Designation: ~~E2892 – 15~~ E2892 – 21

Standard Test Method for Odor and Flavor Transfer ~~from~~From Materials in Contact ~~with~~With Municipal Drinking Water[1]

This standard is issued under the fixed designation E2892; 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 describes procedures for measuring odor and flavor properties of ~~new products~~ materials which may come into direct contact with municipal drinking water. For this method, "drinking water" will be considered water from the source (for example, river, lake, reservoir) through the municipal distribution system (that is, not including in-home or in-business taps). The focus of this test method is the evaluation of the materials in terms of their potential to transfer odors, flavors, or both to water.

1.2 This test method provides sample preparation procedures, methods of sensory evaluation, and a process for interpretation of results.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. All materials that come into contact with drinking water are required to be approved through testing by accredited laboratories using NSF/ANSI Standard 61. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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]

D1292 Test Method for Odor in Water

E253 Terminology Relating to Sensory Evaluation of Materials and Products

E544 Practice for Referencing Suprathreshold Odor Intensity

~~E1885 Test Method for Sensory Analysis—Triangle Test~~

E1870 Test Method for Odor and Taste Transfer from Polymeric Packaging Film

E1885 Test Method for Sensory Analysis—Triangle Test

2.2 ~~*Other Standards:*~~*NSF/ANS Standard:*[3]

NSF/ANSI Standard 61 Drinking Water System Components – Health Effects

3. Terminology

3.1 *Definitions*—See Terminology E253.

[1] This test method is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.06 on Food and Beverage Evaluation.

Current edition approved ~~Jan. 1, 2015~~July 15, 2021. Published ~~January 2015~~August 2021. Originally approved in 2015. Last previous edition approved in 2015 as E2892 – 15. DOI: ~~10.1520/E2892-15.~~10.1520/E2892-21.

[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] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI ~~48113-0140,~~48105, http://www.nsf.org.

4. Summary of Test Method

4.1 ~~The inherent odor and flavor level of the material is estimated from the intensities developed upon exposure to~~ This test method provides a measure of the impact that a material may impart on the odor and flavor of water. This method defines the procedure for preparation and evaluation of the material using four steps: (*1*) ~~Preparation~~preparation of component ~~sample;~~sample, (*2*) ~~Leaching~~leaching of sample in extraction ~~water;~~water, (*3*) ~~Sensory analysis;~~sensory evaluation, and (*4*) ~~Data~~data analysis and interpretation.

5. Significance and Use

5.1 Many materials that come into contact with drinking water have the potential of impacting the aesthetic quality of the water. Some of these diverse materials include: storage reservoirs, concrete or metal piping, or both, sealants, synthetic reservoir covers and liners, mending adhesives, gaskets, paints, and plastics. Though NSF Standard 61 provides testing for health effects, it does not address taste and odor implications. A Utility Quick ~~Test, Ref~~ Test (**1**),[4] has been proposed, but has not been adopted as an official test standard. Taste and odor problems have been reported as a result of organic compounds leaching from approved materials into water. Materials only need to be tested if they come into direct contact with drinking water.

6. Testing Facilities and Personnel

6.1 All personnel involved in any aspect of the testing should take precautions to refrain from using personal products (for example, perfume, cologne, scented soaps, food products) which may introduce extraneous odors.

6.2 Guidelines for optimal sensory testing location criteria are detailed in Ref (**2**). At a minimum, all testing should be conducted in a location that is odor-free, quiet, temperature controlled, and not used for chemical testing.

6.3 This test method is intended for use by trained panels under leadership of a sensory professional. For discussions on training ~~panelists,~~assessors, see Refs (**2-4**).

7. Materials

7.1 *Blank Water,* as odorless and tasteless as possible. Bottled spring water should be assessed by the panel prior to use in testing. If noticeable odor(s) or taste(s) are present, obtain a different lot or brand of water until a suitable product is identified.

