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Standard Guide for Evaluating Cleaning Performance of Ceramic Tile Cleaners¹

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1. Scope

1.1 This guide covers the evaluation of the cleaning performance of products intended for use on ceramic tiles. This guide provides techniques for soiling, cleaning, and evaluating performance of detergent systems under controlled, but practical, hard-surface cleaning conditions.

NOTE 1—The soils described in this guide are known in the industry as “soap scum.”

1.2 Such systems include any detergent, cleaner, or abrasive cleanser intended for cleaning hard surfaces composed of ceramic tile. This guide is not appropriate for evaluating performance on grout. This guide also excludes other surfaces such as glass, resilient flooring, synthetic countertop surfaces or washable wall surfaces. The products for which this guide is intended include solutions of soluble powdered detergent, dilutions of concentrated liquid detergent, or products intended to be used full strength, for example, foams, sprays, liquid, powders, or paste.

1.3 *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 determine the applicability of regulatory limitations prior to use.* Material Safety Data Sheets are available for reagents. Review them for hazards prior to usage.

2. Referenced Documents

2.1 ASTM Standards:²

¹ This guide is under the jurisdiction of ASTM Committee D12 on Soaps and Other Detergents and is the direct responsibility of Subcommittee D12.16 on Hard Surface Cleaning.

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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.

D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials
D2960 Guide for Controlled Laundering Test Using Naturally Soiled Fabrics and Household Appliances

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bathroom soil*—the soil composed of materials present on typical bathroom surfaces.

3.1.2 *cycle*—a cycle is defined as being both the back and forth strokes on the scrubbing apparatus.

3.1.3 *soil*—in hard surface cleaning, foreign matter on a hard surface such as a ceramic tile.

3.1.4 *substrate*—the soiled surface that is being cleaned.

4. Summary of Guide

4.1 Soils are artificially applied in a standardized manner to a ceramic tile surface. The soiled surfaces are cleaned using a straight-line washability apparatus, and the cleaned substrates are evaluated using reflectance measurements, or visually by a panel of judges. A schematic diagram of the soil composition is summarized in Fig. 1.

5. Significance and Use

5.1 This guide suggests methodology for cleaning tests. This methodology can only be applied to assess product performance on typical bathroom soils and is not inclusive of all potential soils present on ceramic tiles or other bathroom surfaces. An assessment of cleaning performance on surfaces other than ceramic tile cannot be presumed since there is no confirmed basis for correlation for this soil on other surface or substrate types.

5.2 The results of tests based on this guide are regarded as diagnostic screening values useful in formulation studies, quality control, and ingredient raw material qualification. The results of this guide should be compared to control treatments, which are incorporated into each performance evaluation. These results should be considered to be relative to **all** other treatments in the study and are not absolute values. For

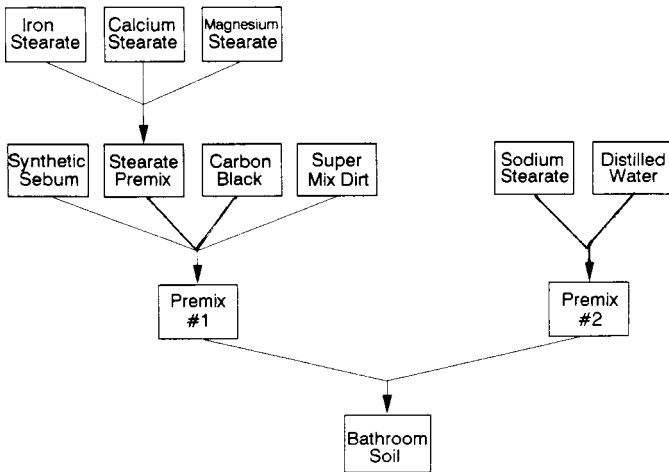


FIG. 1 Bathroom Soil Composition

interlaboratory comparisons, exact treatment conditions must be established and then results should be compared as relative ranking to the control treatments rather than as absolute values.

5.3 This guide is applicable to testing all types of multi-purpose household and bathroom cleaners, whether the detergent is prepared by dissolving a soluble powder, a dilutable liquid, or is a non-dilutable product. It may also be useful for evaluation of products or conditions normally associated with industrial or institutional cleaners.

