

PLASTICS RECYCLING

The global annual production of polymer (plastic) products is about 100 million tons. About 8% of total oil production is consumed for the plastic industry (both as raw material and energy source).

Most plastic products has a short life cycle (less than one year), therefore plastic waste constitutes a relatively large part in the total waste weight - about 10% (26% by volume). The annual plastic waste in the USA is about 15 million tons, in the UK - about 3 million tons.

There are two main problems of the plastic waste:

- ☐ Raw material for plastic production (crude oil) is non-renewable;
- ☐ Most plastics are not bio-degradable. Land filled plastic waste will not degrade for hundreds of years.

The motivations of plastics recycling:

- Raw materials of the recycled plastics are less expensive than virgin raw materials;
- Labor cost of recycling is lower than that of primary production;
- Plastics store energy, which may be recovered;
- High landfills expenses;
- Legislation and government regulations of the waste recycling policy.

- ☐ **Types of plastic resins waste**
- ☐ **Collection of plastic waste**
- ☐ **Mechanical recycling**
- ☐ **Chemical recycling**
- ☐ **Energy recovery**

Types of plastic resins waste

All recycled plastics are divided into 7 groups according to the type of plastic resin:



Polyethylene Terephthalate (PET or PETE)

Use: Soft drink bottles, oven-ready meal trays, salad dressing bottles.



High Density Polyethylene (HDPE)

Use: Milk and juice bottles, washing-up bottles, toys, grocery bags.



Polyvinyl Chloride (PVC)

Use: Clear food packaging, shampoo and mineral water bottles, food trays.



Low Density Polyethylene (LDPE)

Use: Grocery bags, bin liners, bread bags, frozen food bags.



Polypropylene (PP)

Use: Microwave meal trays, ketchup bottles, margarine tubes, yogurt containers, medicine bottles.



Polysterene (PS)

Use: Compact disk jackets, foam meat or fish trays, coffee cups, plastic cutlery, sandwich and hamburger boxes, cafeteria trays.



Other

Collection of plastic waste

The sources of plastics for recycling:

- Industrial waste;
- Agricultural waste (containers, pipes, sheets);
- Waste of hotels, restaurants, shops;
- Municipal waste (plastic litter collected from streets, parks, beaches);
- Household waste - the type of municipal waste collected from householders.

Prior to processing the plastic waste is washed and sorted according to the coding system.

Mechanical recycling

Mechanical recycling of plastic waste is the simplest and relatively cheap recycling method.

The steps of mechanical recycling are as follows:

- Cutting**

Large plastic parts are cut by saw or shears for further processing.

- Shredding**

Plastics are chopped into small flakes.

- Contaminants separation**

Contaminants (e.g. paper) are separated from plastic in cyclon separators.

☐ **Floating**

Different types of plastics are separated in a floating tank according to their density. The flakes are also washed and dried.

☐ **Extrusion**

The flakes are fed into an extruder where they are heated to melting state and forced through the die converting into a continuous polymer product (strand).

☐ **Pelletizing**

The strands are cooled by water and cut into pellets, which may be used for new polymer products manufacturing.

Chemical recycling

Chemical or feedstock recycling is a processes, in which a plastic polymer is broken down into its constituents - monomers. This process is called **depolymerization**. The monomers may be then used as raw material for manufacturing a new polymer. Chemical recycling (feedstock recycling) is more expensive than mechanical recycling.

There is a range of chemical recycling methods:

☐ **Pyrolysis** - chemical decomposition of polymers induced by heat in the absence of oxygen.

Polyethylene Terephthalate (PET) may be converted into dimethyl terephthalate and ethylene glycol, which are used as additives to the virgin raw materials in PET production.

☐ **Hydrogenation** - chemical reaction with Hydrogen (H₂).

☐ **Gasification** - conversion of polymers into a mixture of carbon monoxide (CO) and hydrogen.

Energy recovery

Plastics store energy, which may be recovered by various ways:

☐ Municipal incineration in energy-from-waste incinerators (Combustion). The heat of plastic waste burnt at high temperature is used for production electricity or steam.

☐ Production of alternative fuels from plastic waste (Pyrolysis and Gasification). The fuel is used in various manufacturing processes and in power stations.

Source : http://www.substech.com/dokuwiki/doku.php?id=plastics_recycling