STUDY OF SEASONAL VARIATION IN PHYSICO-CHEMICAL PARAMETERS OF WATER IN MANIKA MON OF MUZAFFARPUR, BIHAR, INDIA

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ABSTRACT

Changes in modern life style and use of heavy amounts of agrochemicals and fertilizers have caused a scenario due to which there are undesired changes in physico-chemical parameters of water, soil and air. Anthropogenic activities thus have enhanced the quantum of pollution of fresh water ponds and Mons. Water quality has tremendous impact on flora and fauna. Manika Mon is a perennial water reservoir of Muzaffarpur. Because water of this Mon is being used for different purposes, so its physico-chemical analysis was done in different seasons. Temperature of surface water was taken from February to March, May to July, August to September and November to January. Similar studies were also conducted for different parameters. The mean of the data for pH varied from 7.10 May to July, to 8.30 from February to March. In the same periods temperature varied from 13.6^0C to 29.5^0C. Turbidity varied between 48.0 cm to 116 cm, soluble substances from 1022 mg to 1150 mg/l, while dissolved oxygen varied between 5.62 mg/l to 10.16 mg/l , free carbon dioxide 12.58 mg/l to 16.72 mg/l, chloride 28.75 mg/l to 47.70 mg/l, calcium 6.18 mg/l to 12.19 mg/l and Ca-hardness 8.26 mg/l to 19.71 mg/l. Therefore, it is essential that the water body should be put under strict vigilance and constant monitoring so that the water should be maintained at its better quality.

KEYWORDS: Physico-chemical characteristic, Anthropogenic, Agrochemical, Dissolve Oxygen, Free Carbon dioxide, Ca-hardness

Purity of water depends on the concentrations of different component. The surrounding of the water bodies, particularly the ponds and Mon, also influences the physico-chemical properties. This is also true for the human activities. Pond water is generally utilized by the populations, which are present near the water body. Whether the components are as per the quantity, which are recommended for its utilization or they are present in excess can be monitored by analyzing these parameters. We get several literatures where physico-chemical analysis of water has been done. Some of them may be cited here such as, Dwivedi and Pandya (2002); Srivastva *et al.,* (2003); Murthi and Yajurvedi (2004); Narayana *et al.,* (2005); Singh & Mathur (2005); Gupta and Shukla (2006); Shah *et al.,* (2006); Chaurasia and Pandey (2007); Araoye (2009); Bhat *et al.,* (2010); Chandra *et al.,* (2010); Ehiagbonare *et al.,* (2010); Mahananda *et al.,* (2010); Arya *et al.,* (2011); Baswaraja *et al.,* (2011); Sinde *et al.,* (2011); Medudhula *et al.,* (2012); Jena *et al.,* (2013); Nag and Gupta (2014); Uduma and Uduma (2014); Verma & Khan (2015); Bhayali *et al.,* (2016); Balkrishnan *et al.,* (2017); Saha *et al.,* (2017) and Ramnathan and Asmsath (2018).

The purpose of the present study was to analyze the water quality for Manika Mon, which is a perennial water reservoir for the local people. Physico-chemical analysis in different seasons gave different data for different parameters generally considered for the water analysis. So a correlation between the parameters and the season may be established.

MATERIALS AND METHODS

Study Site

Manika Mon is 8 km away from the main town of Muzaffarpur. The study was conducted for a period of one year from August 2016 to July 2017. Once the water of Manika Mon was free from different pollutant and the different components were under the prescribed concentration. But due to anthropogenic activities the quality of water has degraded. Variety of weeds may be seen growing on the marginal land of the Mon.

Sample Collection

Water samples of Manika Mon were collected in pre-sterilized containers and beaker in different seasons at 9.3 to 10.30 AM at a depth of 20-30 cm from the surface. The closed bottles were dipped into the water and then the caps were removed. When the bottles were filled up completely and there was no air bubbles the caps were replaced on the bottles tightly. The parameters like pH, temperature, turbidity etc. were studied at the site. For the

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evaluation of dissolved oxygen samples were collected separately in specific bottle and dissolved oxygen was fixed at the spot by adding 20 ml each of Manganous sulphate ($MnSo_4$) and Alkali Azide Iodine. Precaution was taken during sample water collection so that there was no air bubbles at all. In the Laboratory dissolved oxygen was analyzed following Winkler's titrimetric method.

Dissolved Oxygen mg/l = ml of 0.025 N.$Na_2S_2O_3$ used X 4

Free carbon dioxide was estimated by Standard titrimetric method using phenolphthaline as indicator. Calculation was made as per the standard formula provided by different text books.

Transparency was determined during sunny day and there were no clouds or wind current. The sinking Secchi disc was observed directly above, while the sun was behind. The points at which the disc disappeared and it reappeared were noted and calculation was made by applying the formula provided.

Total soluble substances were calculated by evaporating the known volume of sample water in dried and pre-weighed porcelain cup. From the final weight the weight of the cup was deducted that gave the particles present in the known volume.

Temperature was also taken at the spot with the help of a mercury thermometer.

