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Standard Guide for Sensory Evaluation of Household Hard Surface-Cleaning Products with Emphasis on Spray Triggers[1]

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1. Scope

1.1 This guide presents guidelines specific to the sensory evaluation of trigger hard surface cleaners. It covers the procedure for preparing a nonporous surface with the intent to measure one or all of the various aspects of a trigger product: package, application, performance, and after-use properties, with focus on visual, tactile, fragrance, performance, and package ergonomics. It is applicable for use with assessors, highly trained assessors, and consumers.

1.2 This guide for preparing nonporous hard surfaces is intended to focus on surface preparation and evaluation, not on panel selection, training, or development.

1.3 The reader should be aware that good sensory practices are required when preparing the surfaces, and in developing and training the assessors.

1.4 The researcher is responsible for identifying the most appropriate test design and using the appropriate statistical tool to address that experimental design.

1.5 Since this guide's intended use is to provide direction on the presentation and measurement of the different aspects of spray trigger hard surface cleaners, this guide may not accurately represent all possible soils and surfaces where spray trigger hard surface cleaners may be used.

1.6 This guide provides suggested procedures and is not meant to exclude alternate procedures that may be effectively used to provide the same results.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Values are stated in only SI units when inch-pound units are not used in practice.

1.8 *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 and health practices and to determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4265 Guide for Evaluating Stain Removal Performance in Home Laundering

D5343 Guide for Evaluating Cleaning Performance of Ceramic Tile Cleaners

E253 Terminology Relating to Sensory Evaluation of Materials and Products

2.2 *ISO Documents:*[3]

ISO 4121 Sensory Analysis—Methodology—Evaluation of Food Products by Methods Using Scales and Categories

ISO 5492 Sensory Analysis—Vocabulary

ISO 5496 Sensory Analysis—Methodology—Initiation and Training of Assessors in the Detection and Recognition of Odors

ISO 6658 Sensory Analysis—Methodology—General Guidance

ISO 8586-1 Sensory Analysis—Methodology—General Guidance for Choosing, Training and Monitoring of Selected Assessors

ISO 11035 Sensory Analysis—Methodology— Identification of Descriptors for Establishing a Sensory Profile

2.3 *CSPA Test Methods:*[4]

DCC-09 Glass Cleaners

DCC-09A Standard Guide for Evaluating the Filming and Streaking of Glass Cleaners

DCC-12 Guidelines for Screening the Efficacy of Oven Cleaners

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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] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[4] Available from Consumer Specialty Products Association (CSPA), 900 17th St., NW, Suite 300, Washington, DC 20006, http://www.cspa.org.

DCC-16 Guidelines for Evaluating the Efficacy of Bathroom Cleaners Scrubber Test for Measuring the Removal of Lime Soap

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *nonporous surface*—refers to a solid material that cannot be permeated by liquids.

4. Summary of Guide

4.1 This guide provides direction on how to assess spray trigger hard surface cleaners. This guide describes sample preparation and evaluation approaches to various aspects of a spray trigger hard surface cleaner: visual, tactile, fragrance, performance, and package ergonomics.

5. Significance and Use

5.1 The methods outlined in this guide can be used to qualitatively and quantitatively evaluate the sensory characteristics and performance of trigger hard surface household cleaning products for nonporous surfaces.

5.2 The methods are suited for descriptive analysis and may be adaptable for consumer acceptance research.

5.3 This guide provides the procedure for the evaluation of package, application, performance, after-use and fragrance aspects of hard surface cleaners. Depending on the test objectives, all or some of these measures may be used.

5.4 This guide is designed for use for product research guidance in product formulation, new product development, and quality control issues.

5.5 This guide is a compendium of information or series of options that does not recommend a specific course of action. This guide is not intended for claim substantiation, as it has not been subjected to validation testing.

5.6 This guide is for use by individuals who familiarize themselves with these procedures and who have previous experience with sensory evaluations. It is suggested that the individuals have some experience with developing and training a descriptive panel or work under the supervision of a sensory professional who has.

