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Analysis of dissolved oxygen of the tributaries of River Kosi in Madhepura region

Khushbu Kumari[1], Dinesh Yadav[2] & Arun Kumar[1]
[1]University Department of Zoology, B. N. M. University, Madhepura, Bihar, India
[2]Department of Zoology, T.P. College, B. N. M. University, Madhepura, Bihar, India

ABSTRACT

Dissolved Oxygen (D.O) is the major means of respiration for all aquatic aerobic flora and fauna. It is the amount of oxygen absorbed at the water surface. Decrease in the dissolved oxygen levels can be lethal to aquatic organisms. The rate of dissolved oxygen depends on a variety of climatic conditions like temperature, wind speed, humidity etc. A range of D.O. fluctuations exists owing to the seasonal changes. In this study, analysis of dissolved oxygen was done, Wrinkler's method was used to calculate the amount of dissolved oxygen.

Key Words - Dissolved Oxygen, Temperature, Basin, Tributaries, Wrinkler's method.

***Corresponding author :** prf.arunkumar@gmail.com

INTRODUCTION

Madhepura is located in the heart of Kosi basin occupying around 1788 sq.kms. This water body not only provides water all year around but also provides fish for human consumption. However, Kosi is known as the sorrow of Bihar due the havoc caused by annual floods which causes trouble to people's relocation. The Kosi River is 720 km (450 mi) long and drains an area of about 74,500 km^2. The collection of samples for analysis of dissolved oxygen was done from 5 of its major tributaries namely Mithaidhar, Bhirkhidhar, Budhmadhar, Gomati dhar and river Sursar of the Madhepura district.

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants.

The materials and compounds consume oxygen present in water and thereby reduce Dissolved Oxygen (D.O.) of water. The domestic and industrial waste is commonly disposed off in nearby rivers. These wastes have high biological oxygen demand (BOD) and chemical oxygen demand (COD), due to presence of organic matter. If these wastes are disposed in rivers, it causes drop in D.O. at the point of discharge and it takes considerable time and distance for the stream to regain original D.O. Biological oxygen demand is the original concentration of organic matter in water. The D.O. varies with downstream distance from the point of discharge of effluent into flowing stream. Various investigators have worked on dissolved oxygen of water and various factors affecting it. Deficiency of dissolved oxygen is a measure threat to the aquatic life also.

Proper identification of water quality conditions in a river system based on limited observations is an essential task for meeting the goals of environmental management. Various classification methods have been used for estimating the changing status and usability of surface water in river basins.

Dissolved Oxygen (D.O.) is one of the main physio-chemical parameter which determines the quality

of water. D.O. is the amount of gaseous oxygen dissolved in water. Oxygen usually enters the water by surface absorption method by rapid movement of water or via the aquatic plants as a byproduct of photosynthesis. Dissolved oxygen in other words is the amount of oxygen in water that is available for aquatic organisms. It is a necessary attribute for good quality water. The rate of dissolved oxygen depends on a variety of climatic conditions like temperature, wind speed, humidity etc. Lower dissolved oxygen levels may kill the aquatic organisms.

MATERIALS & METHODS

The water samples were collected from 5 major tributaries of Kosi River at the point of discharge of effluent and at various downstream distances namely:- Mithaidhar, Bhirkhidhar, Budhmadhar, Gomati dhar and river Sursar of the Madhepura district.

The samples were analyzed for dissolved oxygen by using Wrinkler method. Materials required are Bottle of 300 ml, 2 ml of alkaline iodide azide solution, 2ml of concentrated sulphuric acid, sodium thiosulphate solution (0.025N).

Modified Wrinkler's method was used for measuring the dissolved oxygen. Water sample is filled in a bottle of 300 ml capacity without any bubbles. 2 ml of alkaline iodide azide solution is added to it. The bottle is shaken well. Brown precipitates are seen on the bottom of the bottle which is then dissolved by adding 2ml of concentrated sulphuric acid. This solution is then titrated against sodium thiosulphate solution (0.025N). The readings of the titration are carefully noted.

D.O. content is calculated using the following formula:

$$\text{D.O.} = \frac{(\text{ml x N})\text{of titrant x } 1000 \text{ x } 8}{V_2(V_1 - \text{V})V_1}$$

Where, V_1 = volume of tyrants,

V_2 = volume of sample titrated

N = normality of $Na_2S_2O_3$

RESULTS

Dissolved oxygen is the most important factor in monitoring water quality in aquatic environment, because all living biota require oxygen for respiration except anaerobic forms.

