

## **Recycling of Different Plastics**

### PET (polyethylene terephthalate)

In 1989, a billion pounds of virgin PET were used to make beverage bottles of which about 20% was recycled. Of the amount recycled, 50% was used for fiberfill and strapping. The reprocessors claim to make a high quality, 99% pure, granulated PET. It sells at 35 to 60% of virgin PET costs.

The major reuses of PET include sheet, fiber, film, and extrusions. When chemically treated, the recycled product can be converted into raw materials for the production of unsaturated [polyester](#) resins. If sufficient energy is used, the recycled product can be depolymerized to ethylene glycol and terephthalic acid and then repolymerized to virgin PET.

### HDPE (high density polyethylene)

Of the plastics that have a potential for recycling, the rigid HDPE container is the one most likely to be found in a landfill. Less than 5% of HDPE containers are treated or processed in a manner that makes recycling easy. Virgin HDPE is used in opaque household and industrial containers used to package motor oil, detergent, milk, bleach, and agricultural chemicals.

There is a great potential for the use of recycled HDPE in base cups, drainage pipes, flower pots, plastic lumber, trash cans, automotive mud flaps, kitchen drain boards, beverage bottle crates, and pallets. Most recycled HDPE is a colored opaque material, that is available in a multitude of tints.

### LDPE (low density polyethylene)

LDPE is recycled by giant resin suppliers and merchant processors either by burning it as a fuel for energy or reusing it in trash bags. Recycling trash bags is a big business. Their color is not critical, therefore, regrinds go into black, brown, and to some lesser extent, green and yellow bags.

### PVC (polyvinyl chloride)

There is much controversy concerning the recycling and reuse of PVC due to health and safety issues. When PVC is burned, the effects on the incinerator and quality of the air are often questioned. The Federal Food and Drug Administration (FDA) has ordered its staff to prepare environmental impact statements covering PVC's role in landfills and incineration. The burning of PVC releases toxic dioxins, furans, and hydrogen chloride. These fumes are carcinogenic, mutagenic, and teratogenic. This is one of the reasons why PVC must be identified and removed from any plastic waste to be recycled.

Currently, PVC is used in food and alcoholic beverage containers with FDA approval. The future of PVC rests in the hands of the plastics industry to resolve the issue of the toxic effects of the incineration of PVC. It is of interest to note that PVC accounts for less than 1% of land fill waste. When PVC is properly recycled, the problems of toxic emissions are minimized. Various recyclers have been able to reclaim PVC without the health problems. Uses for recycled PVC include aquarium tubing, drainage pipe, pipe fittings, floor tile, and nonfood bottles. When PVC is combined with other plastic waste it has been used to produce plastic lumber.

### PS ([polystyrene](#))

PS and its manufacturers have been the target of environmentalists for several years. The manufacturers and recyclers are working hard to make recycling of PS as common as that of paper and metals. One company, Rubbermaid, is testing reclaimed PS in service trays and other utility items. Amoco, another large corporation, currently has a method that converts PS waste, including residual food, to an oil that can be re-refined.

### The Future





Recycling is a viable alternative to all other means of dealing with consumer plastic waste. In response to the problem of mixed plastic waste, a coding system has been developed and adopted by the plastic industry. The code is a number and letter system. It applies to bottles exceeding 16 ounces and other containers exceeding 8 ounces. The number appears in the 3 bent arrow recycling symbol with the abbreviation of the plastic below the symbol.



Western European companies, especially the German firms Hoechst and Bayer, have entered the recyclable plastic market with success. With a high tech approach, they are devising new methods to separate and handle mixed plastics waste.

A potential use for recycled materials includes plastic lumber. The recycled plastic is mixed with wood fibers and processed into a replacement for lumber. The wood fibers would have become land fill if not reused. The end product is called Biopaste. This is expected to eventually become a multi-million dollar enterprise. Research and development continue to improve this product.

Recycling is a cost effective means of dealing with consumer plastic waste. Research to reduce the cost of recycling needs to continue. Recycling of plastics is not going to reach the level of the recycling programs of paper and some metals until lower cost, automatic methods of recycling are in place. Fortunately, the solutions to these problems are not beyond the scope of our technology or our minds. Below is a chart listing the different types of plastics and their uses before and after they are recycled.

**Table 3: Major Plastic Resins and Their Uses**

<b>Resin Code</b>	<b>Resin Name</b>	<b>Common Uses</b>	<b>Examples of Recycled Products</b>
	<b>Polyethylene Terephthalate (PET or PETE)</b>	<b>Soft drink bottles, peanut butter jars, salad dressing bottles, mouth wash jars</b>	<b>Liquid soap bottles, strapping, fiberfill for winter coats, surfboards, paint brushes, fuzz on tennis balls, soft drink bottles, film</b>
	<b>High density Polyethylene (HDPE)</b>	<b>Milk, water, and juice containers, grocery bags, toys, liquid detergent bottles</b>	<b>Soft drink based cups, flower pots, drain pipes, signs, stadium seats, trash cans, re-cycling bins, traffic barrier cones, golf bag liners, toys</b>
	<b>Polyvinyl Chloride or Vinyl (PVC-V)</b>	<b>Clear food packaging, shampoo bottles</b>	<b>Floor mats, pipes, hoses, mud flaps</b>
	<b>Low density Polyethylene (LDPE)</b>	<b>Bread bags, frozen food bags, grocery bags</b>	<b>Garbage can liners, grocery bags, multi purpose bags</b>

	<p><b>Polypropylene (PP)</b></p>	<p><b>Ketchup bottles, yogurt containers, margarine, tubs, medicine bottles</b></p>	<p><b>Manhole steps, paint buckets, videocassette storage cases, ice scrapers, fast food trays, lawn mower wheels, automobile battery parts.</b></p>
	<p><b>Polystyrene (PS)</b></p>	<p><b>Video cassette cases, compact disk jackets, coffee cups, cutlery, cafeteria trays, grocery store meat trays, fast-food sandwich container</b></p>	<p><b>License plate holders, golf course and septic tank drainage systems, desk top accessories, hanging files, food service trays, flower pots, trash cans</b></p>