Test Method for Dusting Behavior of Dyes

1. Purpose and Scope

1.1 This test method provides a means to assess the dusting behavior of dyes.

2. Principle

2.1 Dust is generated from a dye sample by means of a dust-generating device, extracted from the dust-bearing air by vacuum and conveyed to a detection point, where the amount of dust generated is estimated visually or determined quantitatively by a gravimetric or photometric option.

3. Terminology

3.1 **dust,** n.—fine particles of solid material dispersed in a gas.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Follow good laboratory practices. Wear safety glasses in all laboratory areas.

4.2 An eyewash safety shower should be located nearby and a self-contained breathing apparatus should be readily available for emergency use.

5. Uses and Limitations

5.1 Dyestuff dust is formed during handling operations such as dispensing, transferring, sprinkling, etc.

5.2 The dustiness of dyestuffs is an important characteristic when considering aspects of hygiene, health and safety in the dyestuff consuming industry. It is important, therefore, that a reliable and reproducible method exists to measure this property.

5.3 Although other methods of dust measurements exist, the method given in this test procedure is both more representative of and comparable with actual practice when handling dyestuffs. With respect to a comparison of dyestuffs or the reliability limits, it should be understood that the resulting value is not a specific value like density.

5.4 Solid dyes are sold in different physical forms (powdered, granulated, etc.). The particle-size distribution of commercial products varies considerably. The mean particle diameter may be less than 50 µm or as much as several millimeters. The range of particle-size distribution of a solid dye may also be narrow or wide.

5.5 The particle-size distribution of dyestuff dust is largely independent of the physical form of the dyestuff. Two typical particle-size distributions for dyestuff dust are shown in Fig. 1.

6. Apparatus and Materials (see 13.1)

6.1 Balance, accurate to ± 0.1 g, for weighing the dye.

6.2 Dust-generating device, with filter holder and connecting joints, and incorporating the following additional components (see Figs. 2 and 3, and 13.2).

6.2.1 Filter, white, diameter 50 ± 2 mm, capable of trapping the dust quantitatively (pore size < 5 µm), for gravimetric and photometric options made of cellulose acetate nitrate. For the visual option, suitable glass fiber filters can be used.

6.2.2 Vacuum pump with a suction capacity of at least 20 L/min.

6.2.3 Regulator for adjusting the air flow rate.

6.2.4 Flowmeter capable of monitoring the air flow rate between 10-20 L/min.

6.2.5 Timer for opening the slide valve to start suction, and for timing the period of suction.

6.3 Dust assessment apparatus.

6.3.1 For visual option, Gray Scale for Staining (see 13.3 and 13.4).

6.3.2 For gravimetric option, analytical balance.

6.3.3 For photometric option, photometer.

6.4 Analytical balance, accurate to ± 0.01 mg, for weighing the dust collected on the filter (see 6.2.1) (gravimetric assessment option), and/or photometer, for extinction measurement of the dust collected and dissolved in a suitable solvent (photometric assessment option).

6.5 Cleaning device; e.g., brush or vacuum cleaner, for cleaning the apparatus.

6.6 Tweezers for removing filter paper from the holder after dust generation.

7. Procedure

7.1 Place the filter holder with the filter (see 6.2.1) in the dust generating apparatus (see 6.2) and close it to give an airtight fit. If the gravimetric option of assessment is used, condition and weigh the filter before insertion into the filter holder.

7.2 Using the balance (see 6.1), carefully weigh 10.0 ± 0.1 g of the dye and place it in the hopper at the top of the apparatus. Start the timer (see 6.2.5) to open the slide valve with a sudden action, allowing the dye to drop down through the tube into the dust chamber below.

7.3 Five seconds after the slide has opened, apply a vacuum to extract the dust from the chamber for collection on the filter (see 6.2.1) under the following conditions:

7.3.1 Air flow rate: 15 L/min.

7.3.2 Extraction time: 120 s (starting 5 s after dye has dropped).

7.3.3 Height of fall: 815 ± 5 mm.

7.4 Using tweezers (see 6.6), carefully remove the dust-laden filter from the holder and evaluate it by one of the options given in Section 8.

7.5 Clean the equipment thoroughly (see 6.5) after each test. If the equipment is wet-cleaned, take particular care that it is dried thoroughly.

8. Assessment of Filter

8.1 Visual option. Compare the dust-laden filter visually with the Gray Scale for Staining (see 6.3.1) rate the filter using Table I of AATCC EP2, Gray Scale for Staining. Half-grades may be used.

Table I—Dust Assessment Rating Scale

Grade	Description
5	No dust
4	Slightly dusty
3	Moderately dusty
2	Dusty
1	Very dusty

8.2 Gravimetric option. Weigh the dust-laden filter on the analytical balance (see 6.4) to the nearest 0.01 mg. Since with low-dusting products the mass of dust is very small (< 1 mg), considerable errors are to be expected with the gravimetric option. In such cases preference should be given to photometric measurement.

