Designation: D 6288 – 98

Standard Practice for Separation and Washing of Recycled Plastics Prior to Testing[1]

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1. Scope

1.1 The practice describes a procedure for separating recycled plastics based on their color (for example, green versus colorless) and a procedure for washing dirty, ground plastic which results in separation of light materials (density < 1.00 g/cm^3). This practice is not intended to represent generic washing procedures used in the plastics recycling industry. The described procedures are solely for preparation of plastic samples for use in other analytical tests. The procedure includes a room temperature wash step to facilitate separation of paper (for example, labels) followed by washing at an elevated temperature.

NOTE 1—Although not presented as a quantitative method, the procedure presented in this practice may be used to provide quantitative results. The user assumes the responsibility to verify the reproducibility of quantitative results.

1.2 The values stated in SI units are to be regarded as the standard.

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.*

NOTE 2—There is no equivalent ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics[3]

D 5814 Practice for Determination of Contamination in Recycled Poly(Ethylene Terephthalate) (PET) Flakes and Chips Using a Plaque Test[3]

E 5991 Practice for Separation and Identification of Poly-(Vinyl Chloride) (PVC) Contamination in Poly(Ethylene Terephthalate) (PET) Flake[3]

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System[4]

3. Terminology

3.1 The terminology used in this practice is in accordance with Terminology D 1600 and Guide D 5033. Units and symbols are in accordance with Standard IEEE/ASTM SI 10.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *light material*—paper, polymers such as polyethylene and polypropylene, and other materials with densities less than 1.00 g/cm^3.

4. Summary

4.1 Different colored (for example, green versus colorless) plastic materials are readily distinguished by visual inspection of a sample.

4.2 Labels, glue residues and other plastics may absorb the dyes used in some procedures for identifying contaminants or these other contaminants may exhibit interfering fluorescence. Consequently, a standard procedure is provided for washing the plastic prior to examination by these tests.

4.3 This practice utilizes a room temperature wash step to facilitate separation of paper (for example, labels) followed by washing at an elevated temperature to permit separation of plastics and other contaminants based on densities. The room temperature wash step effectively removes labels without activating some adhesives.

NOTE 3—The dye and fluorescence tests that may require plastic washed by this procedure are specifically designed to detect poly(vinyl chloride) (PVC) contamination.

4.4 Washed recycled plastic materials are then used for tests such as those described in Practices D 5814 or D 5991.

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[1] This practice is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.95 on Recycled Plastics.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.03.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

5. Significance and Use

5.1 Dirt, paper and mixtures of polymeric materials complicate the interpretation of data from procedures used to identify and, if desired, quantify the contaminants in recycled plastics.

6. Apparatus

6.1 *Bright Aluminum Tray*, shallow depth (750 mm), with minimum area of 774 cm^2 (120 $in.^2$).

6.2 *Balances*, suitable for weighing 500 g of flake.

6.3 *Baffled Beaker*, stainless steel, 15.2 cm (6 in.) diameter with four 1.9 cm (0.75 in.) baffles providing a slurry height/diameter ratio of 0.9.

6.4 *Cover for Beaker* (see 6.3) which can accommodate a thermometer (or other temperature sensing device) and the stirring impeller rod.

6.5 *Overhead Stirrer*, capable of 1000 r/min.

6.6 *Stirring Impeller*, pitched three blade, 7.62 cm (3 in.) diameter.

6.7 *Plastic Pails*, 19 L (5 gal).

6.8 *Strainer*, non-aluminum to fit the pails described in 6.7.

6.9 *Hot Plate*.

6.10 *Thermometer*.

6.11 *Manual Stirring Rod*.

6.12 *Oven*, capable of drying plastic flakes at 60 ± 2°C.

7. Materials

7.1 *Water*, distilled or deionized.

7.2 *Sodium Hydroxide*, granular.

7.3 *Detergent*, nonionic surfactant.

NOTE 4—Nonylphenol or octylphenol derivatives are effective detergents for this procedure. Users of this procedure should be aware that these materials have been linked to endocrine/estrogen activity and false positive interferences with breast cancer research. Anionic detergents may also be effective.

7.4 Wash solution, consisting of 2 L of water, 0.3 % (6 g) nonionic surfactant (see 7.3), and 1 % (20 g) sodium hydroxide (see 7.2). Dissolve the surfactant in cold water prior to addition of the sodium hydroxide.

