

5210 B. 5-Day BOD Test

1. General Discussion

The BOD test is an indirect measurement of organic matter; it measures the change in DO concentration caused by microorganisms as they degrade organic matter in a sample held in a stoppered bottle incubated for 5 d in the dark at 20°C. Analysts measure DO before and after incubation, and compute BOD using the difference between DO measurements. Because initial DO is determined shortly after dilution, all oxygen uptake occurring after this measurement is included in the BOD measurement.

For sampling and storage procedures, see 5210B.4a.

2. Apparatus

a. Incubation bottles: Use 60-mL, glass bottles or larger (300-mL bottles with a flared mouth and ground-glass stopper are preferred). Clean bottles with a detergent, rinse thoroughly, and drain before use. Alternatively, use disposable plastic BOD bottles that are capable of meeting all method quality-control (QC) checks.

b. Air incubator or water bath, thermostatically controlled at 20 ±1°C. Exclude all light to prevent the possibility of photosynthetic production of DO.

c. Oxygen-sensitive membrane electrode, polarographic or galvanic, or *oxygen-sensitive optical probe* with appropriate meter.

3. Reagents

Discard reagents if there is any sign of precipitation or biological growth in the stock bottles. Commercial equivalents of these reagents are acceptable, and different stock concentrations may be used if doses are adjusted proportionally. Use reagent grade or better for all chemicals and use distilled or equivalent reagent-grade water (see Section 1060) to make all solutions.

a. Phosphate buffer solution: Dissolve 8.5 g monopotassium phosphate (KH_2PO_4), 21.75 g dipotassium phosphate (K_2HPO_4), 33.4 g disodium phosphate ($\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$), and 1.7 g ammonium chloride (NH_4Cl) in about 500 mL reagent-grade water and dilute to 1 L. The pH should be 7.2 without further adjustment. Alternatively, dissolve 42.5 g KH_2PO_4 and 1.7 g NH_4Cl in about 700 mL reagent-grade water. Adjust pH to 7.2 with 30% sodium hydroxide (NaOH) and dilute to 1 L.

b. Magnesium sulfate (MgSO_4) solution: Dissolve 22.5 g $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in reagent-grade water and dilute to 1 L.

c. Calcium chloride (CaCl_2) solution: Dissolve 27.5 g CaCl_2 in reagent-grade water and dilute to 1 L.

d. Ferric chloride (FeCl_3) solution: Dissolve 0.25 g $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in reagent-grade water and dilute to 1 L.

e. Acid and alkali solutions, 1N, to neutralize caustic or acidic waste samples.

1) *Acid*—Slowly and while stirring, add 28 mL conc sulfuric acid (H_2SO_4) to reagent-grade water. Dilute to 1 L.

2) *Alkali*—Dissolve 40 g NaOH in distilled water. Dilute to 1 L.

f. Sodium sulfite (Na_2SO_3) solution: Dissolve 1.575 g Na_2SO_3 in 1000 mL reagent-grade water. This solution is unstable; prepare daily.

g. Nitrofurantoin inhibitor:

1) 2-chloro-6-(trichloromethyl) pyridine (TCMP)—Use pure TCMP or commercial preparations.*

2) Allylthiourea (ATU) solution—Dissolve 2.0 g allylthiourea ($\text{C}_3\text{H}_7\text{N}_2\text{S}$) in about 500 mL reagent-grade water and dilute to 1 L. Store at 4°C. The solution is stable for 2 weeks when stored at 6°C without freezing.

h. Glucose-glutamic acid (GGA) solution: Dry reagent-grade glucose and reagent-grade glutamic acid at 103°C for 1 h. Add 150 mg glucose and 150 mg glutamic acid to reagent-grade water and dilute to 1 L. Prepare fresh immediately before use unless solution is maintained in a sterile container. Store all GGA mixtures at 6°C without freezing unless manufacturer recommendations state otherwise. Commercial preparations may be used but concentrations may vary. Discard solutions if evi-

dence of contamination is indicated (e.g., growth occurs in the stock bottle or GGA test results are consistently low).

i. Ammonium chloride solution: Dissolve 1.15 g NH_4Cl in about 500 mL reagent-grade water, adjust pH to 7.2 with NaOH solution, and dilute to 1 L. Solution contains 0.3 mg N/mL.

j. Source water for preparing BOD dilution water: Use demineralized, distilled, or equivalent reagent-grade water, tap, or natural water to make sample dilutions (see 5210B.4c).

4. Preparatory Procedures

a. Sampling and storage: Samples for BOD analysis may degrade significantly during storage between collection and analysis, resulting in low BOD values.

