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Study of Chemical Oxygen Demand (COD) in Relation to Biochemical Oxygen Demand (BOD)

دراسة العلاقة بين المتطلبات الكيميائية COD والحيوية للاوكسجين BOD

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الخلاصة

هذا البحث اجري لدراسة العلاقة بين المتطلبات الكيميائية والحيوية للاوكسجين (COD and BOD) ثلاث عينات مكررة أخذت من مناطق مختلفة لتمثل المياه في مدينة بغداد:**1**- من صدور قناةالجيش **2**- قرب جسر الطالبية على قناة الجيش **3**- من الفتحات الرئيسية للمجاري قرب علوة المخضر في مدينة جميلة Anaerobic main holes effluent (Septic systems) **4**- من نهر ديالى قرب الرستمية **5**- من منطقة تقاطع نهر ديالى مع نهر دجلة جنوب بغداد **6**- من نهر دجلة قرب جسر باب المعظم **7**- من نهر دجلة قرب جسر الائمة **8**- فضلات المجاري من محطة الرستمية قبل معاملتها.معدلات قيم المتطلبات الكيميائية والحيوية للاوكسجين في المناطق المدروسة بينت وجود علاقة معنوية عالية (r = 0.9758) والمعادلة بالتالية تصف هذه العلاقة :

$$BOD= 6.1242 + 0.3142 (COD) + 0.0008 (COD)^2$$

المعادلة اعلاه يمكن ان تستعمل لتعين قيم المتطلبات الحيوية للاوكسجينBOD بدلالة قيم المتطلبات الكيميائية للاوكسجين COD اختصارا للوقت والكلفة لان تقدرBOD يتطلب اكثر من خمسة ايام بينما COD تحتاج ساعة او ساعتين .

Abstract

This investigation has been conducted to Study Chemical Oxygen Demand (COD) in Relation to Biochemical Oxygen Demand (BOD).Three replicates samples were taken in Baghdad city from :1 - From the water upper part of Army Channel , 2 –Near Al-Talbaia Bridge on Army Channel , 3 - Anaerobic main holes effluent (Septic systems) near Vegetables Station in Gamelia City , 4 –From Dyalia river near Ristmaia , 5 - From the intersection between Tigris and Dyalia river southern Baghdad , 6 - From Tigris river Near Bab –Al – Matham Bridge , 7- From Tigris river Near Al – AL-Aiemah Bridge and 8 –Waste water from Ristmaia Station before treatment .

Mean values of COD and BOD in the investigated locations show strong relation with high value of
correlation coefficient (r = 0.9758) and describe by the equation :

$$BOD= 6.1242 + 0.3142(COD) + 0.0008 (COD)^2$$

The above formula used to estimate BOD depending on COD . The COD test can be run in a couple of hours instead of five days to determine BOD .

Key words: COD , BOD , estimated , relationship

Introduction

Aquatic animals such as fish depend on dissolved oxygen , higher levels of dissolved oxygen are necessary for fish respiration .The amount of dissolved oxygen in water is dependent on the water temperature, the quantity of sediment in the stream, the amount of oxygen taken out of the system by respiring and decaying organisms, and the amount of oxygen put back into the system by photosynthesizing plants, stream flow, and aeration. Dissolved oxygen is measured in milligrams per liter (mg/l) or parts per million (ppm). The temperature of stream water influences the amount of dissolved oxygen present; less oxygen dissolves in warm water than cold water. For this reason, there is cause for concern for streams with warm water. Trout need DO levels in excess of 8

mg/liter, striped bass prefer DO levels above 5 mg/l, and most warm water fish need DO in excess of 2 mg/L (1).

Measuring organic and inorganic carbon in surface and ground waters is of great interest to assess quality of life in many ecosystems (2). In pollution abatement works, organic carbon measurement provides a quick and simple method for monitoring pollution levels as well as the accumulation of non biodegradable or refractory organic materials (2).

Under the ecological point of view, organic and inorganic carbon measurements give quantitative information about the carbon cycle and productivity of natural bodies of water. In environmental engineering, measurement of organic carbon provides a non-specific measure for monitoring potentially toxic organic materials in natural waters (3). Septic systems, and agricultural and urban runoff, acts as a food source for water-borne bacteria. Bacteria decompose these organic materials usingdissolvedoxygen,thusreducingtheDO present for fish(3).