5.7 This guide might involve hazardous materials. This guide does not claim to address all of the safety problems associated with its use. It is the responsibility of the user of this guide to establish appropriate safety and healthy practices and to determine the applicability of limitations prior to use.

6. Equipment

6.1 The following equipment may be used during the preparation or evaluation process:

6.1.1 Lights for a flat horizontal surface require overhead lighting that simulates North Daylight (that is, Mac Beth Lighting). See ASTM MNL 60 (**1**).[5]

6.1.2 Lights for a vertical surface may use the Mac Beth portable light box.

6.1.3 Surfaces identified as nonporous are: glass, ceramic, sheet acrylic—also known as Formica®, porcelain, enamel, painted metal, stainless steel, and chrome. Other non-porous surfaces can be used depending on research objectives.

6.1.4 Test soil (refer to Guides D4265 and D5343 for example soil formulas).

6.1.5 Metered sprayer.

6.1.6 Deionized water.

6.1.7 Reagent grade Acetone.

6.1.8 Cheesecloth.

6.1.9 Vertical rack for drying soiled surfaces.

6.1.10 Lint free paper towels or absorbent cotton cloths.

7. Procedure

7.1 These procedures are designed for the preparation of nonporous surfaces to be evaluated by trained assessors or consumers for acceptance in a Central Location Test (CLT) environment. Not all portions of these procedures may need to be conducted and will depend on the objective and scope of the sensory test(s). Depending on the product's end-use, select the soils and surfaces on which this product should be evaluated. It is suggested consideration be given to testing on multiple surfaces or multiple soils, or both, to satisfy the objective of the test.

7.2 *Preparation of Surface for Testing*—Select the nonporous surface(s) that are appropriate for the particular hard surface cleaner to be evaluated. The test surfaces selected should be thoroughly cleaned before and between uses. The test surface has to be evaluated prior to use to determine that it is free of manufacturer defects. This will help minimize any variability from surface to surface. The surface should be cleaned sequentially as follows:

7.2.1 Wash in warm water with unscented hand dish washing liquid.

7.2.2 Rinse with deionized water.

7.2.3 Wipe surface dry of any residual water with cheesecloth. Do not allow water droplets to dry on surface.

7.2.4 Rinse surface with acetone (reagent grade).

7.2.5 Wipe surface dry of any residual acetone with cheesecloth, especially on surface edge.

7.2.6 Exposing the cleaned surfaces to a live stream of air should be used to assess the effectiveness of the surface cleaning process. Those areas not thoroughly clean will take on a white, highly reflective appearance. In such a case, the entire surface will be re-cleaned, repeating the above steps. Soiling of the test surface should not occur until the test surface has been thoroughly cleaned.

7.2.7 After cleaning, place the clean surfaces on a vertical rack. Be sure the vertical rack does not allow the surfaces to touch each other. Take caution to avoid recontaminating the clean surface.

7.3 *Application of Soils*—Select soils suitable for the hard surface cleaner of interest. Industry standard soil formulations are available through industry organizations such as ASTM, CSPA (Consumer Specialty Products Association), and IKW

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

(Industrieverband Körperpflege-und Waschmittel e.V. – German industrial union of detergents and cosmetics). It is the responsibility of the user of this guide to identify the best standard soil for their testing application, for example, bathroom soil, kitchen soil, etc. The selected soil should be applied in a reproducible, uniform, and standard manner. To illustrate the specific nature of the application process, the following instruction steps should be used. The example given is when the Spangler soil is applied to a glass surface, but is applicable for other soils and surfaces. Several test methods (CSPA test methods, see 2.3) are available that present the application of different soils and cleaning products on diverse surfaces and might provide additional insights in conducting the procedures described in this guide.

7.3.1 The Spangler soils are applied using a metered spray onto the clean surface.

7.3.2 Prime the sprayer before use.

7.3.3 Apply a suggested 5.5 ± 1.0 g of soil to a 30.5 by 30.5 cm [12 by 12 in.] glass plate. Uniform application of soil is accomplished by spraying two plates, side-by-side in the fume hood, at a distance of approximately 20 cm [8 in.], using four horizontal sweeping sprays, then two vertical sweeping sprays for a one-coat application.

