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Diel Cycle of Some Abiotic Factors in Rainy Season of Talla Pond, Sukhjora, Ranishwar, Dumka Jharkhand

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ABSTRACT

Fluctuation in different abiotic and biotic factors of aquatic ecosystems at different hours of the day irrespective of day and night is known as "diel cycle". "Diel cycle refers to the events that recur at 24 hours intervals or less, irrespective of day and night. Diurnal studies of water bodies give an idea about succesional changes in the physico-chemical parameters as well as biological spectrum of the water reservoir at different hours of the day. Diel cycle of some abiotic factors of Talla pond, Sukhjora, Raniswar, Dumka, Jharkhand was assessed during rainy season in the year 2012-2013. Maximum air temperature was found to be 33.2° C at 3.00pm and minimum 26.5° C at 3.00 am in monsoon. Water temperature of pond fluctuated in between 29.5°C at 3.00am to 35.4°C at 3.00pm. pH ranged between 6.00 to 6.8. Lowest dissolved oxygen (DO_2) 0.4 ppm was recorded at 3.00am and highest 3.6 ppm at 3.00pm. Minimum amount 14.00 ppm of free carbon dioxide (FCO_2) was analysed at 11.00 am and maximum 27.2 ppm at 3.00 am. Carbonate (CO_3) alkalinity remained completely absent throughout the entire period of diurnal study. Bicarbonate (HCO_3) varied from 86.00 ppm at 7.00 am to 93.2 ppm at 11.00 am.

Key words: Diel cycle, abiotic, biotic, physico-chemical, parameters , biological spectrum, successional changes, reservoirs, alkalinity, ecosystem, biota, autotrops, photosynthesis.

INTRODUCTION

Fluctuation in different abiotic and biotic factors of aquatic ecosystems at different hours of the day irrespective of day and night is reffered to the "Diel cycle". It reflects the biological activities going on in the aquatic environment. Diurnal fluctuation gives an idea about the variation in the physico-chemical factors caused by the biological activities in the system. Ecosystem is constituted by abiotic and biotic factors which interact in such a way that there is a flow of energy in the form of food, leading to the formation of tropic structure represented by producer, consumer and decomposer. Pond is a fresh water, lentic, aquatic ecosystem. Diurnal fluctuation of some abiotic factors of Talla pond of village Sukhjora, Ranishwar, Dumka, Jharkhand was carried in rainy season of the year 2012-13. Earlier diel cycle of different ponds have been evaluated by several scientist like Singh and Saha (1981), Patra and Nayak (1983), Saha and Pandit (1984), Khan and Siddiqui (1970), Nasar (1977), Patil, Singh and Harshey (1982) etc. According to Odum (1971) diel is reffered to the events that recur at 24 hour intervals or less, irrespective of day and night. Diurnal studies of water bodies give an idea about the succesional changes in the physico-chemical parameters as well as biological spectrum of the reservoir at different hours of the day. Some research scholars have paid special attention to the diurnal changes in the

hydrobiological features of different fresh water ecosystems.

MATERIALS AND METHODS

Samples of subsurface water were collected in BOD bottles and standard methods prescribed in standard workbook of Welch (1948) were followed to analyse the different physico-chemical parameters at the spot, as given below:

Temperature:

Air temperature and sub surface water temperature was recorded with the help of a centigrade mercury thermometer (0-50°C).

Hydrogen-ion concentration (pH):

It was assessd by using the water quality analyser (Elico type PE 132). Buffer solution of pH 9.2 and 4.00 were used for standardization.

Dissolved Oxygen(DO_2):

Modified winkler's method was used to analyse DO_2. This standard method was given by Welch (1948). Concentrated sulphuric acid, alkaline iodide, magnus sulphate and N/40 sodium thio-sulphate were taken as reagents. Starch solution was used as indicator. Sodium iodide was employed as preservative in alkaline iodide. At the end initial dark blue colour changed to colourless or original colour which was the end point.

Free Carbon dioxide (FCO_2):

Method given by Welch (1948) was followed to anlyse free carbon dioxide (FCO_2). It is the titrimetric method. 100 ml of sample was titrated against N/44 sodium hydroxide (NaoH) solution. Ten drops of phenalphalein indicator was added to it. Pink colour indicates of absolute FCO_2. If the sample colour remained colourless then it was titrated again against N/44 NaOH. At the end, pink colour appeared.

Carbonate alkalinity (CO_3):

Carbonate (CO_3) was determined by the method prescribed by Welch (1948). It is a titrimatic method. 100ml of sample water was taken in a conical flask. 2 to 3 drops of phenopthalein indicator solution was added. If the solution remains colourless then the carbonate alkalinity was absent. If the colour changed to pink, the carbonate alkalinity was present, which was analysed by titrating the solution with 0.02N sulphuric acid (2/50 H_2SO_4) until the colour disappeared, as the end point.

Bicarbonate alkalinity (HCO_3) :

Method described by Welch (1948) was employed to assess the Bicarbonate alkalinity. 100 ml of sample water was taken into a conical flask. 2 to 4 drops of Methyl orange indicator was added to it. The solution was titrated with 0.02N Sulphuric acid (N/50 H_2SO_4) until the yellow colour changed to pink as the end point. For diurnal study sample of sub –surface water collected at four hours intervals for 24 hours. Different abiotic factors were assessed just after sampling at the spot, using standard methods. The results are given below :

RESULTS AND DISCUSSION

Air temperature :

Table 1 exhibits the range of fluctuation in air (atmospheric) temperature at the sight. It showed a definite pattern of variation i.e. upward trend in the day time and downward in night hours. Ambient temperature ranged in between 26.5°C to 33.2°C. It was recorded as 31.4°C at 7:00 am which increased to 32.4°C at 11 am and got maximum 33.2°C at 3 pm. Then it showed decreasing trend. It was noted as 29.5°C at 7:00 pm, 29°C at 11 pm and 26.5°C at 3:00 am. Bright sunlight might be cause of higher air temperature in day hours and absence of sunlight in night for low temperature.