Biochemical oxygen demand (BOD) is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions (4). It is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. The term also refers to a chemical procedure for determining this amount. This is not a precise quantitative test, although it is widely used as an indication of the organic quality of water (5). Dissolved Oxygen average to 4.0 mg/l minimum and Higherlevelsofdissolvedoxygenarenecessaryforfishrespiration.

Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are the major parameters used as routine surrogate tests for measuring the load of organic carbon into the environment (6) .

To measure oxygen demand, the BOD method relies on enzymes produced by bacteria to catalyze the oxidation of organic matter during a five-day incubation period. In contrast, COD methods use chemical oxidants to oxidize organic matter. BOD simulates the actual treatment process by measuring the organic material that can be oxidized with the oxygen in the sample when catalyzed by bacterial enzymes. Although COD is comparable to BOD, COD actually mea sures chemically oxidizable matter (7).

The benefits of COD testing are often significant. BOD analysis is performed mainly to satisfy permit requirements.With COD analysis, however, early knowledge of the strength of incoming water allows plant operators to optimize treatment processes, because the value measured provides a quantitive estimate of everything currently in the waste stream that can be oxidized. Because the COD test can be run in a couple of hours instead of five days, it gives the operator a more timely idea of loadings entering the plant and how the plant is performing, thereby permitting closer operational control of the treatment process. Technicians are able to quickly respond to changes in oxygen demand and adjust treatment processes accordingly. In this study , therefore to save time and expense COD values could be used to estimate BOD values by using the best fitting equation describe the relationship between BOD and COD (7).

Material and Method

Three replicates samples were taken from :

1. From the water upper part of Army Channel.
2. Near Al-Talbaia Bridge on Army Channel.
3. Anaerobic main holes effluent (Septic systems) near Vegetables Station in Gamelia City.
4. From Dyalia river near Ristmaia.
5. From the intersection between Tigris and Dyalia river southern Baghdad.
6. From Tigris river Near Bab –Al –Motham Bridge.
7. From Tigris river Near Al – Aiemah Bridge.
8. Waste water from Ristmaia Station before treatment .

The samples were filtered by Chemical Oxygen Demand (COD) tests were performed as recommended in an open reflux method, and Biochemical Oxygen Demand (BOD) by the 5-day test
with azide modification using the Winkler method for DO measurement (8,9). SPSS and CurveExpert 1.3 computer programs, also have been used for statistic analysis and interpretation the results.

Results and Discussion:

Table (1)Mean values (mean ± S.E) of COD and BOD in the investigated locations in Baghdad city .

Sample location	*Mean , BOD (ppm , O_2) ± S.E	Mean , COD (ppm, O_2)± S.E
1	8.67 ± 1.20	28.33 ± 2.03
2	26.00 ± 2.31	98.33 ± 1.20
3	116.33 ± 5.78	256.33 ± 20.34
4	49.33 ± 3.48	124.67 ± 7.8
5	45.33 ± 3.18	114.67 ± 5.89
6	30.67 ± 0.88	101.67 ± 4.40
7	26.30 ± 4.91	96.33 ± 6.36
8	126.00 ± 3.06	227.67 ± 19.37