1) *Grab samples*—If analysis begins within 2 h of collection, cold storage is unnecessary. Otherwise, keep sample at 6°C between collection and analysis. Ideally, begin analysis within 6 h of sample collection; if impossible due to distance between sampling site and laboratory, then begin analysis within 24 h of collection. The recommended holding time is 24 h; however, the U.S. Environmental Protection Agency (EPA) allows for a 48-h holding time.

2) *Composite samples*—Limit compositing period to 24 h, and keep samples at 6°C during process. Store for the same time and temperature as grab samples, although in this case, holding time begins when the compositing period ends.

b. Sample preparation and pretreatment:

1) *All samples*—Check pH; if it is not between 6.0 and 8.0, adjust sample temperature to 20 ±3°C, then adjust pH to between 6.5 and 7.5 using an H_2SO_4 or NaOH solution strong enough not

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Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts Levelton Consultants, Levelton Consultants Limited, National Cooperative Highway Research Program, 2007 **Environmental Bioprocesses and Circular Sustainability** Ibrahim Jamal Ahmed, Gabriel Salazar-Robles, Gabriel G. Dirisu, Gabriele Kuhn Dupont, 2026-02-25 TOPICS IN THE BOOK Earthworms as Soil Health Bioindicators in Mogadishu Greenhouses A Comparative Study Under Contrasting Managements Towards Entomoremediation Plastic Consumption Rates and FTIR ATR Analysis of Plastic Frass and Exuviae from *Tenebrio Molitor* Fed with EPS and Maize Investigating the Effect of Gas Flaring on the Physicochemical Properties of Air and Rainwater in Oil Producing Region of Orashi ONELGA Thermally Dried Sewage Sludge A Solution for Circular Economy and Sustainable Agriculture *Food Analysis* Suzanne Nielsen, 2014-09-04 This book provides information on the techniques needed to analyze foods in laboratory experiments All topics covered include information on the basic principles procedures advantages limitations and applications This book is ideal for undergraduate courses in food analysis and is also an invaluable reference to professionals in the food industry General information is provided on regulations standards labeling sampling and data handling as background for chapters on specific methods to determine the chemical composition and characteristics of foods Large expanded sections on spectroscopy and chromatography also are included Other methods and instrumentation such as thermal analysis ion selective electrodes enzymes and immunoassays are covered from the perspective of their use in the analysis of foods A website with related teaching materials is accessible to instructors who adopt the textbook [Nielsen's Food Analysis](#) B. Pam Ismail, S. Suzanne Nielsen, 2024-06-24 This sixth edition provides information on techniques needed to analyze foods for chemical and physical properties The book is ideal for undergraduate courses in food analysis and it is also an invaluable reference for professionals in the food industry General information chapters on regulations labeling sampling and data handling provide background information for chapters on specific methods to determine chemical composition and characteristics physical properties and constituents of concern Methods of analysis cover information on the basic principles advantages limitations and applications The information on food analysis applications has been expanded in a number of chapters that cover basic analytical techniques Instructors who adopt the textbook can contact B Ismail for access to a website with related teaching materials

Water Treatment in Urban Environments: A Guide for the Implementation and Scaling of Nature-based Solutions Veeriah Jegatheesan, Perlie Velasco, Nevelina Pachova, 2024-03-02 The value of implementing nature based solutions NbS for water treatment in urban environments is increasingly recognized due to the multiple ecosystem services and societal benefits they provide The successful implementation of NbS for urban water treatment however depends on a range of diverse technical and societal factors that need to be taken into account Those vary by the type of NbS implemented the societal challenges the NbS are designed to address and the local ecological socio economic and political context in

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Third Century of Biochemical Oxygen Demand Rodger Baird, Roy Keith Smith, 2002 The most comprehensive summary and literature review of Biochemical Oxygen Demand BOD on the market BOD is one of the fundamental concepts in wastewater treatment Throughout the 1800s and the 1900s BOD was exhaustively studied and refined both as a concept and as an analytical procedure Review all previous BOD work including why technicians scientists plant operators regulators and engineers have complained about the BOD test for many years This book is intended to serve three purposes first and foremost is to describe BOD as a test procedure and biological phenomenon secondly to describe the place of BOD within the complex of testing that is used to evaluate treatment processes lastly is to present the development of BOD and preserve all peer reviewed literature citations that mark the road to the current test Written by Rodger B Baird and Roy Keith Smith Mr Baird is Manager of Laboratories for the Los Angeles County Sanitation Districts where he has worked in laboratory supervision and management for more than 30 years Dr Smith has written over 60 published articles and is the author of eight books one in the 4th edition on environmental analysis Chapters detailing sediment oxygen demand chemical oxygen demand and total organic carbon testing and their relationship to BOD testing as well as extensive coverage of the interferences encountered during oxygen demand testing makes this a must have reference Appita Journal ,1998

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