8.3 Photometric option. For photometric measurement of the amount of dust, dissolve the dyestuff by shaking well the

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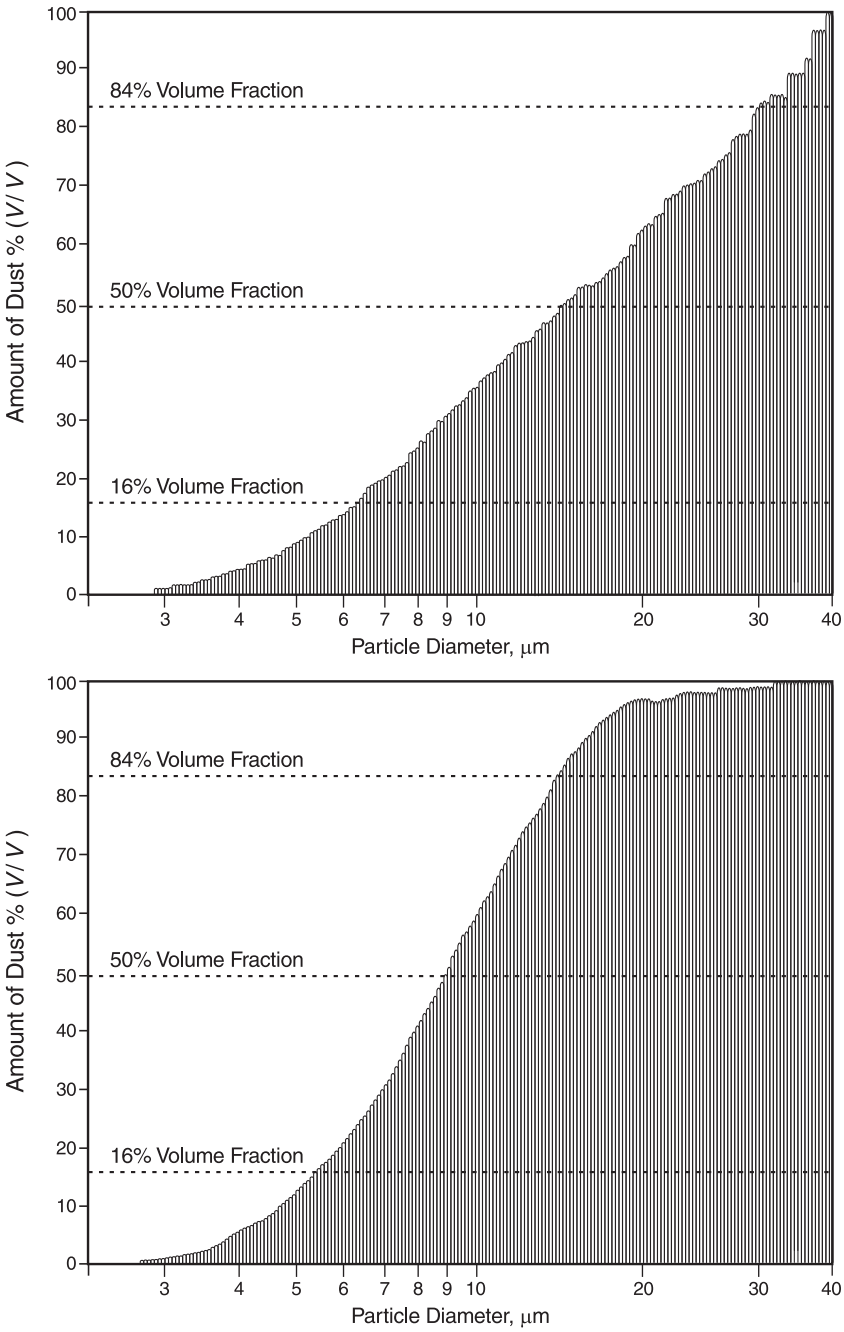

NOTE — The *x*-axis of both graphs has a logarithmic scale.

Fig. 1—Typical graphical representation of the amount of dust (by volume) as a function of the dust-particle diameter.

dust-laden filter in a suitable solvent at room temperature. When a clear solution has formed, measure the transmission with a photometer and read the corresponding amount of dust off a previously prepared calibration graph (see 12.1).

9. Evaluation

9.1 The generation and detection of dust depend on a great number of parameters. For this reason, the determination of the amount of dust yields results which are valid for the specified test conditions. This means that a direct comparison of either the visual or the quantitative results of dust behavior with results from other test methods is not possible. However, the relative order of results of a set of test specimens from one test method is likely to be comparable with that from other test methods.

9.2 Visual option. Express the results of the visual option as the Gray Scale rating obtained in 8.1.

9.2.1 A quantitative determination of the amount of dust produced by a dye is not possible by the visual option. The main reasons for this are different particle size distributions, particle sizes and shades of the dust in each case.

9.2.2 Visual assessment is subjective and depends on factors such as the experience of the examiner, the hue of the layer of dust and the nature of the filter surface (smooth or rough). Variations of up to half a grading unit are inherent in this system. Empirically, the total error under reproducibility conditions (same apparatus and laboratory) does not exceed this value.

9.3 Gravimetric and Photometric options.

9.3.1 Record the results obtained from 8.2 and 8.3 in milligrams of dyestuff dust collected.

9.3.2 In both of the quantitative options (gravimetric and photometric), the determination is based on the amount of dust trapped on the filter. Because the amount of dust is measured in milligrams, in the gravimetric option, variations in the conditioning of the filter and electrostatic influences can lead to substantial errors. If the amount of dust is determined by photometry, care must be taken that the transmission is measured on clear solutions. According to the experience of various laboratories, a reproducibility of about 10% (coefficient of variation) can be attained under favorable conditions.

9.4 Scatter of results. In some cases, scattering of the results may occur. The main causes of this are:

9.4.1 Factors specific to the apparatus:

9.4.1.1 The air flow rate is incorrectly adjusted.

9.4.1.2 The air flow rate through the apparatus is not constant, or the vacuum is incorrectly applied.

9.4.1.3 The timing control is imprecise.

9.4.2 External factors:

9.4.2.1 Humidity.

9.4.2.2 Electrostatic charges inside the vertical tube and the dust chamber.

9.4.2.3 Inhomogeneous distribution of the dust within the sample.

10. Report

10.1 The report should include the following information:

10.1.1 A full description of the sample tested.

10.1.2 The mass of the test specimen.

10.1.3 The assessment option used and the result obtained, expressed as in 9.2 and 9.3.

10.1.4 Details of any deviation from the procedure.

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