HDPE Bleeding Label Test
HDPE-S-01

The following protocol is designed to provide a generic wash process for evaluation of the effects of "bleeding labels" on recycled natural HDPE material. A "bleeding label" is one with water dispersible or soluble inks that result in discolored wash water and stained natural HDPE flake

This protocol does not purport to address all of the safety issues, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

Equipment/Supplies List

For wrap around and other adhered labels, not shrink sleeve labels

- Label for evaluation, 1.0 grams per test.
- Clean, natural HDPE flakes about 1 cm (3/8 inch) nominal (100 grams/test plus 100 grams for control)
- Beaker – 800 ml. The beaker ID should be about 9 cm (3.5 inches) and have a slurry height to diameter ratio of 0.8
- 500 to 800 ml beaker, for mixing solution
- Hot plate capable of heating to 90^0C
- 125 mm watch glass to cover beaker when heating
- Scale or balance capable of measuring 500 (+\- 0.5*)* grams
- Overhead stirrer capable of 600 rpm
- Stirring impeller - pitched, and 4 cm (1.75 inch) diameter.
- Colorimeter/spectrophotometer
- Thermometer
- Strainer - non-aluminum, fine mesh
- Distilled or deionized Water
- Graduated cylinder, 500 ml
- Caustic (granular NaOH)

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Be sure to read all material safety data sheets.

Natural HDPE Sample Wash Procedure

Be sure to use appropriate laboratory safety procedures / Gloves, safety glasses, etc.

1. Cut up 1.0 grams of label into 0.7 cm (1/4 inch) squares.

2. Prepare "wash" solution in the mixing beaker consisting of 400 ml water (for a slurry ratio of 4:1) and 1.0% by weight (4 grams) caustic (NaOH).
   Do not add surfactants

3. Add "wash solution" to 800 ml beaker. Heat solution on hot plate to 85C (185^0F) while covered with watch glass cover to minimize evaporation.

4. Add the 1.0 grams of label and 100 grams of clean, natural HDPE flake to the solution. Do not use colored flake.

5. Insert overhead stirrer so that the impeller is 1/2 inch above the bottom of the beaker.

6. Turn on overhead stirrer and adjust to 540 rpm.

7. Continue agitation for 15 minutes and maintain solution at 85C (185F)

8. Turn off and remove overhead stirrer. Remove beaker from heat and immediately strain solution, labels, and flake. Save solution for visual observation

9. Immediately rinse the remaining labels and HDPE flake with distilled or deionized water, approximately with 200 ml of water. Separate and dry the HDPE flake from the slurry.

10. To prepare the control HDPE flake for comparison, follow above procedure while omitting the label.

Note: Labels tested should be from commercial production operations. If preliminary testing is conducted on developmental labels from pilot-scale equipment, the testing should be repeated with commercially produced labels.

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Evaluation of HDPE Container Component Color

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1. Produce 100gram natural HDPE flake samples according to this procedure. Be sure to produce a sample of control flake from recycled natural HDPE bottles without the "bleeding label" to be evaluated.

2. Perform color analysis, according to the machine manufacturers instructions, on each sample produced (test of "bleeding label" on possibly stained HDPE and control HDPE) using the following format:

   a. Take five measurements, in reflectance or transmission, on each sample. Record data as X, Y, Z tristimulus values, CIE XYZ, CIE L*a*b*or Hunter **L a b** color coordinates, or equivalent. Adjust the position of the sample holder prior to each measurement to expose different sample areas to measurement.

   b. Report all of the axis readings (such as **L, a, b**) for all five samples and the average for each sample.

3. Evaluation guidance. All three color measurements, **L**, **a**, and **b**, are important to the possible use of the recyclate. The human eye can discern about one **b** unit change. The **L** measures brightness vs dinginess of the flake. **a** measures red/green color components. **b** measures yellow/blue color components.

   Depending on the end use, different amounts of variation from the control can be accepted. Generally, changes of more than two **a** or **b** units or five **L** units are excessive. Absolute **b** values over 3 for flakes measured in reflection may be unacceptable for reuse in bottles.

   Comparisons should be made between control and test samples for the same treatment.

4. Discolored water should be evaluated to see if the discoloration is acceptable for release to municipal sewer systems without further treatment. Strongly discolored water is likely to be unacceptable to many municipal wastewater treatment systems and labels which cause such discoloration should be avoided.

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The guidance contained in this document does not guarantee acceptance or rejection of tested materials. APR encourages users of this protocol to discuss results with various knowledgeable parties using and specifying post consumer HDPE material to determine usefulness of subject test materials. Any guarantees or warranties are expressly disclaimed, including without limitation any implied warranties of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.