

Avery Dennison label releasability in rigid HDPE packaging recycling

To better understand how our standard adhesion filmic label solutions for FMCG applications react during the rigid HDPE recycling process, specifically how they perform throughout the recycling steps and washing temperatures, Avery Dennison conducted a semi-industrial trial in cooperation with The National Test center Circular Plastics (NTCP). We assessed:

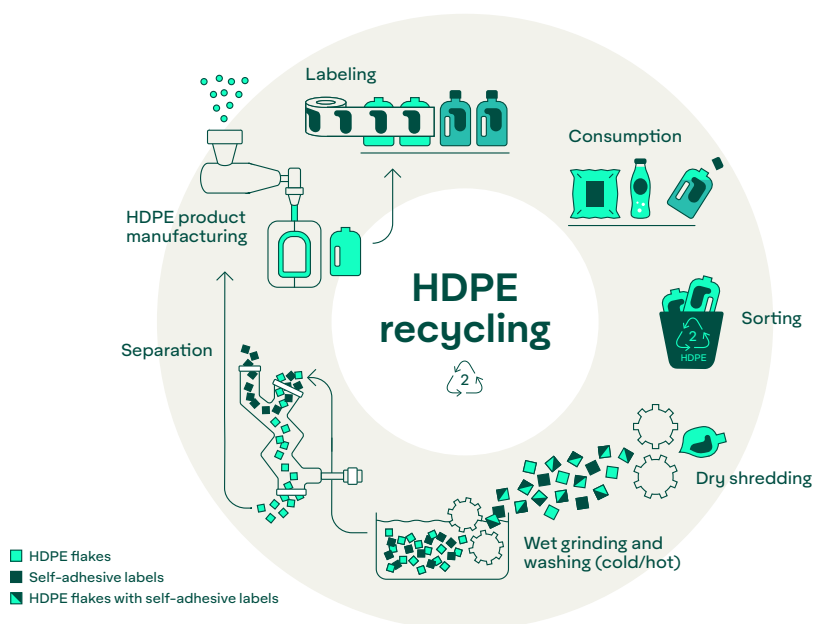
- The releasability of Avery Dennison's filmic label solutions during the full rigid HDPE recycling process
- The cleanliness of the resulting recycled HDPE flakes (recyclates)

The semi-industrial trial took place in December 2023 at the NTCP research center, which is representative of standard European plastic recycling centers.

The semi-industrial trial overview

50,000 white HDPE bottles with different filmic face materials and adhesive combinations¹ were tested. Releasability was assessed after different recycling steps: dry grinding, wet granulator, mechanical dryer cold wash, and mechanical dryer hot wash. The types of standard adhesion² solutions tested are most commonly used for FMCG applications.

Rigid HDPE recycling process



¹ Each bottle was significantly labeled, with >70% coverage

² The standard adhesion filmic label solutions are designed using Avery Dennison's S692N and S7000ER adhesives

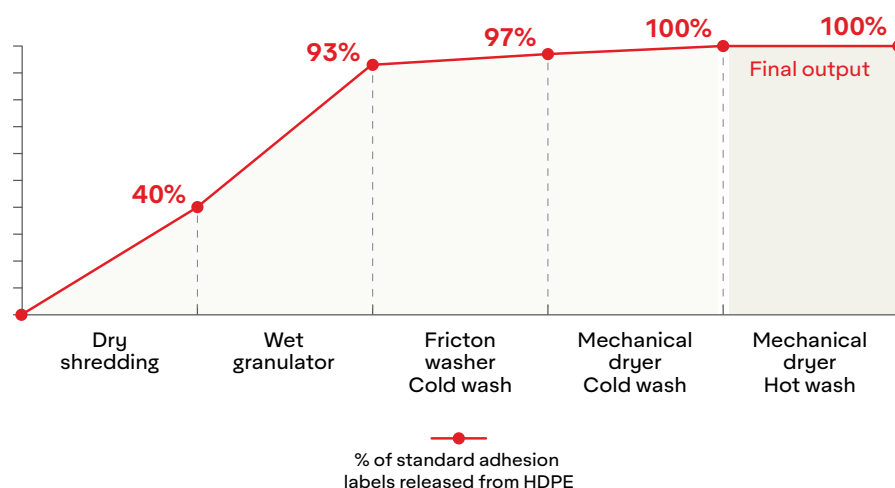
Results: 100% releasability after cold wash

