

Document #:	RD-TM-210-4		Effective Date:	12/21/2018
Revision #:	2		Written By:	B. Pelgen
Revision Date:	12/28/2024		Approved By:	B. McKillip
Revised By:	C. Bushman		Page 1 of 5	
Test Method (TM)		Caustic Evaluation (PET Container) Shrink Sleeve Label		

1.0 Purpose:

- 1.1** The purpose of this Test Method is to detail the procedure for conducting floatability and ink bleed of shrink sleeve labels used for clear PET bottles. An important consideration for inks on shrink sleeve labels is that the ink not contaminate or discolor PET flake when mixed in hot caustic wash water used in the recycling process. If the ink separates from the label film in the wash step, it is desirable that the ink be readily filtered from the PET flake as well as the wash water. If the sleeve label floats, it is desirable that the ink remain adhered to the floating label, and that the ink density not cause a floating label to sink.
- 1.2** This test method shall be the default Multi-Color R&D method for evaluating floatability and ink bleed performance per caustic bath testing and shall only be superseded by customer-specific methods when required.

2.0 Scope/Responsibilities:

- 2.1** Research & Development is responsible for the management of this test procedure.

3.0 Definitions/Acronyms:

- APR – Association of Plastics Recyclers, www.plasticrecycling.org

4.0 Associated Documents, Forms and Records:

APR PET-P-00 PET Standard Laboratory Processing Practices
APR PET-P-04 Washing and Sink/Float Separation of PET Flake
APR PET-CG-02 Critical Guidance Protocol for Clear PET Articles with Labels and Closures
APR PET-B-02 Benchmark Evaluation for Clear PET Articles with Labels and Closures
APR PET-S-05 PET Packaging Component Sink or Float Evaluation
APR RES-LBL-2 Shrink Sleeve Labels on PET Containers APR Resource Document, 01/04/2021

5.0 Materials and Test Conditions:

Materials:

- Test Labels
 - See section 6.0
- PET Flake
 - Ground flake about 1 cm (3/8 in) in size
 - Quantity dependent on number of tests to be run
- Glass Beakers
 - Use appropriate size for batch size
- Strainer
 - Non-aluminum, fine mesh
- Graduated cylinder, 1000 mL

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- 6) Caustic (NaOH)
- 7) Distilled water
- 8) Triton X-100
- 9) Glass stirring rods

Equipment:

- 1) Scale or Balance
- 2) Digital Thermometer
- 3) Hot plate capable of heating to 100°C
- 4) Mixer with impeller
- 5) Storage Bin
- 6) Oven – Fischer Scientific Isotemp Oven Model No. 637G
- 7) Die Cutting Station
 - a) 1 cm (approx. 3/8") square die

Test Conditions:

- 85 ± 2°C (185°F) Hot wash
- 45 ± 2°C (113°F) Warm rinse

6.0 Sample Preparation:

Label Type	Customer Specific Label	Generic Label
Shrink and Stretch Sleeve Labels	Test intended labels on PET containers and blend with un-labeled control bottles (50:50)	Test labeled bottles at 3% weight of all test containers, no 50:50 dilution with control bottles required.

7.0 Procedure:

7.1 Hot Wash

- 1.0** Shrink sleeve labels should be applied to containers and shrunk prior to evaluation. If containers with labels are not available, loose labels may be tested but should be pre-shrunk prior to evaluation by shrinking onto similar sized container. Remove the shrink sleeve label from the container and pass through the rotary die cutting station to cut into 1 cm squares. If no die cutting station is available, samples may be cut into 1 cm squares using scissors or a paper cutter.
- 2.0** Weigh the cut label sample and record exact weight in grams. Mix with proper amount of PET flake according to the chart in section 6.0. For example, if you are testing a generic shrink sleeve label and you have 500 g of PET flake, the label weight should be 3% (15 grams).

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Note: The standard APR method uses a granulator but this does not allow color evaluation of the samples because the granulated flake is too small. As a result, MCC includes several standard PET cut chips from the container as part of the mixture for CIE L*a*b* readings upon test completion.

