Designation: D5975 – 17

Standard Test Method for Determining the Stability of Compost by Measuring Oxygen Consumption[1]

This standard is issued under the fixed designation D5975; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the stability of a compost sample by measuring oxygen consumption after exposure of the test compost to a well-stabilized compost under controlled composting conditions on a laboratory scale involving active aeration. This test method is designed to yield reproducible and repeatable results under controlled conditions that resemble the end of the active composting phase. The compost samples are exposed to a well-stabilized compost inoculum that is prepared from the organic fraction of municipal solid waste or waste similar to the waste from which the test materials are derived. The aerobic composting takes place in an environment where temperature, aeration, and humidity are monitored closely and controlled.

1.2 This test method yields a cumulative amount of oxygen consumed/g of volatile solids in the samples over a four-day period. The rate of oxygen consumption is monitored as well.

1.3 This test method is applicable to different types of compost samples including composts derived from wastes, such as municipal solid waste, yard waste, source-separated organics, biosolids, and other types of organic wastes that do not have toxicity levels that are inhibitory to the microorganisms present in aerobic composting systems.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 There is no similar or equivalent ISO method.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific hazard statements are given in Section 8.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics
D1293 Test Methods for pH of Water
D2908 Practice for Measuring Volatile Organic Matter in Water by Aqueous-Injection Gas Chromatography
D3590 Test Methods for Total Kjeldahl Nitrogen in Water
D4129 Test Method for Total and Organic Carbon in Water by High Temperature Oxidation and by Coulometric Detection
D5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions, Incorporating Thermophilic Temperatures
D5907 Test Methods for Filterable Matter (Total Dissolved Solids) and Nonfilterable Matter (Total Suspended Solids) in Water
D8001 Test Method for Determination of Total Nitrogen, Total Kjeldahl Nitrogen by Calculation, and Total Phosphorus in Water, Wastewater by Ion Chromatography

2.2 *APHA-AWWA-WPCF Standards:*[3]

2540 D Total Suspended Solids Dried at 103°–105 °C
2540 E Fixed and Volatile Solids Ignited at 550 °C

3. Terminology

3.1 Definitions of terms in this test method appear in Terminology D883.

4. Summary of Test Method

4.1 This test method consists of the following:

4.1.1 Selecting a compost sample for the determination of the stability.

[1] This test method is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.03 on Treatment, Recovery and Reuse.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] *Standard Methods for the Examination of Water and Wastewater*, 17th Edition, 1989, American Public Health Association, 1740 Broadway, New York, NY, 19919.

4.1.2 Producing a fully stabilized compost from a similar waste stream under well-controlled laboratory conditions.

4.1.3 Exposing the compost test samples to the fully stabilized compost under controlled composting conditions.

4.1.4 Measuring the oxygen consumption rate and determining the cumulative oxygen consumption.

4.2 Obtaining the level of stability from the cumulative oxygen consumption.

5. Significance and Use

5.1 A measurement of compost stability is needed for several reasons. It aids in assessing whether the composting process has proceeded sufficiently far to allow the finished compost to be used for its intended application. A different compost stability may be required for different applications of the compost.

5.2 A measurement of compost stability also is needed to verify whether a composting plant is processing the waste to previously agreed levels of stability. This measurement is useful in the commissioning of composting plants and the verification of whether plant operators are satisfying permit requirements.

5.3 The level of compost stability also will indicate its potential to cause odors if the compost is stored without aeration, as well as the level to which it has been hygienized and how susceptible the compost is to renewed bacterial and possible pathogenic activity. Compost stability is an important parameter with regard to phytotoxicity and plant tolerance of the compost.

5.4 The determination of compost stability will allow the selection of well-performing composting technologies, as well as the safe application of compost in its various markets. The method indicates a degree of stability, but does not necessarily indicate that one level is preferable over another level of stability.

6. Apparatus

6.1 *Stabilized Compost Inoculum Preparation Bin* (see Fig. 1):

6.1.1 A stabilized compost inoculum preparation bin with a volume of 100 to 200 L, with insulation sufficient to maintain composting temperatures of 50 to 65 °C during a period of at least two weeks when composting similar waste as the waste from which the samples were derived, and equipped with air distribution plate, inlet and outlet, and airtight lid.

6.1.2 *Pressurized Air,* provided to the composting bin at a precise and controllable rate up to 200 L/kg waste/day.

6.1.3 *Thermometer,* with temperature measurement up to 80 °C (±2 °C).

