Chapter 5
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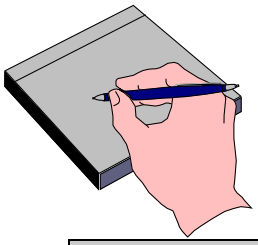
Biochemical Oxygen Demand (BOD)

mL Na_2SO_3 needed = (mL Na_2SO_3 used x mL total test sample)/mL sample portion used for dechlorination.

For example, suppose 1.0 mL of Na_2SO_3 is needed to titrate 100 mL of sample for dechlorination. Calculate the volume of Na_2SO_3 needed to dechlorinate 1500 mL of the BOD sample as follows:

mL Na_2SO_3 needed = (1.0 mL x 1500 mL)/100 mL = 1500/100 = 15 mL



Quiz 5.3

1. Why must samples containing caustic alkalinity or acidity be adjusted before preparing BOD dilutions?

2. What reagents and equipment are required to adjust the pH of BOD samples?

3. Why must samples containing residual chlorine be dechlorinated before preparation of BOD dilutions?

4. What reagents are required to chemically dechlorinate a BOD sample?

5. What must be done to samples which have been dechlorinated or adjusted for pH variations?

Section 12: LABORATORY PROCEDURE

1. Completely fill two BOD bottles with dilution water.

2. Into additional BOD bottles, partially filled with dilution water, carefully measure out the proper volume of sample. Add dilution water until the bottles are completely filled.

NOTE: If the modified Winkler procedure is to be used for DO measurements, two BOD bottles should be prepared for each dilution; one for determination of the initial DO and one for incubation and final DO measurement. If the meter method is used for DO measurements the initial and final DO determinations can be performed on the same bottle.

ADDITIONAL NOTE: If the nitrification inhibition is to be used to determine the carbonaceous BOD fraction (CBOD) of the sample, a separate dilution series of uninhibited sample can be prepared to determine the combined nitrogenous and carbonaceous BOD for the sample. To inhibit the nitrifying bacteria in the sample, add 3.33 mg of nitrification inhibitor to one set of sample dilutions, while the second set of dilutions remains untreated. Continue with the remaining procedural steps with both sets of dilutions.

3. Stopper each bottle taking care to avoid trapping air bubbles inside the bottles as the bottle stoppers are inserted.

APPENDIX B

Preparation of Chemicals

SAFETY NOTE: At a minimum, hand and eye protection should be used when handling any of the chemicals mentioned in this section. Before working with any chemical, consult the appropriate Material Safety Data Sheet (MSDS) to determine if other safety precautions are necessary.

BIOCHEMICAL OXYGEN DEMAND REAGENTS

Phosphate buffer solution

Dissolve 8.5 g potassium dihydrogen phosphate (KH_2PO_4), 21.75 g dipotassium hydrogen phosphate (K_2HPO_4), 33.4 g disodium hydrogen phosphate heptahydrate (Na_2HPO_4 $7H_2O$), and 1.7 g ammonium chloride (NH_4Cl) in about 500 mL of distilled water and dilute to 1 liter. The pH of this buffer should be 7.2 and should be checked with a pH meter. Discard this reagent if there is any sign of biological growth in the storage bottle.

Magnesium sulfate solution

Dissolve 22.5 g magnesium sulfate heptahydrate ($MgSO_4$ $7H_2O$) in distilled water and dilute to 1 liter. Discard this reagent if there is any sign of biological growth in the storage bottle.

Calcium chloride solution

Dissolve 27.5 g anhydrous calcium chloride ($CaCl_2$) in distilled water and dilute to 1 liter. Discard this reagent if there is any sign of biological growth in the storage bottle.

Ferric chloride solution

Dissolve 0.25 g ferric chloride hexahydrate ($FeCl_3$ $6H_2O$) in distilled water and dilute to 1 liter. Discard this reagent if there is any sign of biological growth in the storage bottle.

Sodium hydroxide solution, 1 N

Dissolve 40 g solid sodium hydroxide (NaOH) in approximately 800 mL of carbon dioxide (CO_2) free distilled water. Cool and dilute to 1 liter.

SAFETY NOTE: This reagent is corrosive and can burn hands and clothing. Rinse affected areas with large quantities of tap water to prevent injury and remove contaminated clothing, as residual may still damage skin.

Sulfuric acid solution, 1 N

Cautiously add 28 mL of concentrated sulfuric acid (H_2SO_4), with mixing, to 800 mL of distilled water. Allow to cool and dilute to 1 liter.

SAFETY NOTE: This reagent is corrosive and can burn hands and clothing. Rinse affected areas with large quantities of tap water to prevent injury and remove contaminated clothing, as residual may still damage skin.

Sodium sulfite solution, 0.0250 N

Dissolve 1.575 g anhydrous sodium sulfite (Na_2SO_3) in distilled water and dilute to 1 liter.

NOTE: This solution is not stable and must be prepared daily.

Potassium iodide solution, 10%

Dissolve 10 g potassium iodide (KI) in 100 mL of distilled water. Discard if solution turns yellow.

Acetic acid solution, 1+1

Carefully pour 50 mL of glacial acetic acid (CH_3COOH) into 50 mL distilled water with mixing.

SAFETY NOTE: This reagent is corrosive and can burn hands and clothing. Rinse affected areas with large quantities of tap water to prevent injury and remove contaminated clothing, as residual may still damage skin.

Sulfuric acid solution, 1+50

Cautiously add 5 mL of concentrated sulfuric acid (H_2SO_4) with mixing to 250 mL of distilled water.

SAFETY NOTE: This reagent is corrosive and can burn hands and clothing. Rinse affected areas with large quantities of tap water to prevent injury and remove contaminated clothing, as residual may still damage skin.

Glucose-glutamic acid solution

Dry reagent grade glucose and reagent grade glutamic acid at 103°C for 1 hour. Add 150 mg glucose and 150 mg glutamic acid to distilled water and dilute to 1 liter. Prepare this solution fresh immediately before use.

Nitrification inhibitor

The Hach Chemical Company's Nitrification inhibitor 2533(2-chloro-6-(trichloro methyl) pyridine) or equivalent can be used for inhibition during carbonaceous BOD testing.