
Plastics come full circle

What type of plastic keeps water in and returns in a second life to keep water out? The answer is poly (ethylene terephthalate), one of a family of polymers called polyesters, and more commonly known by its abbreviation “PET”.



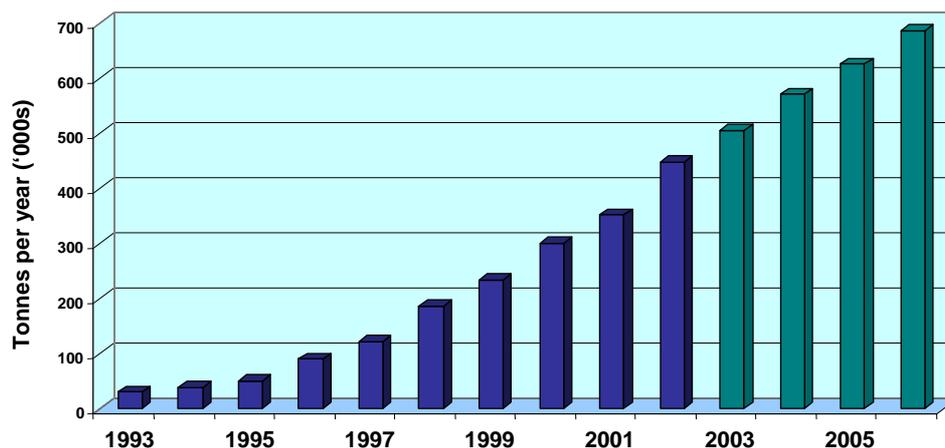
The water on the inside is mineral water, supplied in lightweight bottles that are safe and easy to carry home. And the water on the outside? Simple, it is rainwater, and the same plastic, recycled from used bottles, is now being used to make umbrellas – and a lot of other things besides.



The recycling of PET is one of the big plastics recycling success stories, one that is made possible thanks to the cooperation of everybody. As long as suitable collection facilities are made available, experience shows that the public are more than willing to keep the bottles separate from other domestic waste and either put them out in special collection bags, or place them in local “bottle banks”.

The rate of growth of collection and recycling of these bottles has been staggering. As the chart indicates, projections for 2003 and beyond indicate that this growth rate will be maintained.

PET Bottle Collection in Europe



PET was initially developed in 1941 as a polymer to be spun into synthetic fibres. In the mid 1960s it was used to make film, and finally, in the early 1970s, when blow-moulding techniques were sufficiently advanced, its special advantages were put to a new use. High strength enables it to be used for the packaging of carbonated beverages where the pressure inside the bottle can reach as much as 6 atmospheres. These exceptional properties, combined with light weight, make it possible for people

to carry drinks home from the shop safely. In fact the weight of the average PET bottle has gone down; since 1978, manufacturers have reduced the weight of a 1.5 litre bottle by 30%, from 50 g down to 35 g.

Although bottles have now become the most important application for this polymer, it has come full circle from an application point of view, because the biggest use for the recycled material is – synthetic fibres. The fibre producing industry relies heavily on recycled PET as a source of raw material for the manufacture of textiles, carpets and non-woven fabrics. The “bottle to bottle” recycling process is growing and today about 7% of bottles are recycled back to make new ones, but the fibre market at over 60% is still the major outlet for the recycled product.

Another growing application for recycled plastics is in the manufacture of products typically made from wood where extreme conditions are experienced. Examples include all-weather furniture, fencing and a range of marine applications such as dock



fenders. In this case the polymer most often used is high-density polyethylene (HDPE), typically used to make containers for products such as milk, shampoo and detergents. Municipal collection schemes are increasing the quantity of the empty containers available for recycling with the result that the plastic lumber business is growing rapidly. Plastic furniture, which does not have to be treated with preservatives, can be left outside in all weathers and will not rot, crack, warp or splinter.

Mechanical recycling is only one of the ways that used plastics can be recovered and so come “full circle”. The versatility of plastics in processing and use extends to the methods that are available to recover their value at end of life. For example, the starting point for the raw materials used to make plastics is petroleum (crude oil and natural gas). But only 4% of petroleum production is needed for plastics production: more than 80% is simply burned to meet our energy and transport needs. Plastics have a high calorific value, similar to that of petroleum, so one way of ensuring that the value of the used products is not lost is to recover the energy they contain. This can be done in combustion plants equipped with systems that recover the energy as heat or steam. Modern combustors achieve very low emission levels thanks to their use of extensive flue-gas cleaning systems.

Yet another method is feedstock recycling, a process in which the polymer chains are broken down into smaller units through heat or chemical reaction. The products are mostly oils or gases that are used as building blocks for new plastics or other chemical products.



In one innovating recovery method, end-of-life plastics are used in blast furnaces as a reducing agent that converts metal ores into the basic metal. This application is also able to use the energy contained in the plastics to replace some of the fossil fuels like coal and oil that are needed in this high-energy process.

And in yet another method there are gasification processes in which the plastics are first turned into synthesis gas, a mixture of carbon monoxide and hydrogen, after which several other steps result in the production of basic chemicals such as methanol.