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Standard Guide for Sensory Evaluation of Axillary Deodorancy¹

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1. Scope

1.1 This guide provides procedures which may be used in the design and analysis of studies to quantitatively assess the intensity of human axillary odor for the purpose of substantiating deodorant efficacy of personal care products.

1.2 This guide includes protocols for the selection and training of assessors, selection of subjects, experimental design, and statistical analyses. This practice is limited to assessment of axillary odor by trained assessors. Self-evaluation protocols are valid for selected sensory tasks but may be less sensitive.

1.3 With respect to the source of axillary odor, three groups of secretory glands are present in the axillae which participate to a greater or lesser extent in its production—eccrine, apocrine, and sebaceous. Axillary odor has been primarily ascribed to the apocrine gland secretion (1).² Body odor intensity has been correlated with the volume of the secretory portion of the apocrine gland (2) and the density of the glands.

1.3.1 Apocrine glands are found primarily in the axillary vault in conjunction with axillary hairs (3). Pure apocrine sweat is sterile and odorless and axillary odor results from degradation of apocrine sweat by resident skin bacteria (4). High bacterial populations are found in moist regions of the body, especially in the axillae, providing the appropriate environment for growth (5).

1.3.2 Eccrine glands keep the axillae moist through thermally and emotionally induced secretions (6).

1.3.3 The sebaceous glands excrete higher molecular weight lipid materials which absorb and retain the volatile materials resulting from bacterial action (7). The aerobic diphtheroids are able to produce the typical acrid axillary odor and the micrococcaceae produce an isovaleric acid-like odor when incubated with apocrine sweat (8). Therefore, the most unde-

sirable component of axillary odor is caused by degradation of apocrine sweat by particular bacteria normally found in the axillary vault.

1.4 Personal care products are sold and used primarily for their ability to reduce the perception of body odor not only by the individual using the product but also by individuals within the scope of contact. Deodorant protection may be achieved by these products through various modes of action. Antiperspirants achieve their primary efficacy by means of the action of inorganic salts on the eccrine gland production of sweat. Antimicrobial agents achieve deodorancy by inhibiting the growth and activity of the microflora in the axillary vault thus reducing the microbial decomposition of sweat and the consequent production of body odor. Absorbents function either by “binding” available moisture or malodorous substances. Fragrances are effective by altering the perception of malodor and increasing the degree of “pleasantness.” Other modes of control become important from time to time, representing changes in the state-of-the-art in product development.

1.5 The studies discussed herein are interpreted through the use of statistical tests of hypotheses. These hypotheses are usually of the form:

The Deodorant Efficacy of Treatment A
= The Deodorant Efficacy of Treatment B

1.5.1 It should be noted that failure to reject this hypothesis at a specified level of significance does not prove the hypothesis, but merely that the weight of evidence provided by the experiment is not sufficient to reject the hypothesis. This could occur because either: a) The hypothesis is close to truth and great experimental power would be required to reject it, or b) The experiment by design was low in power and, therefore, incapable of rejecting the hypothesis; even when it is far from true. This can occur due to design structure or low sample size. These facts must be taken into consideration when interpreting study results.

1.6 *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.*

¹ This guide is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.07 on Personal Care and Household Evaluation.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

2. Referenced Documents

2.1 ASTM Standards:³

E253 Terminology Relating to Sensory Evaluation of Materials and Products

E1697 Test Method for Unipolar Magnitude Estimation of Sensory Attributes

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 For definitions of terms relating to sensory evaluation, see Terminology **E253**.

3.1.2 *5-alpha-androst-16-en-3-one* (Δ^{16} (5-alpha) androst-3-one) $C_{19}H_{28}O$ —CAS No. 18339-17-7—component of axillary odor which has a “urinous” character and results from the action of certain skin bacteria on apocrine secretion (**9**).

3.1.3 *5-alpha-androst-16-en-3-alpha-ol* (Δ^{16} (5-alpha) androst-3-alpha-ol) $C_{19}H_{30}O$ —CAS No. 14152-27-3—component of axillary odor which has a “musky” character and results from the action of certain skin bacteria on apocrine secretion (**9**).

