International Journal of Researches In Biosciences, Agriculture & Technology | Sept. 2014 Volume-II , Issue-3 | ISSN No. (Online) 2347-517X

Effect of Temperature and Turbidity on Dissolved Oxygen Content of Wainganga River Water : A Study of River Pollution

A.D.Bobdey[1] and S.S.Deshmukh[2]
1,2 Department of Zoology, Shri Shivaji Science College, Congress Nagar, Nagpur-12, drad.bobdey@sscn.in

Abstract: Present work is carried to study the river water contamination and effect of temperature and turbidity on dissolved oxygen levels. Standard methods of NEERI are used to estimate the water parameters. Data harvested during study period showed the direct positive correlation of temperature and dissolved oxygen. However the increased turbidity of water lowers the dissolved oxygen during day time in comparison with clear water. Turbid and flooded water during rainy season showed moderate values of DO, but during summer season turbidity affects the DO levels of river water with combine effect of temperature. Lowered photosynthetic activities of aquatic vegetation and increased metabolic rates of aquatic fauna due to warm conditions affects the DO values of water. However, the concentration of organic pollutants in less water in river during summer with increased microbial activities and their consumption of O2 from water affects the values.

Key words: River water, Temperature, Turbidity, DO, Pollutants, organic.

Introduction:

Dissolved oxygen is a fundamental requirement for the maintenance of life of all living organisms in water. All living organisms depend upon oxygen in one form or the other to maintain the metabolic processes that produce energy for growth and reproduction. The volume of oxygen in water is called as dissolved oxygen. Oxygen naturally diffuses from the air in to the water. Agitation of the water surface by winds and waves enhances this diffusion process, which is called as 'recreation'. Algae and water plants produce oxygen as a byproduct of photosynthesis. This is the transformation of heat energy from sunlight in to energy that can be used by the plant. Algae and aquatic plants for respiration, which occurs continuously, use the oxygen, but photosynthesis occurs only in the presence of sunlight. Consequently the water that has a large population of algae can experience a great fluctuation in the dissolved oxygen concentration during period of 24 hours.

Dissolved oxygen play an important role in supporting aquatic life in running water and is susceptible to slight environmental change.

The changes in temperature of water from its source to the mains may be helpful in detecting unsuspected source of pollution. The multiplication of bacteria in the water is more rapid at higher temperature than in water of lower temperature. From the study of temperature, the characteristics of water such as density, viscosity, vapour pressure and surface tension can be determined. Temperature is also helpful in determining the saturated value of solids and gases, which can be dissolved in water. It is the temperature, which limits the saturation values of solids, gases that are dissolved in aquatic systems. The rate of chemical reactions and other biological activity such as corrosion or incrustation, BOD, photosynthesis, growth and death of microorganisms are all dependent upon environmental temperature values. Indian climate provides almost an ideal range of solar temperature, which attributes great self-purification strength in the stream. The rate of biochemical reaction is directly proportional to the environmental temperature of hottest summer months; the oxygen demand increases, leading to serious oxygen depletion problem in the aquatic systems (Harish kumar, 1998).

The range in variation in temperature is smaller as changes occur more slowly in water than in air. Water has several unique properties than combine to control temperature changes like high specific heat, high latent heat of fusion and highest known latent heat of evaporation. Pophali, Seddiqi and Khan, (1990). Bharti and Krishnamurthy, (1990) have reported that, besides seasonal variation, water temperature followed the trend of air temperature.

Material and methods:

In view of the various domestic activities and to study the water quality of "WAINGANGA RIVER four sampling stations have been selected in Pauni town in Bhandara district for the present investigation. Station 'S-1' is located at the site of Dam at village Gosikhurd, nine kilometers away from the sampling station S-2 of Pauni town.