***Mean ± Standard Error(S.E)**

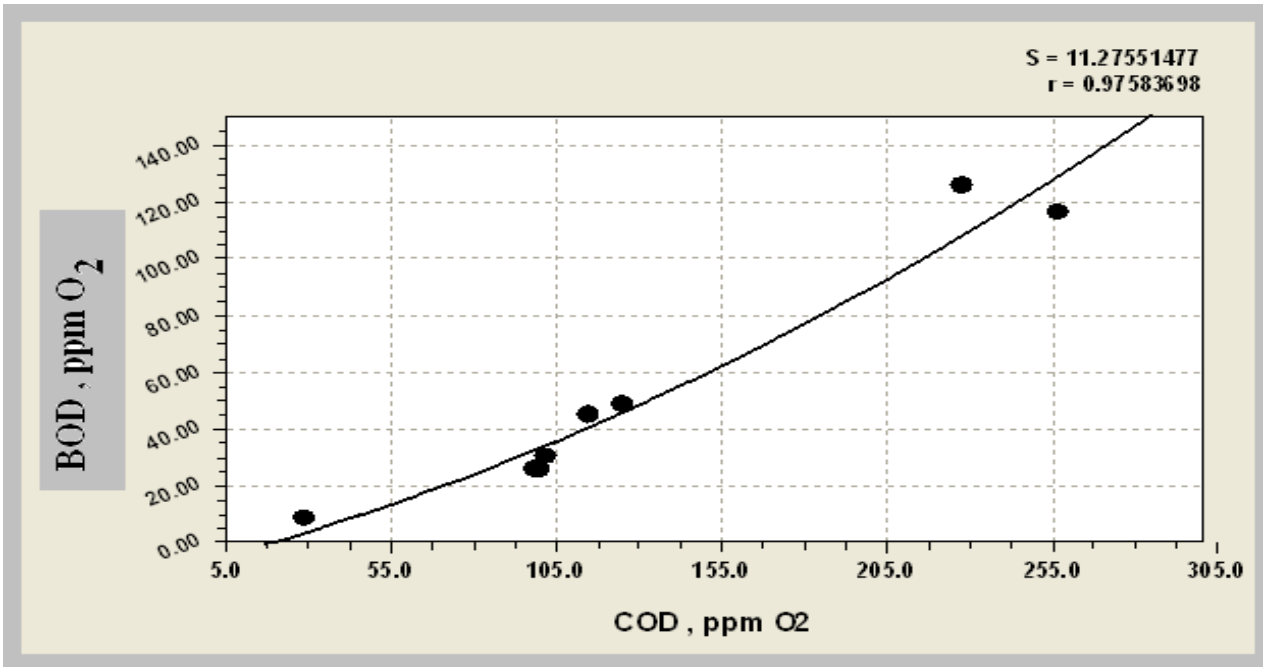

Figure (1) Shows the relationship between COD and BOD values .

The following equation describes the relationship between COD and BOD values . This equation shows strong relation as can be seen by the high value of correlation coefficient (r = 0.9758) .

$Y = 6.1242 + 0.3142X + 0.0008X^2$ r = 0.9758 (Combined by the authors)

Where Y = BOD value (ppm , O_2) and X = COD value (ppm , O_2)

The above equation could be used to estimate BOD depending on COD The COD test can be run in a couple of hours instead of five days that BOD needs to be determined.

As example of estimating the corresponding value of BOD value from 25 (ppm , O_2) COD value :

$Y = 6.1242 + 0.3142X + 0.0008X^2$

= **$6.1242 + 0.3142(25) + 0.0008 (25)^2$**

= **6.1242 + 7.855+0.5**

Y (**BOD**)= 14.4792 **(ppm , O_2)**

Conclusion

The equation : BOD= 6.1242 + 0.3142 (COD)+ 0.0008 (COD)² has been found good to estimate BOD depending on COD . COD test can be run in a couple of hours instead of five days that BOD needs to be determined.

References

1. Barnes, K.H., J.L. Meyer, and B.J. Freeman, (1998). Sedimentation and Georgia's Fishes.
2. Abdulla, H . J. (2011). The harmful impacts of pollution on Tigris river southern Baghdad city. Baghdad – Iraq. Al- Kufa University Journal for biology ISSN : 2073 – 8854 Vol . 1 NO. 1. 2011.
3. Maier, J. M.; McConnel, H. L. (1974); *J. Water Pollut. Cont. Fedn.*, *46*, 623.
4. Abdulla , H . J ., M. F. AL – Marjani and B. A. Baqir . (2008). Study some bacteria and chemical contents of polluted water in Baghdad city , Iraq . Al – Mustansiryia J . Sci . Vol . 19 , No. 2 , 15 – 20 , 2008.
5. Lenore S. Clescerl, Arnold E. Greenberg, Andrew D. Eaton (1999). *Standard Methods for Examination of Water & Wastewater* (20th ed.). Washington, DC: American Public Health Association. ISBN 0-87553-235-7).
6. Abdulla , H . J ., H. A. Al sady and A. S. Husson. (2012). Soil water, and Plant analysis (In Arabic) .PP. 375. Dar Dejla. Aman Jordain.
7. AL – Husony R. M. E. Hassony, H. J. and A. T. Sarhan. (2011). Study on the quality of water in Diyola and Tigris rivers in southern Baghdad Al - Kufa University Journal for biology ISSN : 2073 – 8854 Vol . 1 NO. 1 . 2011.
8. APHA, AWWA and WPCF; (1992), *Standard Methods for the Examination of Water and Wastewater*, 18th ed., American Public Health Association: Washington, D.C.
9. Clair N. Sawyer, Perry L. McCarty, Gene F. Parkin (2003). *Chemistry for Environmental Engineering and Science* (5th ed.). New York: McGraw-Hill. ISBN 0-07-248066-1.