7.3.4 Repeat this process for a total of three coats to achieve the desired soil weight. To ensure a consistent weight of soil per plate, it is best to spray soil onto tare glass plates and check the final weight after complete solvent evaporation. Depending on the soiling compound, the amount of soil applied may vary from the Spangler soil protocol of three coats.

7.3.5 All plates used in the testing array should be soiled at the same time. It is suggested that plates soiled on the same day be used as a group.

7.3.6 **Warning—**The soiling process requires skill and judgment. Consideration should be given to the soil loading desired for the test objective (light, regular or heavy soil load). The soil load selected should be realistic and applicable in meeting the purpose and objective of the test. Practice is encouraged before preparing surfaces for the actual test.

7.4 *Aging of the Soils*—Soils should be aged for 24 h prior to use to ensure that the soil has cured on the hard surface and has achieved the desired soil tenacity. An exception to this is when using established soil protocol where a different aging time is provided. An example is the aging process for Spangler soil: The soiled surface must be aged at 50°C for 2 h, followed by cooling to ambient temperature, prior to application of the spray cleaner.

7.5 *Cleaning of the Surfaces*—It is recommended that the trigger spray product being evaluated be used in accordance with the product use instructions and with the marketed trigger. When appropriate, the user develops/adapts the usage protocol according to the research objective.

7.5.1 If the surface is one that is cleaned in a vertical position, then it is recommended that the product usage and assessment be made in the vertical position. For example, glass is usually seen in a vertical position (windows). Therefore, it is recommended that the surface be cleaned vertically and that the area behind the glass needs to have a neutral backdrop to prevent any distraction from assessing the product performance on this surface. If the surface is one that is cleaned in a horizontal position, then it is recommended that the product usage and assessment be made in the horizontal position. For example, sheet acrylic is usually seen in a horizontal position (counter tops). For assessing horizontal surfaces, the Mac Beth Lighting needs to be positioned such that shadows do not fall across the surface being evaluated.

7.5.2 The test objective will determine who applies the product. For example, if *application* is the area being evaluated, then the assessors or trained assessors apply the product. If *visual* is the area being assessed, the sensory professional applies the trigger products and cleans the surface. This is to ensure consistency across the treated surfaces.

7.5.3 Assessors and trained assessors wipe the surface with a lint free paper towel or an absorbent cotton cloth. Through orientations prior to evaluations trained assessors will have established the number of wipes, the direction of wipes, and the amount of pressure that they need to apply for an application assessment.

7.6 *Trained Assessors:*

7.6.1 Trained descriptive panels should be used when there is the desire to obtain a detailed qualitative and quantitative product characterization and to determine the differences between products on sensory product attributes.

7.6.2 For general information on panel selection criteria and training, consult ASTM Manual 13 (**2**), ASTM Manual 26 (**3**), and ASTM STP 758 (**4**). Additional assessor considerations should be taken into account and screened out depending upon the test requirements. Some considerations are color blindness, olfactory acuity or lack of olfactory sensitivity, allergies, and medical conditions like pregnancy, breast feeding, or chronic disease of the assessor.

7.7 *Consumers:*

7.7.1 Consumer panels should be used when affective and preference information is needed.

7.7.2 Consumers should be recruited among the target population. For example, when assessing a glass cleaner, the consumer should be a user of commercially available glass cleaner and not one who makes their own glass cleaner (such as vinegar and water, or soap and water). However, the test objective will provide direction to identify the appropriate consumer population.

7.7.3 Recruiting of qualified consumers can be done in several ways; for example, mall intercept approach, over the phone, use of a database, or through an announcement on the company's website or the website of the company completing the recruitment.

7.8 *Evaluation Procedure*—The spray cleaner test product can be evaluated at various stages of the product usage: pre-use, application, in-use, and residual. See ASTM STP 433 (**5**) to apply basic sensory principles in the design of the sensory evaluation procedure (blind coding, sample presentation ordering, test booths to use, and so forth).

