Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(3): 1130-1132

Received: 20-03-2019
Accepted: 22-04-2019

AK Rai
Head, Agricultural Economics and Statistics, Kulbhaskar Ashram P.G. College, Prayagraj, Uttar Pradesh, India

Shivangi Singh
Students, Department of Molecular and Cellular Engineering, JIBB, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Sadaf Zia
Students, Department of Molecular and Cellular Engineering, JIBB, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Padmini Manikpuri
Students, Department of Molecular and Cellular Engineering, JIBB, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Kamin Alexander
Assistant Professor, Department of Biological Sciences, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Verma OP
Associate Professor, Department of Molecular and Cellular Engineering, JIBB, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Correspondence
Verma OP
Associate Professor, Department of Molecular and Cellular Engineering, JIBB, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Relation between COD and BOD in Sangam water samples for pre and post bath during Kumbh 2019

AK Rai, Shivangi Singh, Sadaf Zia, Padmini Manikpuri, Kamin Alexander and Verma OP

Abstract
Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are the most commonly used parameters for the characterization of water samples. A correlation between chemical oxygen demand (COD) and biological oxygen demand (BOD) in Sangam water during Kumbh 2019 has been studied. Sangam water sample has been collected from the Holy bath from Sangam from January to March 2019 at Prayagraj city. It was found that the value of correlation coefficient (r) is very close to one (1) from both pre and post bath samples (January- March 2019). The values of empirical parameters a and b were found to be 1.03 and 0.53 of pre and post sample respectively, indicating that there is a highly significant correlation between chemical oxygen demand (COD) and biological oxygen demand (BOD). The value for pre bath of a = 1.34 and b = 0.51 and the value for post bath of a = 2.31 and b = 0.37, thus indicating that there is highly significant correlation between chemical oxygen demand (COD) and biological oxygen demand (BOD).

Keywords: Biological oxygen demand, chemical oxygen demand, sangam water, and correlations

Introduction
Water is not only a vital environmental factor to all the forms of life but it has also a great role to play in socio economic development of human population [6, 3]. The Ganga originates from Devprayag when the Alaknanda river system and Bhagirathi system meets at the Devprayag. The water is used for various purposes such as drinking without treatment, bathing non-contact recreational uses, public water supplies, industrial, agricultural, aqua-culture and wild life propagation, navigation and waste receiving etc. [10].

The Ganga is suffering from severe pollution today affecting human survival in its basin. The script has reached such a level due to various factors such as domestic sewage, industrial effluent discharge, various religious activities and the cremation deteriorate Ganga water up to an alarming situation in passage of time and distance causing families living along the river bank vulnerable to various water born diseases.

Biological oxygen demand is a test which determines the amount of organic material in wastewater by measuring the oxygen consumed by microorganisms in decomposing organic constituents of the waste. The higher the BOD, the more oxygen will be demanded from the waste to break down the organics. The BOD test is most commonly used to measure waste loading at treatment plants and in evaluating the efficiency of wastewater treatment. The two most common parameters used to recognize the composition of wastewater are the biological oxygen demand (BOD) and the chemical oxygen demand (COD). BOD is a measure of how much dissolved oxygen is consumed by aerobic bacteria in 5 days at 20 ^{0}C. It is the broad measure of the strength of the organic matter in a waste stream. The typical range of BOD in domestic wastewater ranges from 100 to 300 mg/L.

COD is chemical oxygen demand and is measured chemically by digestion with acid. There exists a definite correlation between the COD and BOD under certain conditions and by determining the COD, the information about the BOD of the wastewater can be derived, but it is highly waste dependent. These two parameters have advantages and disadvantages, and the choice usually depends on many factors such as, the reproducibility of the determinations, time period required, location of the test. COD results are typically higher than BOD values, and the ratio between them will vary depending on the characteristics of the wastewater. This ratio

This ratio has been commonly used as an indicator for biodegradation capacity. It is called "Biodegradability index" (B.I.). It is generally considered the cut-off point between biodegradable and non-biodegradable waste. The relationship among the numerous parameters facilitate the task of rapid monitoring of the status of pollution [4, 9]. In view of the above facts the present investigation was carried out to study the Correlation between COD and BOD of Sangam water during Kumbh-2019 at Prayagraj (Allahabad).