Besides all these sources of pollution, the decaying cow dung manure also pollutes the river water during summer. The dry regions of the river basin has been taken on lease, for farming the crops of Watermelon and Muskmelon, by some farmers during the months from February to May, The cow dung, which is used as fertilizers for these crop fields enters in the water current at stations S-2 and S-3. The fishing activities are carried at stations S-1, S-2 and S-3, the fisherman prepare artificial hiding places with the help of dry wooden branches of trees. Samples from different sampling stations were collected for physical and chemical analysis. The sample analysis of Temperature, Turbidity and Dissolved Oxygen were performed in the laboratory by using appropriate methods given by NEERI. The weekly collection of samples of water from different spots and depths of river was done by Mayer's sampler. The samples were preserved by refrigeration at 4 °C, in ice box for short interval of travel, which is most general accepted method. (NEERI, 1986).

Result and discussion:

The domestic activities like cloth washing and bathing are commonly observed at stations S-3 and S-4. At station S-3, the intense cloth washing and mass bathing in summer and cattle washing adds the more quantity of detergents, soaps and organic matter. In addition to it, the cow dung from agricultural farming mixes with river water. It is responsible to increase in the decomposition activities and rise in the temperature of river water. The sewage from station S-2 flows up to the area of station S-3 before its complete assimilation in the river water. This is due to short distance between station S-2 and S-3.

The temperature of river water changes with seasonal change in atmospheric temperature, however, it increases from upstream station to down stations with increasing load of pollutants. The intensification of bio-decomposition reactions involves the heat production, which may be responsible to increase the temperature of water in Wainganga river. Mishra and Jha, (1996). At station S-1 there is no significant source of pollution, hence the less temperature of water at this station has been recorded as compared to the downstream stations. The discharge of decaying flowers and leaves from temples and dead bodies constitutes the main source of organic matter at station S-4. Moreover, the discharge of cremated ashes in the river is the cause of increase in the water temperature at this station. Prasanthan and Nayar, (2000). It is evident from the present study that, the temperature of Wainganga river water increases from upstream station to downstream stations with the increasing load of organic pollutants. The values of temperature recorded during the summer are above the permissible levels of drinking water standards.

The seasonal water analysis of river water reveals that, the turbidity fluctuates according to seasons. The sewage and wastes derived from human activities on the bank of river, imparts turbidity to the stream of river. During summer and winter the turbidity in river water may be due to municipal sewage, domestic and religious activities of locality. However, during rainy season, the transported clay, soil and other inorganic pollutants by flooded river primarily increases the values of turbidity. Musaddiq, (2000). The water of Wainganga river becomes more turbid during the summer season, as the less flow of water in river offers the less dilution for incoming sewage and wastes. Regular cloth washing and mass bathing in the months of summer adds the soaps and detergents at station S-3 and S-4. The impact of municipal sewage from station S-2 is observed at station S-3, due to decomposed sewage from station S-2 that reaches at station S-3 before its complete assimilation in river water.

It is concluded that dissolved oxygen in Wainganga river water varies from season to season. Maximum concentrations of DO observed in the winter and minimum during summer season. It is also concluded that, increase in temperature of river water resulted in to decrease of dissolved oxygen. Most of the pollutants discharged in to the river contain organic matter, which enhance the decomposition activities of microorganisms. The consumption of oxygen by microorganisms in the process of biodegradation of organic matter causes the depletion of oxygen from river water. Bhave and Borse, (2001), Thomas et.al, (2001).

During summer the decrease of values at station S-2 at the site of confluence of municipal sewage. At station S-3, it may be due to, the partially diluted organic pollutants from station S-2 and the human activities at station S-3, in the stream of river. The Watermelon fields in the river basin covers the area around station S-2 and S-3. The mixing of decaying cow dung in stream increase the organic pollution. Pande and Sharma, (1998), Mohanta and Patra, (2000).

It is evident from data that, the lower concentrations of DO at sampling station S-4 in summer. This is due to many sources of pollutants that contaminate the river water at this station. Higher concentration of organic matter and increased rate of decomposition due to more temperature of river water during summer may be responsible to depletion of DO levels at down stream stations S-2, S-3 and S-4. However at station S-4, the discharge of crematory ashes forms the turbidity in river water and restricts the light to penetrate inside the water, which intern lowers the oxygen output from aquatic flora. Bilas et.al, (1987) have reported the decrease of dissolved oxygen in river Ganga due to discharge of ashes after cremation. (Sengupta et.al, 1988) (Jameel, 1998).

