Testing of PET Plaques for Color, Haze and Inclusions

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Introduction – Scope, Significance and Use

Products made with PET are often valued because they have high clarity along with low color and haze. When recycling clear PET, it is important that the PET resin, additives, and any other features employed such as labels or closures have the least possible impact on the color and transparency of the resin. Industry experience is that inks, adhesives, additives, layers and coatings, for example, can be sources of color formation and specks in recycled PET.

This document presents a standard method to evaluate any contribution to color, haze or inclusions that might result from recycling PET articles. The test measures the color and haze values of transparent injection molded plaques. This evaluation is an important part of many APR tests and is used to measure any impact of a design feature such as labels, inks, adhesives or additives on PET recycling.

Reference Documents

PET-P-00: Standard Laboratory Processing Practices - APR Practice "Injection Molding 3 mm PET Plaques", PET-P-08

Test Method Summary

3 mm thickness injection molded - amorphous and transparent - PET plaques are prepared. Plaques are evaluated for d65 CIE L*a*b* color values and haze using a color spectrophotometer in transmittance mode. Plaques are evaluated visually for any presence of black specs or other inclusions.

Equipment Required

- Color spectrophotometer capable of measuring CIE L*a*b* Scale and Haze % in transmittance mode with d65 light source.
- Diffuse white light source to use in visual inspection for black specks and inclusions.

Materials Required

- Injection molded plaques 3 mm thick of control and test PET articles.
- TAPPI Calibrated Size Estimation Chart, or Ryan Quality Control provides an alternate size standard chart showing defects with size 1 mm^2
- As alternative to the size chart, a measurement tool capable of evaluating black specks and inclusions greater than 0.35 mm in the largest dimension. (A circle with diameter of 0.36 mm has a surface area of 1 mm^2.)

Test Method Steps

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Color and haze measurement

1) Calibrate the spectrophotometer to the manufacturer's recommendations for transmittance mode.
2) Measure color and haze values for five separate control plaques
   a) Select five random plaques for evaluation.
   b) Place a plaque in the transmittance cavity of the spectrophotometer.
   c) Measure and record the d65 CIE L*, a*, b* color and haze % values
   d) Repeat for each of the five plaques.
3) Measure the color and haze values of five plaques for each test sample.

Inclusion evaluation

This evaluation involves holding injection molded plaques in front of a diffuse white light source and visually, with no magnification, identifying any black specks or other inclusions in the plaque that are larger than 0.1 mm^2 in size. The TAPPI Calibrated Size Estimation Chart provides a visual standard. Ryan Quality Control provides an alternate size standard chart. A circular defect with an area of 0.1 mm^2 is 0.36 mm in diameter.

The test involves evaluation of 50 individual plaques for each of a control and test material; or test results can be reported per 50 plaques.

Evaluation steps:

a) Place the plaque between your eyes and the light source. The approximate distance between plaque and eyes is 30 cm.
b) Count any plaque with one or more black specks and/or inclusions greater than 0.1 mm^2.

Control Plaque Color Data

Sample	Result	L* (d65)	a*(d65)	b*(d65)	Haze %
Control Plaques	Run 1				
	Run 2				
	Run 3				
	Run 4				
	Run 5				
	Average				

Test Plaque Color Data

Sample	Result	L*(d65)	a*(d65)	b*(d65)	Haze %
Testing Plaques	Run 1				
	Run 2				
	Run 3				
	Run 4				
	Run 5				
	Average				

Black Speck Report

Sample	Number of plaques with specks or inclusions	Number of Plaques Evaluated
Control plaques		
Test plaques		

DOCUMENT VERSION HISTORY

Version	Publication Date	Revision notes
1	November 16, 2018	Original Document
2	September 3, 2024	Updated hyperlink for reference documents to match new website