7.2 *Glass Vessel,* beaker or equivalent, large enough to hold volume as determined in Section 10.

7.3 *Aluminum Foil,* uncoated.

7.4 *Glass Bottles,* ~~1-L~~1 L with PTFE-lined screw cap for storing samples prior to sensory ~~analysis.~~evaluation.

7.5 *Plastic Cups,* 5 or 6 oz, brand that has been predetermined not to impart any interfering odors or flavors to water they will contain. Do not use wax coated or paper cups.

7.6 *Watch Glasses,* large enough to cover the cups used in the method.

8. Cleaning Glassware

8.1 Use new, clean glassware for each evaluation. This glassware must be odor-free and shown not to impart any taste or odor to the sample during testing. Any caps or liners not made of glass must be discarded after use since these cannot be sufficiently clean for reuse.

8.2 If it is not economically practical to use new glassware each time, ensure the glassware is clean and odor-free prior to each use.

[4] The boldface numbers in parentheses refer to a list of references at the end of this standard.

8.3 If glassware must be reused, rinse with water immediately after completion of testing. Cleaning should then be completed by washing with commercial, unscented glassware washing detergent to remove any residue. Test the glassware for cleanliness by rinsing with distilled water and observing how the water rinses from the surface. The water should sheet off of the surface rather than form droplets. The exact glassware cleaning procedure used must be tested to confirm the glassware will not impart any taste or odor during testing.

8.4 Store all glassware in a closed cabinet away from chemical odors to protect from contamination. Glassware stored upside down or with foil over any openings will prevent dust from settling on surfaces.

9. Sample Preparation and Cleaning

9.1 A representative sample of the material shall be tested. The sample should include all components as intended in the final use. Test pieces may be either factory made products or site-applied products. The material should be tested in triplicate (that is, three separate samples of material).

9.2 Samples of the test material shall be kept intact as much as possible (that is, not cut into fine pieces). Whole components should be used when practical. If component must be cut, only the areas that will be in contact with drinking water should be exposed to the test water.

9.3 For large components, such as tanks and reservoirs, material samples may be evaluated on behalf of the finished product. Concrete surrogate samples may be evaluated on behalf of concrete lined pipes and other concrete-based products.

9.4 Site applied products include coatings, linings, paints, sealants, and solvent cements. These products applied to an appropriate substrate may be evaluated on behalf of components whose entire water contact surface is covered by the coating. The manufacturer shall provide detailed application instructions, including: (*1*) Surface preparation; (*2*) Mix ratios and mixing method; (*3*) Method of application; (*4*) Minimum cure temperature, time, and conditions; (*5*) Product film thickness; and (*6*) Associated products, for example, primers and undercoats.

9.5 Remove any surface materials (labels, tape, etc); do not use soaps or solvents.

9.6 Rinse with blank water.

9.7 Condition the material to be tested by soaking it in blank water for a defined period of time depending on the material and its use. See NSF/ANSI 61 and Refs (**5 and 6**).

9.8 *Disinfection:*

9.8.1 Note that disinfection may impact the sensory ~~analysis. Conduct aroma analysis~~evaluation. If disinfection is necessary, conduct aroma evaluation on the sample prior to the disinfection.

9.8.2 Disinfect sample by soaking for three hours in aqueous solution (using blank water) of 50 mg/L chlorine; rinse with blank water until wash water contains <0.5 mg/L chlorine.

9.8.3 Repeat the aroma ~~analysis~~evaluation on the disinfected sample. If the aroma characteristics are significantly different from the original sample, the user must determine if this test is appropriate for their purposes.

9.8.4 If the aroma ~~analysis~~evaluation on the disinfected and non-disinfected sample are comparable, proceed with flavor ~~analysis.~~evaluation.

10. Exposure Method

10.1 Use blank water as defined in 7.1 for all leaching procedures.

10.2 A method blank shall be processed in the same manner as the samples, using the same blank water, but without addition of the test material.