Materials and Methods

The present work on to study the correlation between COD and BOD of Sangam water sample was carried out in the department of Molecular and Cellular Engineering, Jacob Institute of Biotechnology and Bioengineering, SHUATS, Prayagraj (Allahabad). The city lies close to Triveni Sangam "three river confluence" which lies at the Sangam (confluence) of the Ganga, Yamuna and Saraswati river. It plays a central role in Hindu scriptures. In the present investigation, the pre and post water sample (5 each) were collected from the Sangam of Prayagraj city. The name of samples, water sampling dates and sampling stations are shown in Table 1.

Table 1: Pre and post bath sampling dates during Kumbh 2019

Name of samples	Dates of sampling	Sampling stations
Pre and post bath	13th and 15th January	Sangam
Pre and post bath	20th and 22nd January	Sangam
Pre and post bath	3rd and 5th February	Sangam
Pre and post bath	9th and 11th February	Sangam
Pre and post bath	3rd and 5th March	Sangam

The samples were analyzed for the COD and BOD by the standard methods [11, 13] and the statistical parameters like mean (*x*), standard deviation(+SD), standard error (SE) and 95% Confidence limit (Cl) have been evaluated.

The correlation coefficient (r) between the variables x and y (that is COD and BOD) was calculated using the well known equation:

$$\sum xy - \bar{x}\sum y$$

$$r = r = \sqrt{(\sum x^2 - \bar{x}\sum x)\,(\sum y^2 - \bar{y}\sum y)} \quad \text{..... (i)}$$

where the summations are taken from 1 to n (n = no. of observation). The value of empirical parameters a and b were calculated with the help of following equation:

$$b = \frac{\sum xy - \bar{x}\sum y}{\sum x^2 - \bar{x}\sum y} \quad \text{.....(ii)}$$

$$a = y - b.x \quad \text{.....(3)}$$

where $x = \sum \frac{x}{n}$ and $y = \sum \frac{y}{n}$

keeping all the observation in mind a linear relationship was proposed between COD and BOD of collected pre and post water sample during Kumbh 2019 at Prayagraj (Allahabad).

Results and Discussion

The results obtained during the present study were shown in the tables 2-4. The values of COD and BOD for pre bath were found to be in the range of (3.1 to 13.3 mg/litre) and (5.3-6.2 mg/litre) respectively and the values for COD and BOD for post bath were found in the range of (3.7-12 mg/litre) and (4.9-6.1 mg/litre) respectively. In mass bathing samples indicates that the value of BOD usually increases in the regular manner with COD as shown in Table 2-4.

Table 2: Prediction of BOD as a function of COD in pre and post water sample

Pre Sample dates	COD observed (mg/l)	BOD observed (mg/l)	Post sample dates	COD observed (mg/l)	BOD observed (mg/l)
13th January, 2019	13.3	6.1	15th January, 2019	12.00	4.9
20th January, 2019	10.9	5.9	22nd January,2019	12.00	6.00
3rd February, 2019	10.5	6.15	6th February, 2019	9.9	6.15
9th February, 2019	7.35	5.15	11thFebruary,2019	6.1	5.95
3rd March, 2019	3.15	6.25	5th March, 2019	3.7	6.1

Table 3: Statistic data for Pre and Post water samples

Parameter	n	Min.	Max.	Average	+SD	SE	95%Cl
COD pre	5	3.1	13.3	9.03	3.51	1.56	3.05
BOD pre	5	5.3	6.2	5.94	0.33	0.14	0.28
COD post	5	3.7	12	8.74	3.31	1.48	2.90
BOD post	5	4.9	6.1	5.61	0.48	0.21	0.411

Table 4: Correlation coefficient (r) and empirical parameters a and b

Parameters	r	a	b
COD – BOD (Pre sample)	0.91	1.33	0.51
COD – BOD (Post sample)	0.91	2.31	0.377

The large positive correlation (r =.91) was found between COD and BOD for mass bathing samples. The values of empirical parameters for pre bath was found that a = 1.334, b = 0.51 and post bath was found that a = 2.31 and b = 0.37 as shown in Table 4. The positive value of a and b indicates that with the increase in variable *x* (that is COD), the value of *y* (that is BOD) also increases.