Chloride

Chloride was also determined by titrimetric method, where potassium dichromate was used as indicator and titration was done with 0.07 N $AgNo_3$.

Chloride (ppm) = (ml x N) of $AgNo_3$ x 1000 x 35.5 / ml of sample.

Calcium

It was estimated by EDTA, titrimetric method.

Calcium (ppm) = X x 400.8 / ml of sample

Where X = Volume of EDTA used.

Ca-hardness

This value was determined by total amount of calcium in known volume of sample multiplied by a factor of 2.497.

All experiments were done in triplicate and the mean was used as data for discussion and conclusion.

RESULTS AND DISCUSSION

Manika Mon was selected for its physico-chemical studies. From the Graph 1, It was noted that temperature of the surface water was observed in different season. The minimum temperature was recorded from November to January where the mean temperature was 13.16^0C. In February to March it was 16.7^0C, while the maximum mean temperature was noted form May to July which was 29.5^0C. These mean temperature again fell down to 22.3^0C from August to September.

From the Graph 1, it was noted that, pH value of the above Mon varied from 7.10 to 8.30. Maximum pH was recorded from February to March, followed by November to January 8.15, while minimum pH was from May to July 7.10. This variation may be due to productivity of the Mon.

From the Graph 1, it was noted that, turbidity indicated the amount of materials suspended in water bodies. In the present study maximum transparency was noted form November to January (116 cm), followed by February to March (112 cm). Here minimum transparency 48.0 cm was noted May to July. From August to October it was 105 cm only.

Total Soluble Substances

In the present study from the Graph 2, it was noted that maximum solid was 11580 mg/l from May to July, followed by 1088 mg/l from November to January. Here minimum 1022 mg/l was noted from February to April.

Dissolved Oxygen

From the Graph 1, it was noted that, dissolved Oxygen of the water sample of the Mon was also calculated. Maximum value 10.16 mg/l was found from November to January, which was followed by 9.4 mg/l from February to March and 8.56 mg/l from August to October. Minimum amount of oxygen was noted 5.62 from May to July. So amount of Oxygen varied from 5.62 to 10.16 mg/l of pond water.
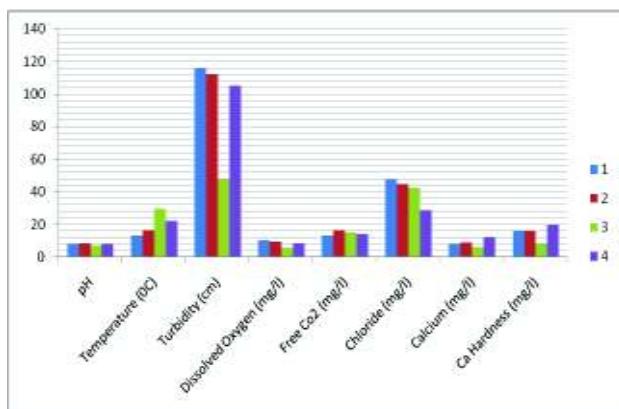
Free Carbon Dioxide

In the present study from the Graph 1, it was indicated that, free carbon dioxide varied form 12.58 mg/l
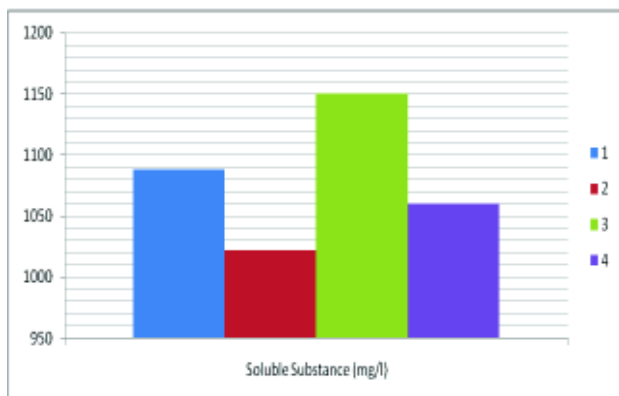
to 16.72 mg/l. Here maximum amount of free carbon dioxide was noted form February to March that was 16.72 mg/l. This was followed by 15.18 mg/l from May to July. Here 14.34 mg/l was noted form, August to October, while the amount of free Co_2 from November to January was only 12.58 mg/l of the sample water.

Chloride

From the Graph 1, it was noted that, the amount of chloride in the sample water was also calculated. Here maximum 47.70 mg/l was calculated from November to January followed by 44.68 mg/l from February to April. This was followed by 42.34 mg/l from May to July. Lowest amount 28.75 mg/l was observed from August to October. So it varied from 28.75 mg/l to 47.70 mg/l of the sample water.

Graph 1: Showing seasonal variations in different parameters used for physico-chemical analysis of water of Manika Mon.

Graph 2: Showing seasonal variations in Total Soluble Substances used for physico-chemical analysis of water of Manika Mon.

