed seasonal variations in the electrical conductivity of water which was higher in summer, which gradually decreased during rainy season [4].

Dissolved Oxygen- Running water has more dissolved oxygen that still water of pond. Water bodies receive oxygen from atmosphere and due to photosynthesis of aquatic plants. Dissolved oxygen of water is utilized by aquatic animals for breathing. When the level is low the condition is called hypoxia, while no oxygen anoxia. This condition occurs when there are excess organic materials, produced due to decomposition of algal bloom and other plant materials. So, dissolved oxygen is consumed by the microorganism. Therefore, estimation of dissolved oxygen is essential. In this work determination of dissolved oxygen was done in every month of the year. Here highest amount 8.36 mg/l of dissolved oxygen was found in the month of January while the lowers 4.55 mg/l was found in the month of June which was followed in by 4.80 in the month of July. Amount of dissolved oxygen in different water bodies have been evaluated by different workers [6,7,11,32]. All these workers have observed that during summer the amount of dissolved oxygen mg/l is lower than winter. So present findings abide with the above findings.

Free Carbon Dioxide- Free carbon dioxide is present in water as a dissolve gas. All natural waters contain some carbon dioxide. Water may get carbon dioxide through the rain water in which dissolve from the air. Rain water following on ground they may absorb carbon dioxide if they flow through the decaying substances. Carbon dioxide dissolve more easily in water compare with oxygen. Aquatic plants depend on free carbon dioxide for their photosynthesis. Free carbon dioxide was measuring every month in Daha *River* water. The free carbon dioxide varied from 3.25 to 10.6 mg/l. The highest value was obtained in the month of March, while the lowest value in the month of January. Second highest 10.80 were observed in June itself; while second lowest value 4.70 mg/l in the month October the mean value was 6.95. Free carbon dioxide is that exists in the atmosphere and is present as gas in water. Variations in the amount of free carbon dioxide mg/L has been reported by several workers [17, 19]. They have also observed highest amount during winter and lowest during summer. Similar observations are also noted in the present work.

Alkalinity- Also known as phenolphthalein alkalinity. In the sample water, it measures the amount of carbonate alkalinity, hydroxyl alkalinity and part of bicarbonate alkalinity. Therefore, alkalinity is a measurement of dissolved alkaline substances in water, pH higher than 7.0, that can neutralize acid. Hither alkalinity in surface water will buffer acid rain or other acidic substances. It also influences anaerobic digestion. In the present work p-alkalinity of Daha *River* was measured in all the months of the year. This ranged from 8.20 to 28.50. While the minimum 8.20 was found in the month of August, the highest value 28.50 was observed in the month of May. The mean value was noted as 14.16 respectively.

Mo alkalinity- It is measured by using methyl orange as an indicator. The results represent alkalinity due to carbonates, bicarbonates, and hydroxide. In the water of Daha *River*, great variations were found in MO alkalinity throughout the year. This ranged between 130.50 mg/l to 316 mg/l. The highest value was found in the month of

March while the lowest in the month of April itself. Methyl orange used as an indicator to determine alkalinity is called MO alkalinity.

Chloride- Higher concentration of chloride may cause different problems in irrigation machine. Different sources are there that add chloride in water among which soil weathering is common. Chloride components of Daha River were studied and it was found that it ranged from 17.80 to 56.00 mg/l. The minimum level was noted in October, while the highest level in the month of December. The mean of the level was 39.98 only. Daha River also gets livestock waste during rainy season. This is one of the sources of chloride in the water.

Total hardness- *River* water passing through soil may dissolve minerals especially the calcium and magnesium. They are the principal agent that causes formation of hard water. However, all *River*s have no hard water. Total hardness of Daha *River* was studied in different months of the year. Here maximum hardness 156.36 mg/l was noted in February while the lowest 15.85 mg/l in the month of August. The mean of the hardness was 99.67. Hardness is caused by the presence of soluble salts of calcium, magnesium, strontium, iron and manganese. It is characterized by reduction of lather or foam deficiency of water in the soap. Variations in different seasons may be due to concentration of water as in summer or dilution due to rain water.

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