7.8.1 The evaluation procedure selected should be designed to meet the objective of the test.

7.8.2 The hard surface should be presented to the assessors, trained assessors, or consumers in the manner in which that

surface is used. For example, most glass surfaces, such as windows and mirrors found in the home, are in a vertical position. Counter tops are horizontal and are made from sheet acrylic, also known as Formica®.

7.8.3 Attributes for product evaluation can be identified through trained assessors using descriptive procedures. In addition, attributes can also be identified from the specific test objective or using historical information on how the product performs. These attributes can be used for trained panel evaluations or can be adapted to be consumer friendly for consumer research. Examples of attributes to be measured can be found in Tables 1-5.

7.8.4 The product can also be studied to evaluate its scent/fragrance characteristics. Examples of attributes for scent measurement can be found in Table 5.

7.8.5 Consult ASTM Manual 13 (**2**) to select scale type and end scale points in descriptive measurements. In consumer tests, scaling can include 9-point or 7-point hedonic scales, as well as diagnostic attribute scales.

7.8.6 The limitation of samples to be evaluated in one setting should be established. Limitations may be imposed due to the volume of product dispensed by an assessor or consumer relative to safety concerns (that is, air quality) as well as assessor or consumer fatigue and ability to discriminate.

7.8.7 Consumer testing should be conducted in a central location facility, which provides adequate lighting and ventilation for the task.

8. Report

8.1 It is recommended that a final report be issued to document the research. A report should include the following steps; however, these steps may be reordered to fulfill the respective establishment's protocol for research documentation.

8.1.1 *Background*—provides the historical information that relates to this piece of research and may contain hypothesis, objectives, and decision action criteria.

8.1.2 *Objectives*—provides a clear statement that captures the reason for this research.

8.1.3 *Methodology*—presents the procedure used, including the equipment, materials, and test products.

8.1.4 *Results*—a presentation and summary of the relevant collected data and statistical analysis.

8.1.5 *Conclusions*—provides the interpretation of the data collected. This section should address the objective and support or disprove the hypothesis.

8.1.6 *Recommendations*—provides a statement of how this information should be used.

9. Keywords

9.1 ceramic; glass; hard surfaces; nonporous; sheet acrylic; Spangler soil; spray trigger cleaner

TABLE 1 Examples of Attributes to be Measured
Stage of Measurement: Package[A]

Trained Assessors	Consumers
Grip width	"Container fits comfortably in your hand"
Force required to open trigger	"Trigger is easy to open"
Force required to close trigger	"Trigger is easy to close"
	"Package looks durable"
	"Package feels durable"

Special Considerations:
1. Focus on the appearance and functional characteristics of the product's package, in particular the delivery device.
2. Preparation and soiling of surface are optional if only interested in studying package ergonomics.
3. Select appropriate fill volume of package to be tested.

[A] Attributes to be measured are not limited to those listed in the table. These are only examples. Other attributes are possible and should be defined based on the test objective.

TABLE 2 Examples of Attributes to be Measured
Stage of Measurement: Application[A]

Trained Assessors	Consumers
Control of spray direction (does product go where directed?)	"Trigger delivers an appropriate amount of product"
Spray pattern	"Product's spray can easily be controlled"
Proportion of over spray	"Product is easy to spray"
Degree of product coverage	"Product delivers a consistent amount each time it is sprayed"
Quantity of product delivered	"The consistency is appropriate for this type of product"
Degree of product leakage from trigger	"The hand does not become fatigued when applying the product"
Degree of product's translucent appearance	"Product stays where it is sprayed"
Foam depth or foam height	"Spray covers a small area"
Product thickness	"Spray covers a large area"
Force to dispense	
Speed of product run down (dripping)	
Degree of product cling	

Special Considerations:
1. Preparation and soiling of surface are optional if only studying performance of the delivery device.
2. Need to establish quantity of product to be delivered by the assessor; calibration of the trigger is recommended to ensure a consistent volume delivery with each spray.
3. If delivery device has more than one delivery style, select delivery form most appropriate for test.
4. Need to determine if evaluation should be performed on vertical or horizontal surface, or both.