6. Preparation of Soil

6.1 *Summary of Method*—White ceramic tiles are soiled with a composite soil composed of two separate preblends. One preblend consists of a mixture of synthetic sebum, metal stearates, carbon black, and dirt. The second preblend is a predissolved sodium stearate solution. Soil is applied using a painting pad applicator. The soiled substrate is scrubbed with a fine-celled sponge, to which the detergent system being tested has been applied, or with a damp sponge when the product is to be applied to the soil surface. Cleaning performance is evaluated by comparing reflectance measurements made on the clean/unsoiled test panel, soiled panel (untreated), and on the soiled panel after scrubbing with a straight-line washability apparatus. Results can be either a visual rating or calculated as a percentage of soil removed.

6.2 Materials:

- 6.2.1 *Super Mix Potting Soil*, from local store,
- 6.2.2 *Palmitic Acid*, reagent grade,
- 6.2.3 *Stearic Acid*, powder, triple pressed,
- 6.2.4 *Coconut Oil*,
- 6.2.5 *Paraffin Wax*,
- 6.2.6 *Sperm Wax*,
- 6.2.7 *Olive Oil*,
- 6.2.8 *Squalene*,
- 6.2.9 *Cholesterol*,
- 6.2.10 *Oleic Acid*,
- 6.2.11 *Linoleic Acid*, purified,
- 6.2.12 *Sodium Stearate*, technical grade,
- 6.2.13 *Ferric Chloride*, hexahydrate, $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$,
- 6.2.14 *Calcium Stearate*, technical grade,
- 6.2.15 *Magnesium Stearate*,

- 6.2.16 *Carbon Lampblack*,
- 6.2.17 *Distilled Water*, and
- 6.2.18 *Synthetic Hard Water*, 100 ppm hardness, as CaCO_3 , 3:1 $\text{Ca}^{+2}:\text{Mg}^{+2}$.

6.3 Equipment:

- 6.3.1 *Balance*,
- 6.3.2 *Stirplate/Hotplate*, two,
- 6.3.3 *Magnetic Stirbars*, two,
- 6.3.4 *Beakers*, 4000 mL, 2000 mL, 1000 mL, 600 mL (metal), and 500 mL,
- 6.3.5 *Forced Draft Oven*, capable of $110 \pm 5^\circ\text{C}$,
- 6.3.6 *Buchner Funnel*, 500 mL,
- 6.3.7 *Vacuum Flask*, 2000 mL,
- 6.3.8 *Filter Paper*, Whatman 1,
- 6.3.9 *Separatory Funnel*, 500 mL,
- 6.3.10 *Ring Stand and Ring*, to fit separatory funnel,
- 6.3.11 *Mortar and Pestle*,
- 6.3.12 *Sieve*, 14 mesh,
- 6.3.13 *Ball Mill and Ceramic Jar*, with 1-in. diameter ceramic cylinders,
- 6.3.14 *Cookie Sheet*,
- 6.3.15 *Replacement Mini Trimmer Paint Pads*, two,
- 6.3.16 *Refrigeration*, for storage, 35°F , and
- 6.3.17 *Plastic Disposable Pipets*.

6.4 Procedure:

Pre-mix No. 1 Preparation

6.4.1 Synthetic Sebum Soil:

6.4.1.1 Prepare synthetic sebum soil using the following constituents:

Constituent	Weight %
Palmitic acid	10.0
Stearic acid	5.0
Coconut oil	15.0
Paraffin wax	10.0
Sperm wax	15.0
Olive oil	20.0
Squalene	5.0
Cholesterol	5.0
Oleic acid	10.0
Linoleic acid	5.0
Total	100.0

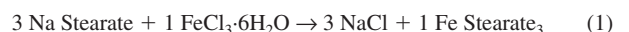
6.4.1.2 Weigh the oils out into one beaker. Then weigh the powders out into another beaker. Weigh the paraffin wax and sperm wax into a third beaker.

6.4.1.3 Warm the oils on a hot plate, but do not allow mixture temperature to exceed 54°C . Add powders and stir until dissolved.

6.4.1.4 Add the paraffin wax and sperm wax and stir until all ingredients are dissolved.

6.4.1.5 Pour the sebum into a glass jar and refrigerate at 35°F . The sebum may be stored at 35°F for up to six months.

6.4.2 *Iron Stearate Preparation*—Iron stearate is not commercially available and must, therefore, be prepared in the lab. The following reaction is used to prepare iron stearate:



6.4.2.1 Dissolve 15 g of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in 285 g of distilled water. Pour solution into a 500-mL separatory funnel. Set aside until needed.