6.1.4 Suitable devices for measuring oxygen and CO_2 (optional) concentrations in the exhaust air of the composting bin, such as sensors or appropriate gas chromatography.

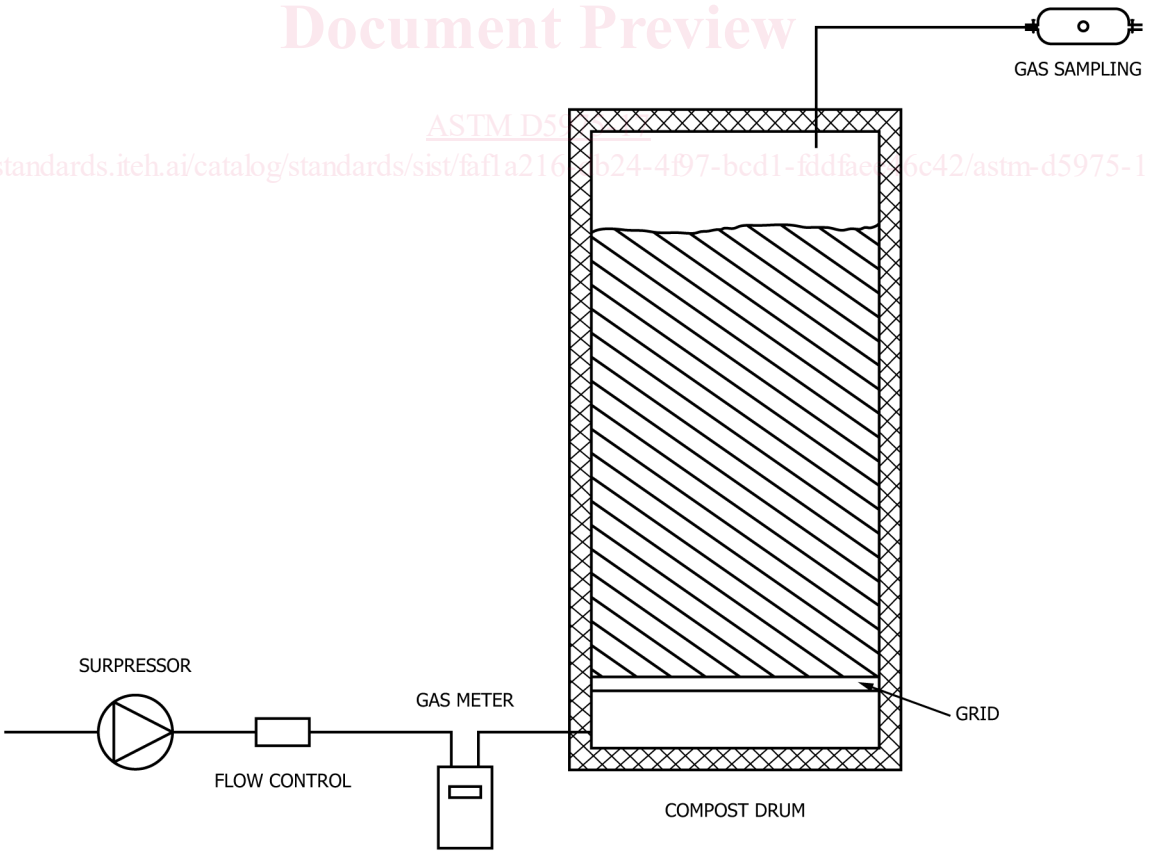

FIG. 1 Optional Set-Up Compost Preparation Bin

6.2 *Composting Apparatus* (see Fig. 2):

6.2.1 A series of at least nine composting vessels (one test substance, one blank, one positive reference, all in three replicates) of 2 to 5 L of volume.

6.2.2 *Incubators,* water baths, or other temperature controlling means capable of maintaining the temperature of the composting vessels at 25 °C (±2 °C).

6.2.3 *Pressurized Air System,* providing H_2O-saturated air to each of the composting vessels at the appropriate aeration rates.

6.2.4 Suitable devices for measuring oxygen concentration in the exhaust air of the composting vessels, such as specific sensors or appropriate gas chromatography.

6.3 *Miscellaneous:*

6.3.1 *Balance* (±1 mg), to weigh sample and stabilized compost.

6.3.2 *Scales* (±0.1 kg), to weigh composting waste for stabilized compost production.

6.3.3 Normal laboratory glassware, equipment, and chemicals.

6.3.4 Suitable devices and analytical equipment for measuring dry solids (at 105 °C), volatile solids (at 550 °C), volatile fatty acids by aqueous-injection chromatography, and total Kjeldahl nitrogen.