The trial results showed that:

- 100% of Avery Dennison's standard adhesion filmic label solutions for FMCG applications are released from HDPE packaging during the recycling process, leaving high-quality HDPE flakes³
- To enable label releasability, mechanical stress is critical and must be included in testing protocols
- There was no significant difference between the final releasability of different Avery Dennison filmic facestock and adhesive combinations typically used for FMCG applications – 100% were released after cold wash
- There was no difference observed in the releasability of our labels in cold wash or hot wash⁴

Percentage of labels released from containers after each process step

The average across all standard adhesion filmic facestock and adhesive combinations typically used for FMCG applications



Conclusion and proposal

The results show that current requirements for label adhesives to wash off in either hot or cold temperatures will have little impact on label releasability during recycling. The results also show that brands do not need to seek out separate labeling solutions that enable recyclability, since Avery Dennison's standard adhesion filmic label solutions for FMCG applications are compatible. We recommend regulatory bodies and recycling associations to consider the following updates to their HDPE design for recycling guidelines:

- HDPE design for recycling guidelines should be updated to reflect the true behavior of our filmic label solutions during recycling. We propose guidelines be updated to "adhesive to be released in the recycling process⁵".
- The full recycling process, including mechanical stress, should be taken into account in future design for recycling guidelines. This includes lab test protocols for label decoration on natural and white HDPE containers and colored HDPE containers and tubes.
- The impact of the adhesive in the washing water and disposal of the washing water is an important topic to assess total environmental impact. Additional testing in collaboration with recyclers is necessary.

³ The semi-industrial trial conducted did not assess the recycling steps that occurred after washing (e.g. extrusion). The claims presented by this trial are under the condition that the label has passed sorting requirements.

⁴ Hot wash was performed sequentially after the cold wash

⁵ Current design for recycling guidelines mention specific temperatures (cold or hot wash) or adhesive properties (water soluble)

About Avery Dennison

Avery Dennison Corporation (NYSE: AVY) is a global materials science and digital identification solutions company that provides a wide range of branding and information solutions that optimize labor and supply chain efficiency, reduce waste, advance sustainability, circularity and transparency, and better connect brands and consumers. Our products and solutions include labeling and functional materials, radio frequency identification (RFID) inlays and tags, software applications that connect the physical and digital, and a variety of products and solutions that enhance branded packaging and carry or display information that improves the customer experience. Serving an array of industries worldwide — including home and personal care, apparel, general retail, e-commerce, logistics, food and grocery, pharmaceuticals and automotive — we employ approximately 35,000 employees in more than 50 countries. Our reported sales in 2023 were \$8.4 billion.

Learn more at www.averydennison.com.

About NTCP

NTCP is an independent, not-for-profit, R&D organization established at the end of 2018 in order to accelerate the circular objectives for plastics recycling. NTCP acknowledged the urgency and need in the market for test and research capability on the relevant industrial scale. By designing and building R&D facilities on an industrial scale, an independent and accessible facility that encourages collaboration in the value chain was realized.

With their facilities for the sorting and washing process of plastics on a relevant industrial scale, the NTCP is the first independent R&D center which is representative for large-scale industrial installations. The practical tests and experiments with real waste streams result in a continuous data collection that helps stakeholders from the chain to accelerate their circular objectives.

Contact us

To learn more about the results from our semi-industrial test, please feel free to contact us at sustainable.labels@eu.averydennison.com

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For more information on technical performance and printing recommendations, please refer to the respective datasheets. Please note that the Avery Dennison product range and service offering can be subject to changes. For an accurate overview, please check our website label.averydennison.eu or contact your local Avery Dennison sales representative.

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