During the of winter season relatively more flow of water dilutes the sewage and wastes in the river basin. Less temperature of river water influence the microbial activities to some extent and, the solubility of oxygen is also increases with the reduction in temperature of river water. Athappan et.al, 1992. During rainy season large quantity of water in river basin dilutes the organic matter. Subsequently the more turbulence of water in flooded river adds the atmospheric oxygen in water on some extent. The organic matter from surface runoff, sewage discharge and domestic activities including cattle washing, lowers the levels of DO in the rainy season. Biswas et.al, (1975) have recorded similar findings. It has been observed from the present study, the dissolved oxygen in Wainganga river decreases gradually from upstream station S-1 to downstream station S-4. (Aggarwal et al, 2000).

The study during summer and winter months reveals that, artificial fish hiding places were located in the stream around the area between station S-2 and S-4,). The decaying leaves and branches of tree may increase the organic pollutants on some extent. However, this will need further confirmation by carrying the specific experiments to ascertain its impact. It will be interesting to note if this has any significant role in the status of DO in the water of river Wainganga. The potable range of drinking water for DO is minimum 4.0 mg/l. In Wainganga river water the least values are observed below the permissible limits.

Table- 1.- Variations of dissolved oxygen in wainganga river with variations in temperature and turbidity.

Season	station	Temp.(oC)	Mean variation	Tubidity (NTU)	Mean variation	DO (Mg/l)	Mean variation
SUMMER (Feb., Mar. Apr. May.)	S-1	28.69-35.13	6.44	12.0-16.8	4.8	4.0 – 6.3	2.3
	S-2	29.04-35.45	6.41	15.0-19.0	4.0	3.9 – 5.8	1.9
	S-3	29.68-35.60	5.92	19.5-27.0	7.5	3.5 – 4.4	0.9
	S-4	29.65-36.40	6.75	24.0-34.3	10.3	3.1 – 4.0	0.9
WINTER (Oct.,Nov., Dec., Jan.)	S-1	26.13-28.14	2.01	18.0-28.0	10.0	7.6 – 8.1	0.5
	S-2	26.76-28.68	1.92	19.5-29.5	10.0	5.8 – 6.4	0.6
	S-3	26.71-27.91	1.20	26.9-32.5	5.6	4.7 – 5.2	0.5
	S-4	26.13-28.53	2.40	32.0-34.6	2.6	4.4 – 5.1	0.7
RAINY SEASON (Jun. Jul, Aug.Sep.)	S-1	28.74-31.18	2.44	11.0-24.5	13.5	4.2 – 6.8	2.6
	S-2	28.91-32.40	3.49	15.7-26.0	10.3	4.0 – 6.1	2.1
	S-3	29.65-32.50	2.85	18.0-26.5	8.5	3.0 – 5.9	2.9
	S-4	30.20-33.04	2.84	20.0-30.5	10.5	2.9 – 5.4	2.5

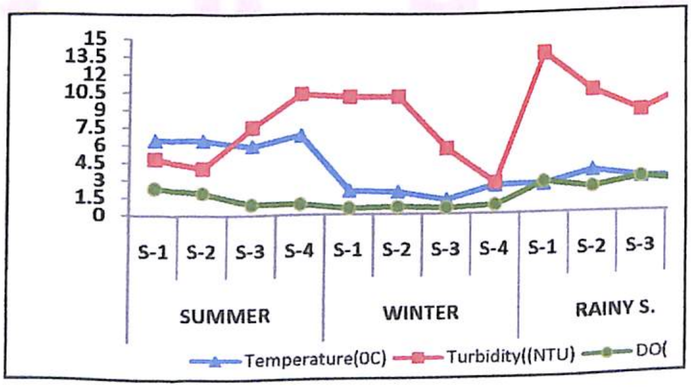

Figure.-1- Mean variations in Temp. Turbidity and Dissolved oxygen during Summer, Winter and Rainy season.