8. Procedures

8.1 *Separation of Plastics Based on Color*:

8.1.1 Spread a representative portion of the recycled plastic on an aluminum tray.

NOTE 5—Use an appropriate sampling technique to insure that the sample used for this test is representative of the entire gaylord or bale of material.

8.1.2 Visually inspect the recycled plastic and separate the materials based on color (for example, green versus colorless).

8.2 *Room Temperature Washing Procedure*:

NOTE 6—Although not required for all plastics, the room temperature washing procedure is useful to remove labels from some products. This step can reduce filter screen plugging from paper because the low temperature does not activate some adhesives.

8.2.1 Place the wash solution (see 7.4) in the baffled beaker (see 6.3).

8.2.2 Select and accurately weigh 500 ± 20 g of dirty plastic from the sample. Add this sample to the solution in the beaker.

8.2.3 Insert the overhead stirrer so that the impeller is 2.54 cm (1 in.) above the bottom of the beaker.

8.2.4 Turn on the overhead stirrer and adjust the speed to 1000 r/min. Continue agitation for 15 min at room temperature (25 ± 2°C).

NOTE 7—Bubbles may be attached to plastic flakes and these bubbles may cause heavy materials to float when they would otherwise sink. Using a screen to gently disturb the floating particles and cause release of the air may permit these heavy materials to sink instead of float.

8.2.5 After 15 min, turn off the overhead stirrer and remove it from the baffled beaker. Wait 5 min to allow paper and other light materials to rise to the surface and polymers such as PET and PVC to sink. Using the manual stirring rod (see 6.11), gently agitate the light materials to allow any trapped PET or PVC to sink.

8.2.6 Place a strainer (see 6.8) over a 19 L pail (see 6.7). Carefully pour the wash solution from the beaker through the strainer causing the light materials to be trapped on the strainer. Do not allow the heavier plastic material that settled in the beaker to be transferred to the strainer.

8.2.7 Add water to the beaker to raise the water level to within several inches of the top.

8.2.8 Agitate this plastic/water mixture with the manual stirring rod to further separate any trapped light materials. Allow any heavier polymers to sink to the bottom of the beaker, then pour the majority of the water through the strainer into the pail.

8.2.9 Rinse the light materials in the strainer for 2 min with cold water (see 7.1) while agitating the material with the manual stirring rod. Drain rinse water into the pail.

8.2.10 Transfer the trapped light materials from the strainer to paper towels and allow them to air dry.

NOTE 8—To shorten the drying time, place the isolated light materials in an oven at 60 ± 2°C.

8.3 *Elevated Temperature Washing Procedure*:

8.3.1 Place wash solution (see 7.4) into a baffled beaker (see 6.3) and heat to 88 ± 2°C (190 ± 5°F) on a hot plate. Cover the beaker (see 6.4) to minimize evaporation.

8.3.2 Select and accurately weigh 500 ± 20 g of dirty plastic from the sample. Add this sample to the solution in the beaker. If the room temperature wash procedure (see 8.2) was used to separate labels and other light materials, transfer all of the heavy plastic from the beaker (see 8.2.8) to the beaker with the wash solution at 88 ± 2°C (190 ± 5°F). Be careful to transfer all material from the first beaker.

8.3.3 Insert the overhead stirrer so that the impeller is 2.54 cm (1 in.) above the bottom of the beaker and return the solution temperature to 88 ± 2°C (190 ± 5°F).

8.3.4 Turn on the overhead stirrer and adjust the speed to 1000 r/min. Continue agitation for 15 min while maintaining the solution temperature at 88 ± 2°C (190 ± 5°F).

8.3.5 After 15 min, turn off the overhead stirrer and remove it from the baffled beaker. Remove the beaker from the hot plate.

8.3.6 Place a strainer (see 6.8) over a 19 L pail (see 6.7). Carefully pour the wash solution from the beaker through the strainer causing the solid material to be trapped on the strainer.

8.3.7 Add warm water (88 ± 2°C (190 ± 5°F)) to the beaker to raise the water level to within several inches of the top. Agitate this plastic/water mixture with the manual stirring, then pour the majority of the water through the strainer into the pail.

8.3.8 Rinse the material in the strainer for 2 min with cold water (see 7.1) while agitating the material with the manual stirring rod. Drain rinse water into the pail.

8.3.9 Transfer the trapped materials from the strainer to the aluminum tray (see 6.1) and oven dry at 60 ± 2°C.

9. Keywords

9.1 contamination; poly(ethylene terephthalate) (PET); poly(vinyl chloride) (PVC); recycled plastics; washing