[A] Attributes to be measured are not limited to those listed in the table. These are only examples. Other attributes are possible and should be defined based on the test objective.

TABLE 3 Examples of Attributes to be Measured
Stage of Measurement: Performance[A]

Trained Assessors	Consumers
Rate of soil removal	"Soil is removed easily"
Degree of soil removal	"Soil is removed quickly"
Degree of effort to remove soil (combination of number of strokes to clean and degree of pressure used).	"Product begins working before wiping"
Degree of effort to wipe away product	"Product effectively cleaned the surface"
Dissipation of foam	"Product is easily rinsed off the surface"
Feel of product when wiping (also considered to be lubricity)	"Product requires little effort to wipe off the surface"
Degree of product remaining after rinsing	

Special Considerations:
1. Check package directions to determine if rinsing is recommended and decide whether the evaluation procedure should include rinsing.

[A] Attributes to be measured are not limited to those listed in the table. These are only examples. Other attributes are possible and should be defined based on the test objective.

TABLE 4 Examples of Attributes to be Measured
Stage of Measurement: After-Use[A]

Trained Assessors	Consumers
Evaporation rate	"Surface feels clean"
Degree of residue appearing on surface	"Surface looks clean"
Degree of cloudiness on surface	"Surface is shiny"
Degree of streaking remaining	"Surface is not streaky"
Degree of filming remaining	"Surface is not dull"
Degree of shine on surface (or lack of clarity or shine)	
Color of residue remaining on surface	
Degree of soil residue remaining	
Residual grittiness felt on surface	
Residual oiliness felt on surface	
or any "custom" tactile term depending upon soil used	

Special Considerations:
1. The residual evaluation should be completed after following package use directions.

[A] Attributes to be measured are not limited to those listed in the table. These are only examples. Other attributes are possible and should be defined based on the test objective.

TABLE 5 Examples of Scent/Fragrance Attributes to be Measured
Stage of Measurement: Package, Application, Performance, After-Use[A]

Trained Assessors	Consumers
Strength of overall odor	"Overall liking of fragrance/scent"
Strength of fragrance/scent	"Fragrance/scent is appropriate for this type product"
Specific fragrance/scent types relating to products tested (that is, pine scent, lemon scent, and so forth)	"Fragrance/scent strength is appropriate"
Strength of base odor	Appropriateness of fragrance/scent for specific "connotation" terms of interest (that is, removes odor, safe for surfaces, smell like it would clean, and so forth)

Special Considerations:

1. Product scent should be evaluated separately from other product performance measurements (that is, package or product delivery characteristics).
2. Select stage(s) to measure based on objective of the test.
3. Need to establish quantity of product to be delivered by the assessor.
4. If delivery device has more than one delivery style, select delivery form most appropriate for test.
5. Need to determine if product scent should be evaluated on a nonporous surface or applied onto some other type of suitable container (that is, glass jar).
6. Soiling of the surface is optional and will depend on the objective of the test.
7. If evaluating multiple samples, establish limitation of samples to be evaluated in one setting to minimize assessor or consumer fatigue and over exposure of the product to the assessors or consumers getting familiar with the scent.

[A] Attributes to be measured are not limited to those listed in the table. These are only examples. Other attributes are possible and should be defined based on the test objective.

REFERENCES

(1) *Physical Requirement Guidelines for Sensory Evaluation Laboratories: 2nd Edition, ASTM MNL 60*, Carla K. Kuesten and Lori Kruse, Eds., ASTM International, 2008.

(2) *Manual on Descriptive Analysis Testing for Sensory Evaluation, ASTM MNL 13*, Robert C. Hootman, Ed., ASTM International, 1992.

(3) *Sensory Testing Methods: 2nd Edition, ASTM MNL 26*, Edgar Chambers IV and Mona Baker Wolf, Eds., ASTM International, 1996.

(4) *Guidelines for the Selection and Training of Sensory Panel Members, ASTM STP 758*, ASTM International, 1981.

(5) *Basic Principles of Sensory Evaluation, ASTM STP 433*, ASTM International, 1968.