10.3 All samples should be prepared in triplicate (that is, three separate pieces of material to be leached in three containers of blank water).

10.4 The test shall be conducted using a 24-h exposure period. Alternate exposure times may be used to better replicate operational use of the product.

10.5 Surface area to volume ratio should be at least 15 cm^2/L or greater. For guidance on proper surface to volume ratios for particular material types, see NSF/ANSI Standard 61 and Refs (**1, 5 and 6**). The entire surface of the sample should be covered by the extraction water. The extraction vessel should be covered with clean aluminum foil and stored at ambient temperature (25 ± ~~2°C).~~ 2 °C).

10.6 At the end of the leaching period, the water (leachate) should be decanted into ~~1-L~~1 L glass bottles with no headspace and sealed with PTFE-lined caps. Store samples at ~~4°C~~4 °C until time of ~~analysis. Analysis~~ sensory evaluation. The evaluation should be conducted within 48 hours.

11. Sensory Method

11.1 ~~The recommended method is the~~ A method commonly used in the municipal water industry is Standard Method 2170 Flavor Profile Analysis published in Ref (**7**), which is based on Flavor Profile Method in ASTM Manual 26 (**2**). Refer to Standard Method 2170 for details on the analysis. This descriptive method is preferred over ~~triangle difference tests~~ discrimination methods such as the triangle test (Test Method E1885~~)~~), or the threshold odor number method (TON, Test Method D1292, Standard Method 2150B, Ref (**7**)) because it is a direct measurement of the contaminating attribute and an overall difference from the blank water. Other descriptive methods may be used; however, the Standard Method 2170 ~~is currently~~has been the method used by the drinking water industry, and the use of a single technique provides consistency among sensory panels.

~~Note 1—This practice is for aroma only.~~

11.2 The flavor intensity scale is shown in Appendix X1. An odor intensity scale spanning the typical drinking water intensity range (**8**) is shown in Appendix X2. Additional practice to help understand odor intensity can be conducted using the butanol scale (Practices E544).

11.3 Use an experienced panel of five assessors who are trained in this method, but no fewer than three; see Refs (**2-4, 9**). Assessors should be selected for their ability to identify odors and flavors, rank intensities, and communicate perceptions.

11.4 Provide a score sheet with a short list of common attributes, plus write-in spaces. Common sources of off-odors and flavors along with their sensory descriptors can be found in Test Method E1870. See Appendix X3 for an example score sheet.

11.5 Routine and random blind controls and blank water spiked with a reference standard to an intensity of just greater than "slight" should be included with the test samples (for example, styrene at 100 ppb or dimethyl styrene at 120 ppb).

11.6 Sample temperature is ~~25°C.~~25 °C. Samples should be ~~analyzed~~evaluated in the order presented. A known blank control may be used as a reference. Samples should be in cups that have been previously determined not to have any off-odors or off-flavors that will interfere with the ~~analysis.~~ sensory evaluation. Samples should be poured into the cup (approximately 30 mL of sample) and covered immediately with a watch glass.

11.7 Assessors should conduct odor ~~analysis~~evaluation first. If the odor ~~analysis~~evaluation fails the test, it may be determined that no flavor ~~analysis~~evaluation should be conducted.

11.7.1 Gently swirl the cup on the table to release odors into the headspace.

11.7.2 Move the watch glass back slightly and, keeping hands away from the cup, assess the aroma by taking a few short sniffs. Rest for 10 to 15 s between samples. Repeat if necessary to decide on the descriptors, but the intensity rating should be decided on the first sniff.

11.7.3 Record each odor attribute on the score sheet (Appendix X3) with a corresponding intensity (Appendix X1, Appendix X2).

11.7.4 Assess odor for all samples; do not discuss with other ~~panelists~~assessors until the time for discussion.

11.8 If the odor test passes, follow with flavor ~~analysis.~~evaluation.

11.8.1 Take approximately 10 mL of water into the mouth and roll it over entire tongue. Slurping may enhance the flavor assessment; the panel should decide upon the technique prior to assessment.