Note (For Graph 1&2): 1= November to January, 2 = February to April, 3 = May to July, 4= August to October

Calcium

Calcium present in the sample water was also calculated. It was observed from the Graph 1, that, here maximum 12.19 mg/l was noted form August to October, followed by 8.74 mg/l from February to April. 8.09 mg/l of calcium was noted from November to January and lowest concentration of calcium 6.18 mg/l from May to July. Thus amount of calcium varied from 12.19 mg/l to 6.18 mg/l in different seasons.

Ca-hardness

Here it was noted from the Graph 1, that the mean value of calcium hardness was the highest 19.71 mg/l from August to October, followed by 16.08 mg/l from February to March and 16.07 mg/l from November to January.

It was the minimum 8.26 from May to July. Therefore, Calcium hardness varied from 19.71 to 8.26 mg/l in the different seasons.

DISCUSSION

Different parameters of physico-chemical analysis of water evaluated in the present work revealed seasonal variations. pH value that is hydrogen ion concentration of water evaluated here revealed that water of Manika Mon was always alkaline as the pH values ranged between 7.10 to 8.30.

So during February to April the water was maximum alkaline. Sharma *et al.,* (1984) reported that in India, many small confined water pockets are particularly alkaline in nature. Here it was noted that pH was highest 8.30 in February to April. Above findings are in agreement with the findings of Saha *et al.,* (2017) who also reported that an average pH during summer was 7.15 and 8.3 during post monsoon.

Temperature

The mean of three months, of different season for temperature varied from 13.16 to 29.5^0C. It is reported that temperature of small water reservoir fluctuates according to the seasons and in depth of water. Here also during summer the surface temperature was highest because temperature of

the air is highest during this. Above findings are in conformity with the findings of Barman *et al.,* (2015) who also reported that temperature of pond water during summer ranged between 27.1 to 28.33, while during winter it was 8.70^{0}C to 12.7^{0}C.

Turbidity

This indicates the impurities suspended in water. It measures the amount of light scattered or absorbed, silt, clay, organic matter and plankton percentage determines the turbidity. Here turbidity during May to July was 48.0 cm only. This may be due to higher percentage of phytoplanktons and concentration of water of the pond. The maximum 116 cm during November to January may be due to dilution after monsoon and loss of phytoplankton. Above findings is also supported by the findings of Barman *et al.,* (2015) and Sangeeta *et al.,* (2017). Thus turbidity is caused by the suspended and colloidal matter, such as clay, silt, fine organic and inorganic matter and plankton. Due to this in present study also, fluctuation in turbidity was found in different seasons.

Soluble substances are not visible but when water is evaporated, the amount of residue indicates the soluble molecules present in a water sample. In the present work total dissolved solids value of water ranged from 1022.0 mg/l to 1150 mg/l. The highest amount was noted from the month of May to July, while the lowest during the February to April. Higher amount of soluble substances in water during summer may be due to higher concentration as the water is evaporated during this season and there is no dilution of present water.

Higher concentration of total dissolved solute/ nutrient may lead to eutrophication of the water body. This has been confirmed by Sahni and Yadav (2012); Verma and Khan (2015); Sharma and Ramendra (2016); Tamizhagan and Pugazhendy (2016).

Dissolved oxygen was also estimated in the present study for the water of Manika Mon. The amount of dissolved oxygen varied from 5.62 to 10.16, while the highest amount was noted during November to January, 10.16 mg/l followed by 9.48 mg/l during February to April. The minimum 5.26 mg/l was found during summer. We know that at higher temperature oxygen is less dissolved in water. Due to this oxygen released by the phytoplankton & other aquatic plants during day time due to photosynthesis

is not dissolved in water, while at night maximum O_2 are utilized by the phytoplanktons as well as by the aquatic plants. Present finding corroborates with the findings of Barman *et al.,* (2015); Dixit *et al.,* (2015); Sharma and Singh (2016); Balkrishnan *et al.,* (2017) and Ramnathan and Amsath (2018).

Chloride

In the present study amount of chloride found in the Manika Mon water in different seasons was also studied. Here it was noted that its concentration varied from 28.75 to 47.70 mg/l. Maximum concentration was from November to January, followed by February to March. Its concentration was minimum 28.75. From the month of August to September. Sharma and Singh (2016) also reported similar variations in the concentration of chloride. Higher concentration indicates polluted condition of the water that may influence the growth of vegetation.

Calcium

Amount of Calcium was also calculated in different seasons. This varied from 12.19 mg/l to 6.18 mg/l. Higher concentration was observed from August to October while the minimum from May to July. Barman *et al.,* (2015) also observed the similar result. So present finding is in agreement with the above workers. Concentration of calcium, aids to the hardness of water, calcium hardness was also studied. Here 19.71 mg/l was the maximum found during August to October and Minimum 8.28 found during May to June. Source of Calcium in fresh water pond is the agro-chemicals containing Calcium, which are carried by the rain water from the field to the water bodies.

CONCLUSION

Physico-chemical studies were done in different seasons. The findings clearly indicate that there are variations in different parameters considered here. Because surrounding people are utilizing this water so its annual monitoring is essential.

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