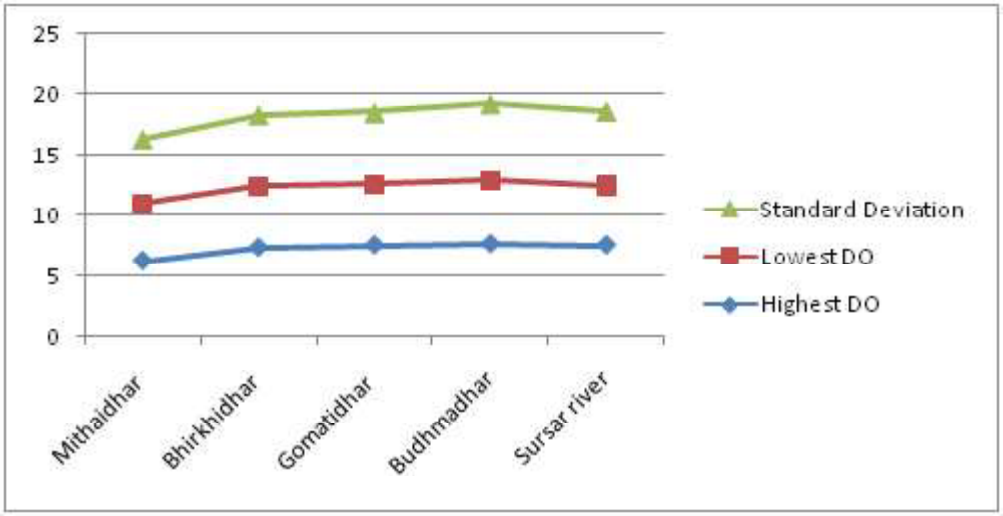
During the period of study, the lowest D.O. was observed during the month of June and highest D.O. was observed during the months of December and January. It is seen that the range of dissolved oxygen varied considerably along with seasonal changes. Minimum changes were observed during summer season, intermediary changes during the monsoons and maximum changes during the winters.

Mithaidhar- Dissolved oxygen varied within the range of 4.7 m to 6.7 mg/ L. During the study, the lowest dissolved oxygen, 4.8 mg/L was recorded during July, 2018 and the highest 6.2 mg/L was observed during January, 2018. In the next year, minimum and maximum, dissolved oxygen, 4.7 mg/ L, and 6.7 mg/L was recorded respectively.

Table 1:- Observed maximum and minimum D.O at different tributaries of Kosi River

Site	Range of D.O (mg/L)	Highest D.O recorded (mg/L)	Lowest D.O recorded(mg/L	Standard deviation value
Mithaidhar	4.7-6.7	6.2	4.8	5.3+-0.5
Bhirkhidhar	5.0-7.3	7.3	5.1	5.9+-0.7
Gomatidhar	5.0-7.9	7.5	5.1	5.9+-0.8
Budhmadhar	5.2-7.7	7.6	5.3	6.3+-0.8
Sursar river	5.0-7.5	7.5	5.0	6.1+-0.7

Graph 1:- Graphical representation of maximum and minimum Dissolved Oxygen at different tributaries of Kosi River



Bhirkhidhar- Dissolved Oxygen recorded within the range of 5.0 mg/L to 7.3 mg/ L. During the study, minimum and maximum dissolved oxygen, 5.1 mg/ L and 7.3 mg/L was observed during July, 2018 and January, 2018 respectively. In the next year, lowest and highest dissolved oxygen, 5.0 m and 7.4 mg/ L. was recorded in August, 2019 and January, 2019, respectively.

Gomatidhar- Dissolved oxygen ranging from 5.0 mg/I, to 7.9 mg/L. During the first annual cycle, the lowest dissolved oxygen, 5.0 mg/L was recorded during June, 2018 and highest 73 mg/L, was observed in December, 2018. In the second annual cycle, the lowest dissolved oxygen, 5.1 mg/L, was measured during June, 2019 and highest 7.9 mg/L was recorded in January, 2019.

Budhmadhar- Dissolved oxygen fluctuated within the range of 5.2 mg/L to 7.7 mg/L. During the first year of study, the lowest and the highest dissolved oxygen, 5.3 mg/L, and 7.7 mg/L was recorded during June, 2018 and January, 2018 respectively. In the following year, minimum dissolved oxygen, 5.2 mg/L was observed in June, 2019 and maximum, 7.6 mg/L was recorded during Jan, 2019.

Sursar River- Dissolved oxygen varied within the range of 5.0 to 7.5 mg/ L. During the first annual cycle, lowest dissolved oxygen, 5.0 mg/L, was determined during June, 2018 and highest, 7.5 mg/ L was recorded in January, 2018. In the following year of study, the minimum and the maximum dissolved oxygen, 5.1 mg/L, and 7.2 mg/L, was recorded during July, 2019 and December, 2019, respectively.

Dissolved oxygen concentration in tributaries of river Kosi showed well-defined seasonal changes, the minimum was observed during summer season and the slight higher in monsoon season and the maximum during winter.

CONCLUSION

The development of a surface water monitoring network is a critical element in the assessment, restoration, and protection of stream water quality. It was observed that due to the disposal of waste in major tributaries of River Kosi namely Mithaidhar, Bhirkhidhar, Budhmadhar, Gomatidhar and river Sursar the concentration of dissolved oxygen in the water drops drastically. Simple material balance equations can be used to estimated deficit and D.O. at the mixing points. For regaining the initial dissolved oxygen in the river water it takes several weeks and has to travel more than 75 kms. During these periods and area the aquatic life is miserable, it becomes unsuitable for aquatic flora and fauna. It can be concluded that the control of pollutants and organic matter needs to be taken care of more effectively.

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