11.8.2 Swallow slowly. Alternatively, the panel staff may decide prior to assessment to expectorate the sample.

11.8.3 Record each flavor attribute with a corresponding intensity.

11.8.4 Do not discuss with other ~~panelists~~assessors until the time for discussion.

11.9 The panel discusses and comes to a consensus agreement on the intensity of each attribute.

12. Data Interpretation

12.1 Interpretation of the data is based on the intensity rating of the consensus profile. The consensus score should be compared to the control sample (method blank).

12.2 Historically, attributes in drinking water that are ~~ranked~~rated with an intensity greater than “slight” have triggered consumer complaints (**10 and 11**). Therefore, leachate water with no recorded attribute intensities greater than “slight” shall be considered as passing the test. Leachate waters with attribute intensities greater than slight shall be considered to have failed the test.

12.3 All three replicates must pass for the material to pass the test.

13. Recommendation

13.1 Materials that pass this test are considered acceptable for use in applications in direct contact with drinking water.

14. Reporting

14.1 A final test report shall include the following (example in Appendix X4):

14.1.1 A unique test report number and date of the test.

14.1.2 References to standards utilized in the test.

14.1.3 A clear description of the tested material.

14.1.4 Detailed description of the procedures used for the sample preparation, including procedures for disinfecting or conditioning of the materials as well as details regarding the exposure methodology, such as surface to volume ratio and contact time and temperature.

14.1.5 Number of assessors used.

14.1.6 Results of the testing displayed as consensus scores from the assessors.

15. Precision and Bias

15.1 Because results of sensory tests are functions of individual sensitivities, a general statement regarding the precision of results that is applicable to all populations of assessors cannot be made. However, adherence to the recommendations stated in the standard should increase the reproducibility of results and minimize the bias.

16. Keywords

16.1 drinking water; flavor; municipal; odor; off-note

APPENDIXES

(Nonmandatory Information)

X1. BASIC TASTE INTENSITY SCALE

X1.1 See Table X1.1: for the Taste Intensity Scale with general reference examples.

TABLE X1.1 Basic Taste Intensity Scale

	Intensity			
	Flavor Profile Method[A]	Flavor Profile Analysis[B]	Concentration	Products
	Sweet			
Slight	1	4	5 % Sucrose	Peanut Butter
Moderate	2	8	10 % Sucrose	Soft Drinks
Strong	3	12	15 % Sucrose	Jellies
	Sour			
Slight	1	4	0.05 % Citric Acid	Milk Chocolate
Moderate	2	8	0.10 % Citric Acid	Soft Drinks
Strong	3	12	0.20 % Citric Acid	Lemon Juice
	Salty			
Slight	1	4	0.4 % Sodium Chloride	White Bread
Moderate	2	8	0.7 % Sodium Chloride	Canned Soups
Strong	3	12	1.0 % Sodium Chloride	Soy Sauce
	Bitter			
Slight	1	4	0.05 % Caffeine	Milk Chocolate
Moderate	2	8	0.10 % Caffeine	Semi-Sweet Chocolate
Strong	3	12	0.20 % Caffeine	Baking Chocolate

[A] Manual on Sensory Testing Methods, ASTM ~~MNL 26,~~ MNL26, ASTM International, West Conshohocken, PA (2).
[B] *Standard Methods for the Examination of Water and Wastewater*, 21st Ed., APHA, AWWA, and WEF, 2005 (5).

X2. ODOR INTENSITY SCALE (68)

X2.1 See Table X2.1 for an Odor Intensity Scale (8).

TABLE X2.1 Odor Intensity Scale

	Intensity	Hexanal Concentration (µg/L)
None	0	0
Slight	4	30.0
Slight to Moderate	6	102.5
Moderate	8	1608.5

X3. SAMPLE SCORE SHEET

X3.1 See Table X3.1.