

7.2.1 EQUIPMENT AND SUPPLIES

Table 7.2-1 lists equipment and supplies commonly used in the BOD₅ test using amperometric determination of DO. For more detailed guidance on equipment, supplies, maintenance, and calibration of the DO instrument, refer to NFM 6.2. If the iodometric (Winkler) method of DO determination is to be used, refer to table 6.2-3 in NFM 6.2 for a list of equipment and supplies.

Equipment used for BOD sampling must be thoroughly cleaned with nonphosphate detergent and rinsed with tap water and deionized water, as described in NFM 3.

CAUTION: Before handling chemical reagents, refer to Material Safety Data Sheets. Wear safety glasses, gloves, and protective clothing.

Table 7.2-1. Equipment, supplies, chemical reagents, and preparation of dilution water and chemical solutions used in the procedure for determination of five-day biochemical oxygen demand

[±, plus or minus; °C, degrees Celsius; BOD, biochemical oxygen demand; mL, milliliter; mm, millimeter; NFM, *National Field Manual for the Collection of Water-Quality Data*; L, liter; g, gram; KH₂PO₄, potassium dihydrogen phosphate; KHP0₄, potassium monohydrogen phosphate; Na₂HPO₄, sodium monohydrogen phosphate; NH₄Cl, ammonium chloride; N, normality; KCl, potassium chloride; DO, dissolved oxygen; CoCl₃, cobalt chloride]

| Item | Description |
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| Equipment and supplies | |
| Constant temperature chamber or water bath | Thermostatically controlled to maintain 20 ± 1 °C. During incubation, exclude all light to prevent the possibility of photosynthetic production of oxygen. |
| Aquarium pump, plastic air tubing, and air diffusion stones | Wash tubing and air diffusion stone thoroughly with a 0.2-percent nonphosphate detergent solution and rinse thoroughly 3 to 5 times with deionized or distilled water before use. |
| BOD bottles | 300 mL, ground glass stoppered. Wash bottles thoroughly with a 0.2-percent nonphosphate detergent solution and rinse with deionized or distilled water before each test. Label bottles appropriately for sample identification. |
| Glass beads | Borosilicate, solid spherical; 5-mm diameter. Wash thoroughly with a 0.2-percent nonphosphate detergent solution and rinse with deionized or distilled water before use. |
| Graduated cylinder | Borosilicate, 50- to 250-mL capacity, depending on the volume of sample to be tested. |
| Overcap | Paper or plastic cup, or aluminum foil, to be placed over BOD stoppers to prevent evaporation of the water seal. |
| Pipet | Bacteriological, large bore, borosilicate, volume ranging from 1 to 50 mL, depending on the volume of sample to be tested. |
| Thermometer | Calibrated within temperature range of approximately 5-40 °C with 0.5°C graduations (NFM 6.1). |
| Sample container(s) | Wide mouth, screwtop lid, polyethylene, polypropylene, or borosilicate glass. Containers of 1-L capacity are sufficient for most samples. |
| Waste disposal container(s) | Capped, and of appropriate material to contain specified sample and chemical wastes. |
| Chemical reagents¹ and preparation of dilution water | |
| Calcium chloride (CaCl ₂) solution ² | Dissolve 27.5 g of CaCl ₂ in deionized water and dilute to 1 L. |
| Dilution water | Deionized water of high quality; must be free from toxic substances such as chlorine or toxic metals. |
| Ferric chloride (FeCl ₃) solution ² | Dissolve 0.25 g of FeCl ₃ •6H ₂ O in deionized water and dilute to 1 L. |
| Magnesium sulfate (MgSO ₄) solution ² | Dissolve 22.5 g of MgSO ₄ •7H ₂ O in deionized water and dilute to 1 L. |
| Phosphate buffer solution ² | Dissolve 8.5 g of KH ₂ PO ₄ , 21.8 g of KHP0 ₄ , 33.4 g of Na ₂ HPO ₄ •7H ₂ O, and 1.7 g of NH ₄ Cl in about 500 mL of deionized water. Dilute to 1 L. |

Table 7.2-1. Equipment, supplies, chemical reagents, and preparation of dilution water and chemical solutions used in the procedure for determination of five-day biochemical oxygen demand—*Continued*

| Item | Description |
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| Chemical reagents for sample pretreatment and preparation of chemical solutions | |
| Sodium hydroxide (NaOH) for caustic acidity pretreatment | Add 40 g of NaOH to about 900 mL of deionized water. Mix and dilute to 1 L (1 N NaOH). Store in a plastic container. |
| Sodium sulfite (Na ₂ SO ₃) or sodium thiosulfate (Na ₂ S ₂ O ₃) for residual chlorine pretreatment solution | Dissolve 1.575 g of Na ₂ SO ₃ or NaS ₂ O ₃ in 1 L of deionized water. This solution is not stable and should be prepared daily to weekly, as needed. Store refrigerated in a dark bottle. |
| Sulfuric acid (H ₂ SO ₄) for caustic alkalinity pretreatment | Slowly and while stirring add 28 mL of concentrated H ₂ SO ₄ to about 900 mL of deionized water. Mix and dilute acid solution to 1 L (1 N H ₂ SO ₄). |
| DO equipment and supplies (refer to NFM 6.2) | |
| Calibration chamber | Follow manufacturer's recommendations. |
| DO instrument system | Temperature and pressure compensated. |
| Stirrer attachment for DO sensor | Must fit in 300-mL BOD bottle. |
| Pocket altimeter-barometer | Calibrated, Thommen™ model 2000 or equivalent. |
| DO sensor membrane replacement kit | Membranes, O-rings, KCl filling solution. |
| Oxygen solubility table | Refer to table 6.2-6 in NFM 6.2. |
| Zero DO calibration solution | Dissolve 1 g Na ₂ SO ₃ and a few crystals of CoCl ₃ in 1 L water. Prepare fresh zero DO solution before each use. |

¹Properly discard chemical reagents if there is any sign of biological growth or if past the expiration date.

²Can be purchased from the HACH™ Instrument Company in the form of nutrient buffer pillows ready for immediate use.