The statistical data like mean, standard deviation, standard error and 95% Cl for COD and BOD for pre bath was found to be 9.03, 3.51, 1.56, 3.05 and 5.94, 0.33, 0.14, 0.28 mg/litre respectively and for post bath was found to be 8.74, 3.31, 1.48, 2.90 and 5.61, 0.48, 0.21, 0.41 mg/litre respectively as shown in Table 3.

The 95% Cl shows that there are 95% chances that the true mean of the respective parameter will be somewhere between the mean value and obtained value of 95% Cl.

From the correlation results it was inferred that there is an excellent agreement between pre bath and post bath observed values of BOD and COD.

COD is chemical oxygen demand and is measured chemically by digestion with acid [8]. There exists a definite correlation between the COD and BOD under certain conditions and by determining the COD, the information about the BOD of the wastewater can be derived, but it is highly waste dependent [7, 8]. These two parameters have advantages and disadvantages, and the choice usually depends on many factors such as, the reproducibility of the determinations, time period required,

location of the test [9]. Although, the BOD test has been in use for more than a century, and consequently remains deeply entrenched in the practice and experience of biological wastewater treatment; the test is clearly lacking in many respects compared to the COD test [1]. On the other hand, COD analysis estimates the amount of organic matter in wastewater in only three to four hours, rather than the five days required by the BOD test, and can be used as an alternative. COD results are typically higher than BOD values, and the ratio between them will vary depending on the characteristics of the wastewater. This ratio has been commonly used as an indicator for biodegradation capacity [5]. It is called "Biodegradability index" (B.I.). It is generally considered the cut-off point between biodegradable and non-biodegradable waste [12]. Once an average B.I. has been established for the plant wastewater stream, COD test can be used to predict BOD.

Conclusion

On the basis of experimental findings it can be concluded that the COD level of pre and post sample of Sangam water (Kumbh-2019) is much higher than that of BOD level. that is the COD level in the range (3.1 to 13.3) is higher than the range of BOD (4.9 to 6.2). This results greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen levels. A reduction in DO can lead to anaerobic conditions which is deleterious to higher aquatic life forms.

References

1. Esener AA, Roels JA, Kossen NWF. The bioenergetic correlation of COD to BOD. Biotechnology Letters. 1981; 3(4):193-196.
2. Hammam GS. Influence of Raw Wastewater Biodegradability on Optimal Selection and Performance of Treatment Processes, MSc. thesis, Cairo university, Egypt, 2013
3. Jeykuma, Indra TS, Thillai AP. Status of groundwater quality and public health around Tiruchendur. Indian Journal Environment Piot. 2003; 23:256-260.
4. Kannan C, Rajashekharan. Correlation of water quality parameters of printing industry effluent in Sivakasi. Indian Journal of Environment and Health. 1991, 330-335.
5. Metcalf, Eddy. Wastewater Engineering: Treatment and Reuse, 4th Ed., McGraw-Hill York, USA, 2003.
6. Park K. Park's test book of preventive and social medicine. Banarsidas Bharat Publishers, Jabalpur, 1997.
7. Russell DL. Practical Wastewater Treatment, John Wiley & Sons, Inc., Hoboken, NJ, USA, 2006
8. Sawyer CN, Parkin GF, McCarty PL. Chemistry for Environmental Engineering, 5th ed. New York: McGraw-Hill, 2003.
9. Srivastava VS. A relation between COD and BOD for textile dyeing and printing effluents of GIDC areas of Surat city. Journal of Indian water works Assoc. 1999; 31(4):771-773
10. Sundararajan, Anand. A Study on The Impact of Coal washers Effluents Along Damodar River Stretch In Dhanbad District, Jharkhand, India, International Journal of Engineering And Management Science. 2011; 2(4):233-245
11. Trivedy RK, Goel PK. Chemical and biological methods for pollution studies. Environmental Publications, Karad, 1984.
12. Turak UG, Fsar HA. Research of BOD And COD Values of Wastewaters that Contain Certain Organic Materials", A Donor Menderes Univ., 4th AACD congress, Kusadasi – Aydin, Turkey, Proceeding Book, 2004, 177,
13. Verma OP. Practical biotechnology (1st edn) Parmar Publishers and Distributor, Dhanbad, India, 2012.