

PET Packaging Recycling Process

Introduction

PET bottles and thermoforms can be recycled by reclaimers to create washed recycled PET flake or PET pellets, known as r-PET, that are used in a variety of applications including: textiles, carpet fibers, strapping, sheet extrusion and new PET bottles. PET is valued for its good physical properties, safety for use with food and beverages, clarity and lack of color. The process steps used to recycle PET have been developed to maintain these important performance attributes.

Discussion of PET recycling can be broken down into four separate process segments:

1. Create granulated flake
2. Create washed flake
3. Create melt filtered pellets
4. Create solid stated product.

Process variations may be employed at different reclaimer locations. The discussion below captures process steps that are most commonly used, and where package design features may have an impact on the quality or productivity of the process.

Process Segment 1: Create Granulated Flake

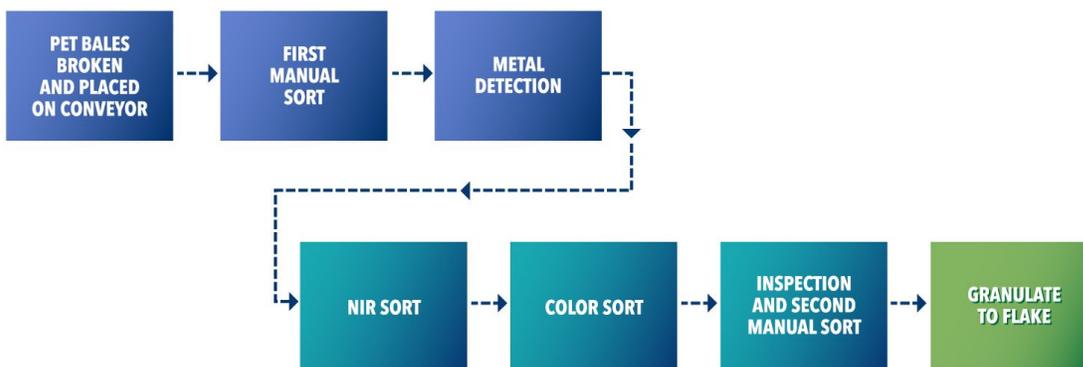
In this process segment, bales of PET packaging are broken open, sorted and granulated to create PET flake that facilitates separation of PET from labels, closure materials, and other contents in the bale. Recall that bales of PET will contain PET packaging, along with closures, labels, pump or spray dispensers, and attachments such as handles or heat seal foils. There will be residual contents from food and beverage containers in the packaging. And there will be non-PET materials in the bale that were not removed at the MRF; examples include paper and cardboard, plastic films, or metal cans.

PET reclaimers might employ bales of PET bottles only, thermoforms only, or bales that contain a mixture of bottles and thermoforms.

Helpful Links:

[APR Model Bale Specification for PET Bottles with Gradings](#)

[Bale Audit Test Methods used to assess the content of a bale of PET Bottles](#)



Notes on this process segment:

- First manual sort is to remove anything unexpected or readily undesirable in the bale contents. Examples include: paper or film, non-PET packaging, metals.
- Metal detection removes steel and aluminum. PET packages with metal closures may be ejected at this point.
- Materials ejected by the NIR sorter are usually baled for disposal.
- Colored PET is ejected from the stream and sent to secondary processing to recover green bottles.
- The second manual sort may be used to remove anything missed by auto-sortation, or to remove bottles known by a reclaimer to be a problem for recycling.

Process Segment Options

Some reclaimers:

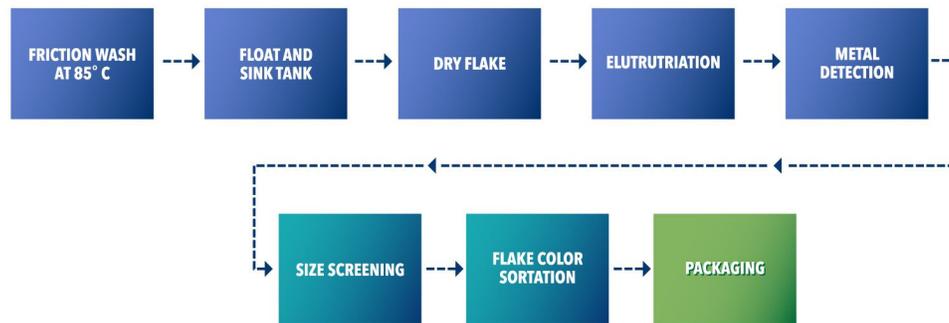
- Employ a whole bottle wash where bottles are washed with hot wash water prior to NIR auto-sortation. Washing removes dirt and many labels to help promote accurate sortation, reduce wear on recycling equipment, and reduce particulate contamination.
- Employ a process step where bottles are sent through a unit to mechanically remove labels prior to the auto-sortation steps, or alternatively, after auto-sortation to remove labels that prevented accurate sorting.

Process Segment 2: Create Washed Flake

In this process segment, flake is washed and then materials that float in water are removed in the “float sink tank”. The elutriation process involves an air stream employed to remove materials such as fines and label residue from dry PET flake. Screening removes any PET flake that is too big or too small to be desirable. It is

common today to use a final auto-color sorter to evaluate the color of the dry flake and remove any off-colored material resulting from label residue or contamination.

Washed flake can be the feed stock used in many postconsumer applications for recycled PET, or r-PET. A few examples of products produced from washed flake include: PET sheet, fibers.



Process Segment 3: Create Melt Filtered Pellets

Some r-PET applications are better served by supply of PET pellets that have higher bulk density and better conveying and feeding properties than PET flake. Melt filtered pellets are commonly created through the following steps:

- Drying PET flake in a desiccant drier at about 150° C for about 4 hours
- Extruding the flake at 270° to 300° C.
- Passing the melt through a metal screen filter to remove physical contamination
- Pelletizing the PET

Process segment 4: Create Solid Stated Product

An important property of PET is referred to as “IV” intrinsic viscosity. IV is a measure of the molecular weight of PET. Many PET buyers specify a specific value of IV for their application. Since melt processing will reduce the IV of PET, it is desirable to have a process that can raise IV to meet end user requirements.

Solid stating increases the IV of PET. There are cases where melt filtered pellets are solid stated to boost IV. There are other cases where washed flake can be solid stated prior to use. PET flake or pellets are subjected to high temperature, about 210° C, under either vacuum or dry nitrogen for several hours of time. During this

exposure, water is removed from the PET and what chemists call a “polyester condensation reaction” allows a build in molecular weight and IV.

Further, the US FDA has strict requirements for r-PET that is used in food and beverage applications. Solid stating is the most common method used to remove any contaminants that are of concern with food and beverage applications and allow compliance with FDA requirements.