

Used PET-Bottles "As a valuable raw material"

Plastics offer a suitable packaging option for all types of goods. They protect, are flexible, hygienic and provide aroma protection. A lot of food packaging is made from the plastic with the abbreviation PET. The advantages of this plastic are that it is colorless, completely translucent, unbreakable and lightweight. Beverage bottles made of PET are particularly well known. They can be produced quickly and easily in large quantities and their low weight means that energy consumption during transportation is low.

Plastics have a long shelf life, which is an advantage for drainpipes or packaging, for example. However, if disposed of carelessly, this durability can become a problem for the environment.

SINCE WHEN HAVE PET BOTTLES BEEN AROUND?

In 1973, the American inventor Nathaniel Wyeth patented the first PET bottle. Unlike the plastic bottles already in use at the time, this material could also withstand the pressure of carbonated liquids.

HOW DO PET BOTTLES GET THEIR SHAPE?

PET bottles are produced in two steps:

- 1) **Raw Production (preform or PETling):** PET granulate is heated in an injection molding machine. This creates a uniform mass. The machine then injects the mass into a mold under pressure. Once it has cooled down the preform is ready.
- 2) **Production of the PET bottle:** The small and lightweight preforms are transported to the bottling plant (beverage manufacturer). There are stretch blow molding machines there, which heat the preform and place it in a negative mold. A mandrel stretches the soft blank into the length. The preform is then pressed into the mold with compressed air. As soon as the bottle has cooled down, it can be filled.

PET Profile

NAME: Polyethylenterephthalat

TYPE: Thermoplast

MELTING POINT: 250-260°C

USE: Beverage bottles, adhesive tapes, gear wheels, textile fibers, safety belts, ...

RECYCLINGSYMBOL:  PET

THERMOPLASTS (PLASTOMERS)

Plastics that deform when heated are called thermoplastics. The macromolecules in these plastics are mainly next to each other. This allows the molecules to slide along each other when the temperature rises, making deformation easily possible.

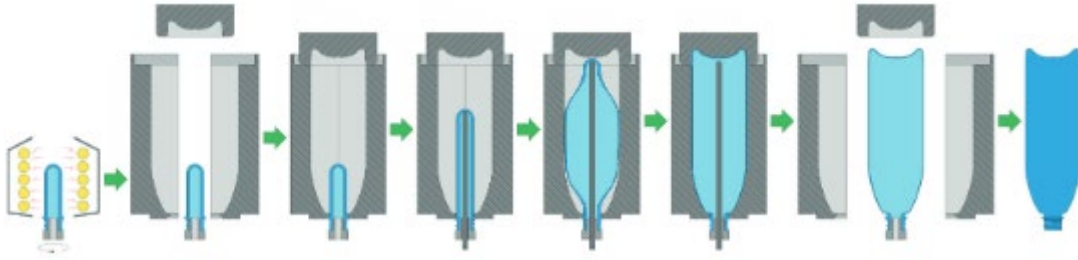


Figure 1: Stretch blow molding process.

In the stretch blow molder, the preform is turned into a drinking bottle step by step.

EXPERIMENT

Place an empty PET bottle in a sink and carefully pour boiling hot water into the bottle.

1. what do you think will happen?
2. what has happened?
3. why did this happen?

From old to new!

Consumer

Shop responsibly and dispose of PET bottles correctly after use: as a consumer, you can keep the cycle of recyclable materials going.

Collection

Once disposed of correctly PET bottles are pre-sorted and taken to the recycling plant.

Fine sorting and shredding

The PET bottles are sorted by color. Everything is then chopped into flakes.

Cleaning

The flakes are then cleaned using various processes.

EMPTY CIRCLE

Extrusion

The flakes are processed into rPET, which can then be used to produce new food-grade packaging.

EMPTY CIRCLE

Injection molding

PET preform are produced from rPET. Either pure rPET or a mixture with fresh material is used for this purpose.

EMPTY CIRCLE

Stretch blow molding

In the next process step, new PET bottles are formed from the preform.

Filling

The "new" bottle is filled - with milk, water or juice, for example - and returned to the retailer.

The use of recycled material can save up to 90 % CO₂.

WHAT HAPPENS TO THE DISCARDED PET BOTTLES?