7. Reagents and Materials

7.1 Analytical-grade cellulose (microcrystalline, as used in thin-layer chromatography) with a particle size of less than 10 µm, for use as a positive control.

8. Hazards

8.1 This test method requires the use of hazardous chemicals. Avoid contact with the chemicals and follow manufacturer's instructions and Safety Data Sheets (SDS).

8.2 The waste materials used for the production of stabilized compost, or the compost samples may contain sharp objects. Take care when handling.

8.3 The composting vessels are not designed to withstand high pressures. The system should be operated at close to ambient pressure.

8.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

9. Stabilized Compost

9.1 The stabilized compost, which serves as an inoculum and the test matrix, should be well-aerated compost two to four months old, coming from the organic fraction of municipal solid waste or source-separated organics, and sieved over a screen of <10 mm. It is recommended that the stabilized compost control consumes 15 to 80 mg of oxygen/g of volatile solids over the four-day test period. The stabilized compost must have a total solids content between 50 and 60 % on wet weight, an ash content of less than 70 % on total solids, a pH between 7 and 8, and be free of volatile fatty acids (less than

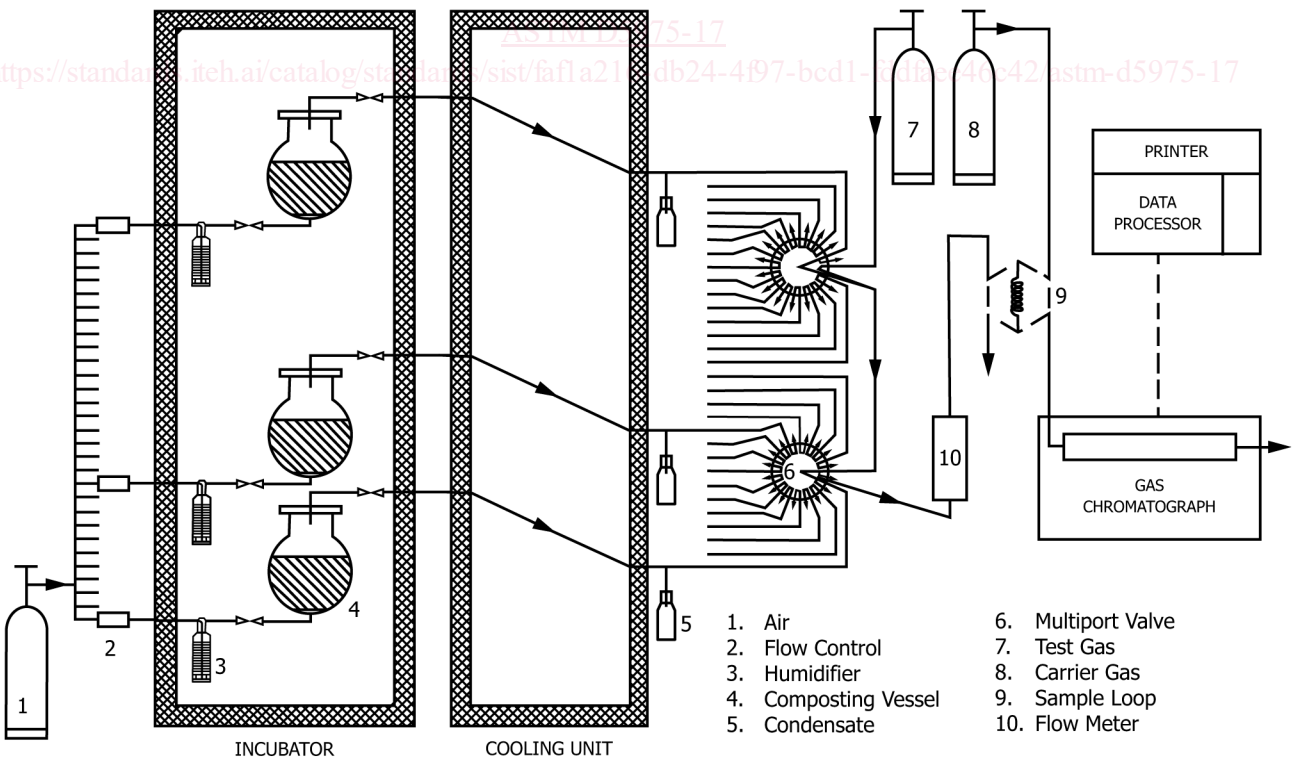

FIG. 2 Optional Set-Up Using Gas Chromatograph (see also Test Method D5338)