Plastic bottles **protect against gasses and UV radiation**

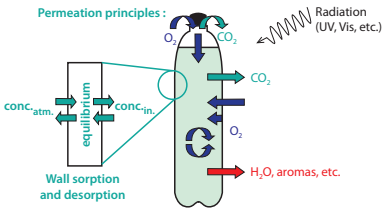
Improve **protection without compromising recyclability**

In recent years, PET (polyethylene terephthalate) has been the packaging material of choice for water and soft drinks. Plastic bottles are increasingly being used for beer, juices, sports drinks, and aromatized alcoholic drinks. But each product requires specific qualities in its bottles. It is sometimes difficult to find an appropriate solution especially since the bottling sector aims for maximum recyclability.

prevent pack

Preserving aroma, colour, volume, and CO_2 content

All plastics are to varying degrees permeable for gasses and most allow a certain spectrum of light (UV radiation) to pass through. These are two major factors that limit the shelf life of drinks in plastic bottles. The CO_2 content of carbonated soft drinks goes down slowly. Oxygen penetrating can lead to oxidation and thus to vitamin loss, colour changes, and flavour and aroma degradation. Visible light as well as UV light can also cause changes in colour, taste, and aroma. In addition, PET bottles slowly allow vapour to pass through, albeit very slowly. This means that the net volume can eventually drop below the indicated amount.



The impact of all these influences is different for each product. For example, the taste of milk is particularly susceptible to UV and visible light. Carbonated soft drinks and beer suffer from CO2 loss. Beer and juices tend to oxidize with the O2 in the air. These different sensitivities lead to a variety of bottle designs adapted to the product at hand, including opaque bottles for milk and transparent brown bottles for beer.

Adapting the bottle design

In order to reduce the effect of gasses, the bottle manufacturer can modify the design of both the bottle and the cap. In most cases, the cap has already been optimized for minimizing CO_2 and O_2 penetration.

For best results, the amount of contact surface between product and bottle must be as small as possible. In this respect, imaginative designs often work out badly. So do small bottles, because they have a larger surface to volume ratio. Yet, small bottles are gaining market share: in 1990, the average volume of a plastic bottle was 1,5 litres. In 2005, it was down to only 0,8 litres. It was obviously necessary to further improve the packaging itself.

In order to use as little material as possible in the fabrication of the bottle, the thickness of the sidewall of the bottle is made as thin as possible. As a result, the average weight of a 1,5 litre plastic bottle dropped from 42 grams down to 30 grams in the past fifteen years. However, thinner bottle sides inevitably offer less protection. This was another reason for new design and material measures.

good to **remember**

There are many new techniques **to improve the barrier against gasses and UV**, but these techniques tend to prevent easy recycling at end of life.

Plastic bottles are increasingly being used for beer, juices, sport drinks, and aromatized alcoholic beverages. Each type of use **requires a well-adapted bottle design** and material to guarantee the product's shelf life.

Manufacturers are increasingly **making plastic bottles out of multiple layers** or a single layer of a polymer compound.

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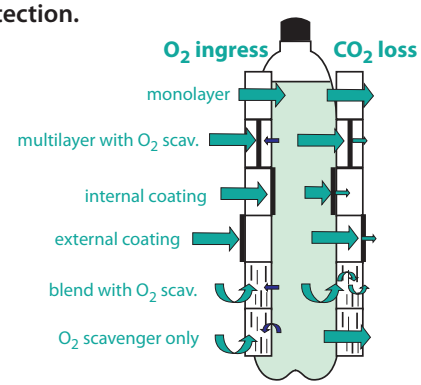
New techniques to improve barriers

Research is ongoing to find additional barriers against CO_2 and O_2. Passive as well as active barriers are being used to improve product protection.



- Passive barriers reduce permeability in the sides of the bottle. The side is often made of three to five layers, usually a combination of PET/EVOH or PET/MXD-6. Furthermore, an increasing number of bottles are made out of one layer of a polymer compound. In some cases, a plasma coating is being added to the inside of the bottle. Research is also being carried out to find the optimal external coatings and the effect of adding nano-compounds (inorganic particles as small as one thousand millionth of a metre).

- Active barriers are particles that are added to the bottle material and react with the permeating O_2 molecules. This process is called 'oxygen scavenging'. It slows down the effects of O_2 and increases shelf life by several months.

Design for recycling

Not all barrier technologies are recycling compliant, which is a primary point of interest nowadays. The sector is increasingly following a 'design for recycling' strategy. They urge designers to keep in mind recyclability at end of life. The following aspects require attention:

- The design must encourage the use of recyclable and mutually compatible plastics.
- The design must be such that the packaging can be dismantled easily after use.
- The design maximizes the amount of recycled content and stimulates investing in the special machinery required for processing recycled materials.
- Material use is carefully documented.

In a recent study, four authoritative PET recycling support organizations (ABC, EPRO, EUPR, and PETCORE) analysed existing plastic bottle manufacturing techniques and made an assessment regarding 'design for recycling'. The next Preventpack edition will present a new tool that will enable you to assess the recyclability of your packaging. You will be informed about all aspects to consider for enabling an efficient recycling process. Questions regarding recyclability of packaging can be addressed to **prevention@fostplus.be** or **plarebel@essencia.be**.

For **additional information :**

- European Organization of Plastics Recycling and Recovery Organisations (EPRO): **www.epro-plasticsrecycling.org**.
- European Plastic Recyclers (EUPR): **www.plasticsrecyclers.eu**.
- PET Container Recycling Europe (PETCORE): **www.petcore.org.**
- Plarebel: **http://www.plarebel.be.**