Plastics, such as PET bottles, are too valuable to waste. After they have been used, plastic packaging can be recycled. However, the waste must be sorted and disposed of correctly. In Austria, plastics must be disposed of in the yellow bags or garbage cans or handed in sorted (only plastics of the same type may be disposed of together - e.g. only PET) at the waste collection centers.

PET is a plastic that can be fully recycled. This means that new PET bottles can be made from used PET bottles. These bottles are labeled rePET or rPET, which is short for "recycled PET".

The illustration above shows how new bottles are made from used PET bottles. By recycling PET, the material is not only used once, but a complete recycling cycle is created. This conserves resources and reduces greenhouse gas emissions.

TASK

You will see three empty circles in the cycle. These are placeholders for the preform, the flakes and the granules from the plastic teaching aid box. Place these three materials in the correct places in the circuit.

Recycling is when waste is processed and new products are created from it. This is important as many raw materials are only available in limited quantities on our planet. Raw materials are therefore not wasted and this protects our nature and the environment.

Here you can watch the video "Recycling in one minute": <https://t1p.de/rPET>

From bottles to granulates

A used plastic bottle made of PET goes through these seven steps in a recycling plant:

1) STORAGE

Thousands of bales weighing around 400 kilograms with up to 20,000 transparent blue or green PET bottles are stored in the yard of the recycling plant.

2) AUTOMATIC SORTING

These are sorted automatically in several complex process steps: Metal is pulled out; light materials are separated from heavy ones and PET from other plastics.

3) SORTING

The PET bottles that do not contain beverages, but for example liquid soap or fabric softener, are then sorted out by hand.

4) FLAKES

The bottles are crushed into flakes in wet mills and hot-washed twice. Hot washing is necessary to clean the flakes and remove adhesive residue from labels. Bottle cap flakes are separated from the PET flakes using a float-sink process and label residues are separated from the PET flakes using wind.

5) FINAL SORTING

During final sorting, optical sorting processes are used to remove flakes of a different color and final impurities (e.g. metals).

6) EXTRUSION

In der Extrusion werden die Flakes getrocknet, zusammengesmolzen und zu kleinen Stücken geschnitten. Das so entstandene Granulat ist speziell behandelt und food-safe*.

7) CONTROL

Complex analysis procedures are used in the laboratory to check whether the granulate meets the specifications for food safety.

*food-safe: Materials that come into contact with food are subject to strict requirements. For example, they must be non-toxic and must not change the taste or smell of the food. If materials meet these criteria, they are food-safe.

TASK

Describe the path from the PET bottle to the granulate in your own words.

Discussion round

WHICH DRINKS BOTTLES SHOULD YOU BUY AND WHICH NOT?

PET bottles, rPET bottles, glass bottles, disposable or reusable bottles


1) Write down your opinion and illustrate it with arguments. Also give examples to support your arguments. You can find out important facts and figures on the internet.

STRUCTURE OF AN ARGUMENT		
Statement (your opinion)	Explanation (argument)	Example
Bottles made of rPET are the future.	Raw materials are not only used once in the production of bottles, but several times	A complete recycling cycle is created, as you can see in the video "Recycling in one minute"

2) Get together in groups of about 6 people and discuss the advantages and disadvantages of each type of bottle. Use your arguments!

IMPORTANT RULES FOR THE DISCUSSION		
Only one person is talking!	Listen and let others finish!	Stay calm and objective!

Plastic teaching material box - PET-Preforms

Manufacturer	ALPLA
Product	PET Preforms
Material	PET (polyethylene terephthalate)
Production	Injection molding (stretch blow molding)
Recycling symbol	

ALPLA

ALPLA produces innovative packaging systems, bottles, lids and injection-molded parts. Sustainability and the climate-friendly use of resources form the basis of the company's actions. With more than 25 years of experience in recycling and its own recycling plants, ALPLA helps to ensure that plastics remain in the recycling loop.

Apprenticeships at ALPLA:

Plastics technician, Electrical engineering - plant and operating technician, Machining technician, Information technology - operating technician, Plant logistics clerk, Mechanical engineering design engineer, Toolmaking design engineer

Apprentices worldwide: 243 / thereof in Austria: 76 / thereof in Vorarlberg: 66