3.1.4 *apocrine gland*—a highly coiled tubular system found primarily in axillary epidermis. These glands continuously produce and store apocrine sweat for later excretion onto the skin surface via hair follicles. The excretion is activated by androgenic sympathetic stimuli such as pain or fear (**1**).

3.1.5 *deodorant efficacy*—the effectiveness or treatment, or both, of a product in reducing axillary malodor.

3.1.6 *eccrine gland*—a simple unbranched tube with a terminal coil. These glands are found in the epidermis over the entire body surface. The glands are controlled by the autonomic nervous system and serve as an evaporative cooling mechanism. Although heat is the primary stimulus, localized eccrine sweating can also occur as a result of emotional stress and other physiological stimuli (**3**).

3.1.7 *IVA, isovaleric acid* (3-methylbutanoic acid) $C_5H_{10}O_2$; $(CH_3)_2CHCH_2COOH$. CAS No. 503-74-2—component of axillary odor which has a “sweaty, acid” character and results from the action of certain skin bacteria on apocrine secretion.

3.1.8 *right-left imbalance*—a condition of some subjects who have one axilla with notably more intense odor than the other axilla as determined from the control odor evaluation.

3.1.9 *sebaceous gland*—a gland closely related to the hair follicle which produces sebum which combines with apocrine secretion at the base of the follicle. Sebaceous glands are under androgen control (**6**).

3.1.10 *sequential analysis*—a statistical technique which may be used to screen potential assessors for sensory acuity to a specific stimulus. The assessor is repeatedly tested until he or she passes or fails the test at a specified level of significance (**10, 11**).

3.1.11 *trigeminal response*—a sensation caused by stimulation of the trigeminal nerve. The sensation is that of a physical feeling, such as burning and tingling.

4. Summary of Guide

4.1 The protocols described provide for the designation of panels of individuals suitably selected and trained to perform the functions of assessors and subjects for the purpose of assessing deodorant efficacy. Details of specific procedures are given in **Appendix X1 – Appendix X3**. Deodorant products should be tested in a manner which maximizes test sensitivity while still reflecting normal consumer-use conditions. Examples are provided to assist the investigator in the design and performance of test protocols.

5. Significance and Use

5.1 The procedures recommended in this practice can be used to clinically assess axillary deodorant efficacy of personal care products.

5.2 This practice is applicable to the product categories which include deodorant and toilet soap bars, liquid bath soaps and gels, deodorant sticks, antiperspirants, creams and lotions, body talcs, and aerosol and pump delivery deodorants, antiperspirants, and body colognes.

5.3 Procedures of the type described herein may be used to aid in the communication of efficacy within and between manufacturers and to the consumer through the various public communications media. Guidelines are suggested due to the need to determine the relative or absolute performance of experimental materials or of commercial products.

5.4 These procedures may be used by persons who have familiarized themselves with these procedures and have had previous experience with sensory evaluation.

5.5 This practice provides suggested procedures and is not meant to exclude alternate procedures which may be effectively used to provide the same clinical result.

6. Subject Selection and Restrictions

6.1 *Criteria for Selection*—The population should be defined and subjects selected from this population in a random, and unbiased manner according to the experimental design considerations defined in **8.11**. If a test is being performed with the product directed at a subset of the consuming population, the subjects should be selected from a population representative of the subset.

6.1.1 The subjects should have a recognizable body odor level when evaluated under the procedures given in this practice.

6.1.2 In situations where it is desirable to enhance test sensitivity, the following criteria may be adopted:

6.1.2.1 Based on the control odor scores (see **8.3**), subjects who have low or extremely high odor should not be selected for the test. Subjects may be considered as having a “high” odor relative to a normal population if they develop an odor score in excess of 7.0 on a 0- to 10-point scale or 3.5 on a 0- to 5-point scale. Likewise, subjects may be considered as having a “low” odor relative to a normal population if they

³ 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.