Water temperature:

Water temperature showed a regular trend of variation such as increase in day hours and decrease in night hours. Table 1 exhibits the range of fluctuation in water temperature. Water temperature was recorded as 30.4°C at 7:00am which gradually increased at 34.2°C at 11:00am and reached to the climax 35.4°C at 3:00pm. It started

decreasing afterwards and assessed as 31.5°C at 7:00pm, 30.2°C at 11:00 pm and lowest as 29.5°C at 3:00am. Water temperature was appeared to be directly influenced by air temperature i.e increase in day time and decline at night. Nasar (1977) Bohra (1977), Singh and Saha (1981), Singh and Singh (1985) and Saha (1986) have recorded similar pattern of fluctuation in water temperature.

Hydrogen-ion concentration (pH):

pH of the pond water showed slight variation(Table 1). pH value was assessed as 6.8 at 7 am, 6.8 at 11pm, 6.7 at 3 pm, 6.6 at 7 pm, 6.5 at 11 pm and 6.00 at 3 am. It remained acidic throughout the day (24 hours). It showed an upward trend during day and downward at night, which might be due to accumulation of carbon dioxide during night and CO_2 was utilized during day time by aquatic autotrops for photosynthesis similar to the reports of Khan and Siddiqui (1970) , Singh and Singh (1985) and Saha (1986), lower pH in night may be attributed to greater accumulatin of free carbon dioxide in night hours released by aquatic biota after respiration. In day time CO2 might be utilised by aquatic plants for photosynthesis.

Dissolved oxygen (DO_2):

Table 1 shows the fluctuation in DO_2 during diurnal study. It range in between 0.4 ppm to 3.6 ppm. It was recorded as 0.8 ppm at 7 am 2.8 ppm at 11 am, 3.6 ppm at 3 pm, 0.8 ppm at 7 pm,0.4ppm at 11 pm and 0.4 ppm at 3am.DO_2 revealed an increasing trend during day time which gradually decreased during night. Greater evolution of oxygen by higher rate of photosynthesis of aquatic autotrophs, might be the probable cause of highest dissolved oxygen during daytime. Its lower value during night was perhaps due to utilization by aquatic biota for respiration, as well as dearth of accumulation of oxygen by photosynthesis in want of sunlight in night. It supports the report of Nasar (1997) and Gautam and Agarwal (1984).

Free Carbon Dioxide (FCO_2):

The presence of free carbon dioxide (FCO_2) in water indicates the productive nature of aquatic systems. FCO_2 varied from 14.00 pm to 27.2 pm (table 1). It was analysed as 22.00 pm at 7:00 am ; 14 pm at 11:00 am ; 14.4 pm at 3:00 pm ; 16.00 pm at 7:00 pm 20.00 pm at 11:00pm and 27.2 pm at 3:00 am (table 1). Higher FCO_2 concentration were recorded during night obviously due to its accumulation by respiration of aquatic plants and animals (biota), as well as its non utilization by aquatic plants for photosynthesis in want of sunlight. Its lower values were recorded during morning hours of the day. Mulgund and Hosmani (1979) have reported the similar view.

Carbonate ($C0_3$):

Carbonate was completely absent during entire period of diel anylasis (Table 1). According to Cole (1969) Carbonate alkalinity be found only when pH was more than 8. Absence of carbonate can thus be attributed to pH factor.

Bicarbonate ($HC0_3$):

Table 1 exhibits the range of fluctuation in HCO_3 during durinal study. It ranged between 86.00 pm to 93.2 pm. It was assessed as 86.00ppm at 7.00 am , 93.2 pm at 11:00 am , 86.00 pm at 3:00pm , 88.00 pm at 7:00pm ,88.00 pm at 11:00 pm and 90.00 pm at 3:00 am. Its higher concentration were recorded during noon hours of the day which might be due to addition of soaps and detergents by washing activities , which supports the report of Patra and Nayak (1993), Khatri (1984) and Saha (1986). Lower values of Bicarbonate were observed in morning hours. Lesser washing activities and lesser photosynthetic activities in morning hours have direct impact on Bicarbonate concentration. Higher value of Bicarbonate indicates the productive nature of aquatic systems.

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Table-1

Time / Parameters	7.00 A.M.	11.00 A.M.	3.00 P.M.	7.00 P.M.	11.00 P.M.	3.00 A.M.
Atm. temp.^{0}C	31.4	32.4	33.2	29.5	29.00	26.5
Water temp.^{0}C	30.4	34.2	35.4	31.5	30.2	29.5
pH	6.8	6.8	6.7	6.6	6.5	6.00
DO_2 ppm	0.8	2.8	3.6	0.8	0.4	0.4
FCO_2 ppm	22.00	14.00	14.4	16.00	20.00	27.2
CO_3 ppm	0.00	0.00	0.00	0.00	0.00	0.00
HCO_3 ppm	86.00	93.2	86.00	88.00	88.00	90.00

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