Acknowledgements:

Author is cordially thankful to Dr. Prakash G. Puranik, former Head, P.G.Dept. of Zoology Dharampeth and M.P.Deo Memorial College, Nagpur, for his untiring guidance during the work. However, thankfulness is due to Dr. D.K.Burghate, Principal Shivaji Science College for kind help, however, Dr. A.P.Sawane, Head. Dept. Zoology, A.N.College, Warora for continuous help during the experimental work.

References:

Aggarwal T. R., Singh K. N. and Gupta A. K., (2000). Impact of sewage containing domestic wastes and heavy metals on the chemistry of Varuna river water. Poll. Res. 19, (3) : 491-494.

Athappan P. R., Sethuraman K. and Kannan N., (1992). A study on the pollution of river Vaigai at
Madurai. Indian J. Env. Proct., Vol. 12, (11): 818-823.

Bharti S. G. and Krishnamurthy S. R. (1990). Effect of industrial effluents on river Kali around Dandeli, Kernataka. Part I-Physico-chemical complexes. Indian J. Environ. Hlth., Vol. 32, No. 2, 167-171.

Bhave S. K. and Borse P. V. (2001). Seasonal variation in temperature, dissolved oxygen, pH and salinity and their influence on planktons in Aner river water, Jalgaon, Maharashtra. Poll. Res. 20, (1): 79-82.

Bilas R. (1987). Number of dead bodies. Silver Jubilee Symposium on Tropical Ecology, Bhopal, Oct. 5/10/1981. Book, River an Overview of Env. Research. NEERI, Publ, 1987, pp. 74.

Biswas R.D., Gupta S. K. and Ghosh K. (1975). Coflocculation of monsoon Ganges silt. Indian J. Environ. Hlth., Vol. 17, No. 2, 121-126.

Harish Kumar (1998). Modern Methods In Environmental Pollution Analysis, Volume-2. 1st Edition, 1998, Sarup And Sons Publication, New Delhi, ISBN : 81-7625-029-5(set).

Jameel Abdul A. (1998). Physico-chemical studies in Uyyakondan channel water of river Cauvery.
Poll. Res. 17, (2) : 118-114.

Mishra P. K. and Jha S. K. (1996). Effect of water pollution on biochemistry of hydrophytes. Poll. Res. 15 (4) : 411-412.

Mohanta B. K. and Patra A. K. (2000). Studies on the water quality index of river Sanamachhakandana at Keonjhar Garh, Orissa, India. Poll. Res. 19, (3) : 377-385.

Musaddiq M. (2000). Surface water quality of Morna river at Akola. Poll. Res. 19, (4) : 685-691.

NEERI (1986). Manual On Water And Waste Water Analysis. National Environmental Engineering Research Institutte, Nehru marg, Nagpur, India.

Pande K. S. and Sharma S. D. (1998). Natural purification capacity of Ramganga river at Moradabad (U.P.). Poll. Res. 17, (4) : 409-415.

Pophali S., Siddiqui S. and Khan L. H. (1990). Study of some Physico-chemical parameter to asses pollution load in Patra river. Indian J. Env. Proct., Vol. 10, No. 3 : 203-207.

Prasanthan V. and Vasudevan Nayar T. (2000). Impact assessment - hydrological studies on Parvaphyputhen AR. Poll. Res. 19, (3) : 475-479.

Sengupta B., Laskar S., Das A. K. and Das J. (1988). Inoranic pollutants of Ganga water in the region of Berhampore to Katwa, West Bengal. Indian J. Environ. Hlth., Vol. 30, No. 3, 202-208.

Thomas S., Harikrishnan K., George S., Paulmurugan R. and Das M. R. (2001). Studies on the water quality of Kuttanad Wetland ecosystem Kerala. Poll. Res. 20, (1) : 59-66.