- 3.0** Place beaker on hotplate.
- 4.0** Add water to the beaker.
 - 4.1** Water needs to be four times the weight of the amount of PET flake. For example, if you are testing a total of 500 g PET, your water quantity should be 2000 mL.
- 5.0** Position the impeller between 0.5-1 times the impeller diameter from the bottom of the beaker.
 - 5.1** The impeller is 50 mm (~2 in) in diameter. The impeller should be 25-50 mm (~1-2 in) from the bottom of the beaker.
- 6.0** While the water is heating, add NaOH pellets to the water to create a 1% solution.
 - 6.1** 1% of 2000 g = 20 g of NaOH
- 7.0** When the solution reaches 45°C, add Triton X-100 to the NaOH solution to create 0.3% (by weight) content.
 - 7.1** 0.3% of 2000 g = 6 g of Triton X-100
- 8.0** When the solution reaches 85°C, add the PET flake/sample mixture.
- 9.0** Maintain the solution at 85°C.
- 10.0** Increase the standing mixer speed to approximately 1520 rpm. Agitate for 15 minutes.
- 11.0** After 15 minutes, shut off the standing mixer.
- 12.0** Remove beaker from hot plate.
- 13.0** Allow the beaker to sit for 5 minutes.
- 14.0** Skim off and save any floatables.
- 15.0** Pour the liquid-flake mixture over the strainer.
- 16.0** Save the wash water.
- 17.0** Vigorously stir the retained wash water.
- 18.0** Take a sample (about 1 liter) of wash water for further evaluation.

7.2 Warm Rinse

- 19.0** Add 2000mL of water to beaker.
 - 19.1** Water needs to be four times the weight of the amount of PET flake. For example, if you are testing a total of 500g, your water should be 2000mL.
- 20.0** Place beaker on the hot plate.
- 21.0** Position the impeller between 0.5-1 times the impeller diameter from the bottom of the beaker.
 - 21.1** The impeller is 50 mm (~2 in) in diameter. The impeller should be 25-50 mm (~1-2 in) from the bottom of the beaker.
- 22.0** When the rinse water reaches 45°C, add the PET flake/sample mixture.
- 23.0** Maintain the rinse water at 45°C.

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24.0 Increase the standing mixer speed to approximately 1520 rpm. Agitate for 5 minutes.

25.0 After 5 minutes, shut off the standing mixer.

26.0 Remove the rinse beaker from the hot plate.

27.0 Allow the beaker to sit for 5 minutes.

28.0 Skim off and save any floatables.

29.0 Pour off the liquid-flake mixture over the strainer.

7.3 Sink/Float

30.0 Fill a large container/bowl with water.

30.1 Water needs to be eight to ten times the weight of the amount of PET flake. For example, if you have a total of 500g of sample, you need to use 4000-5000mL of water.

31.0 Add the PET flake to the container.

32.0 Agitate with glass stirring rod for 5 minutes.

33.0 Allow container to sit for 5 minutes.

34.0 Skim off and save the floatables.

35.0 Pour the liquid-flake mixture over the strainer to recover the PET flake.

7.4 Dry Recovered Materials

36.0 Dry the PET flake so that it is dry to the touch and free flowing.

36.1 Flake can be air-dried or dried in an oven at a temperature no more than 60°C.

37.0 Retain the 50-100g of flake for further evaluation.

8.0 Interpretation:

8.1 An important consideration for inks on shrink sleeve labels is that the ink not contaminate or discolor PET flake when mixed in hot caustic wash water used in the recycling process. If the ink separates from the label film in the wash step, it is desirable that the ink be readily filtered from the PET flake as well as the wash water. If the sleeve label floats, it is desirable that the ink remain adhered to the floating label, and that the ink density not cause a floating label to sink.

8.2 The APR method suggests that more than 95% of typical polyolefin labels are removed by this procedure. Additional separation is expected during elutriation.

8.3 The following guidelines (comparison to control) are set for the PET flake:

8.3.1 $L^* > 82$ units

8.3.2 $\Delta a < 1.5$ units

8.3.3 $\Delta b < 1.5$ units

9.0 Revision Notes:

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Revision Number	Date of Revision	Name of Editor	Changes Made
1	7/27/2023	Brittany Pelgen	Added Revision section, updated company logo, minor corrections
2	12/28/2024	Craig Bushman	Revised method to focus only on SSL and removed mention of other label technologies. Changed title and method number.