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.

Designation: D5905 – 98 (Reapproved 2018)

Standard Practice for the Preparation of Substitute Wastewater[1]

This standard is issued under the fixed designation D5905; 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 practice covers the preparation of an aqueous mixture containing constituents in concentrations such that it will have physical and chemical matrix characteristics similar to municipal wastewater.

1.2 Wastewaters are extremely variable, depending on the quantity and nature of the materials being discharged into the collection system. The mixture prepared with this practice is not representative of any particular wastewater. Rather, it allows the user to prepare a mixture that exhibits a similar matrix impact on test method performance as is typical of municipal wastewater and can be prepared from common materials inexpensively and reproducibly. It allows the evaluation of test methods, over time, against the same reference point.

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

1.4 *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.*

1.5 *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]

D1129 Terminology Relating to Water

D1141 Practice for the Preparation of Substitute Ocean Water

D1193 Specification for Reagent Water

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this standard, refer to Terminology D1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *substitute wastewater, n*—a mixture of dissolved and suspended materials in water, typical of the influent to a municipal wastewater treatment facility.

4. Significance and Use

4.1 Substitute wastewater may be used for laboratory testing where a reproducible mixture simulating municipal wastewater is required. To provide a more rugged evaluation of a test method's ability to measure analytes and the precision of the test method under more demanding conditions, it is necessary to utilize a matrix more complex than reagent water. Substitute wastewater is intended to be used as a material to be spiked with analytes or interferents of interest to evaluate the performance of test methods.

4.2 Utilization of substitute wastewater as a matrix in interlaboratory validation studies will allow inclusion of performance statistics for this matrix in the Precision and Bias section of test methods. Users of test methods will be able to evaluate their application of test methods in this matrix against published results.

5. Apparatus

5.1 *Blender,* household or commercial variety, with a chemically inert container and a tight sealing lid.

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where

[1] This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.02 on Quality Systems, Specification, and Statistics.

Current edition approved Dec. 1, 2018. Published December 2018. Originally approved in 1996. Last previous edition approved in 2013 as D5905 – 98 (2013). DOI: 10.1520/D5905-98R18.

[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.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of determination.

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type I of Specification D1193.

6.3 *Kaolin*—USP grade. Dry to constant weight at 103°C before use.

6.4 *Beer*—A commercially produced beverage made by fermenting mixtures of grains, malts, and hops; reduced calorie: less than 100 calories/12 oz (1180 J/mL). Reduced-calorie beers are often sold with the designation "lite" or "light." Transfer the beer into a container and then cap, allowing 20 % head space. Shake vigorously. Loosen cap. Allow to sit refrigerated for 24 h to dissipate carbonation and then allow to reach room temperature.

6.5 *Flour*—General or all-purpose, bleached, enriched, presifted, wheat. All brands fitting this description are acceptable. Dry to constant weight at 103°C before use.

6.6 *Ocean Salts,* Commercially available as dry salt mixtures used to prepare water for salt water aquariums. Can be purchased at pet stores. Dry to constant weight at 103°C before use.

6.7 *Triton X-100* [4] Solution—Surfactant solution. Add 1.200 g to water and dilute to 1 L.

NOTE 1—A key purpose of this practice is to provide a reproducible formulation. The use of an alternate surfactant may significantly alter the performance of this material in its intended application. Use of an alternate surfactant should be clearly indicated whenever data related to the use of this practice is published.

7. Procedure

7.1 Place approximately 500 mL of water in blender.

7.2 Add the following amounts of the indicated reagents:

7.2.1 Flour, 0.400 g,

7.2.2 Ocean salts, 2.000 g,

7.2.3 Kaolin, 0.080 g,

7.2.4 Triton X-100 solution, 20.0 mL, and

7.2.5 Beer, 120.0 mL.

7.3 Blend on lowest setting for 30 s. Significant foam will be generated. Allow most of the foam to subside before transferring. Transfer quantitatively to a 2-L volumetric flask and dilute to 2 L with water.

7.4 This solution may be held at 0 to 4°C for up to 24 h but then shall be preserved and held in accordance with the requirements of the test method under evaluation.

8. Keywords

8.1 analytical performance; matrix; wastewater

[3] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

[4] Union Carbide, Triton X-100 has been found to be satisfactory for this purpose.

APPENDIX

(Nonmandatory Information)

X1. TYPICAL ASSAY RESULTS OF SUBSTITUTE WASTEWATER

X1.1 The following analytical results (see Table X1.1) were obtained in a single laboratory from a single determination. This data is presented for informational purposes only and the user of this practice should make their own determination of background concentrations.

X1.2 All results are in milligrams per litre.

TABLE X1.1 Typical Assay Results of Substitute Wastewater

Analyte	Concentration	Analyte	Concentration
Biological oxygen demand	>570	Selenium	<0.002
Silver	<0.0002	Tin	<0.8
Aluminum	0.03	Thallium	<0.001
Arsenic	<0.001	Vanadium	<0.2
Boron	0.1	Mercury	<0.0002
Barium	0.003	Ammonia nitrogen	0.1
Beryllium	<0.0002	Kjeldahl nitrogen	30
Calcium	10	Phosphorus	8
Cobalt	<0.05	Nitrite nitrogen	0.01
Iron	0.1	Nitrate nitrogen	0.05
Potassium	26	Suspended solids	232
Copper	0.01	Volatile suspended solids	198
Nickel	0.003	Total solids	2200
Lead	<0.001	Total volatile solids	1300
Cadmium	<0.001	Chloride	490
Chromium	<0.001	Chemical oxygen demand	3500
Zinc	0.02	Cyanide	<0.02
Magnesium	33	Ortho phosphorous	7
Manganese	0.01	Sulfate	85
Molybdenum	0.03	Total organic carbon	1600
Sodium	200	USEPA Priority Pollutant List organic compounds	all below detection [A]
Antimony	<0.003		

[A] The Priority Pollutant List as found in Title 40, Code of Federal Regulations, Part 122, Appendix D, Table II (40 CFR, Part 122) by the U.S. Environmental Protection Agency, 1990. Gas Chromatography and Gas Chromatography/Mass Spectroscopy Methods 624, 625, and 608 as found in Title 40, Code of Federal Regulations, Part 136, Appendix A, (40 CFR, Part 136) by the U.S. Environmental Protection Agency, 1990. Samples diluted 1:4 for determination of volatile components due to foaming.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/