

# fantastic plastics



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**ExxonMobil**

**Published by:**

**Malaysian Plastics Manufacturers Association (MPMA)**

37 Jalan 20/14, Paramount Garden

46300 Petaling Jaya, Selangor Darul Ehsan

Tel: 603 7876 3027 Fax: 603 7876 8352

Email: [info@mpma.org.my](mailto:info@mpma.org.my) Url: [www.mpma.org.my](http://www.mpma.org.my)

**Sponsored by:**

**ExxonMobil Chemical Malaysia Sdn Bhd**

Menara ExxonMobil

Kuala Lumpur City Centre

50088 Kuala Lumpur

Tel: 603 4815 2000 Fax: 603 2173 9301

Url: [www.exxonmobil.com](http://www.exxonmobil.com)

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**Acknowledgement:**

This handbook was prepared by MPMA and it wishes to acknowledge the following authorities and organisations for some of the information in this Handbook:

- Ministry of Housing and Local Government, Malaysia
- PlasticsEurope
- [allplasticbottles.org](http://allplasticbottles.org)

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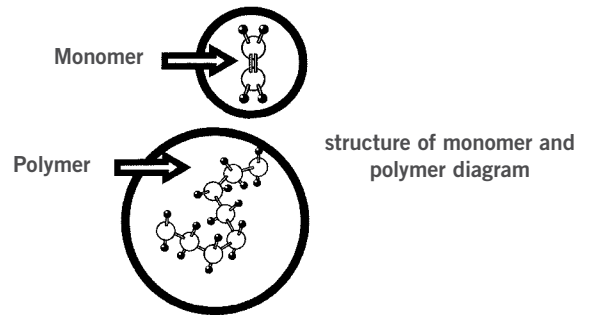






## About plastics

Plastics are organic compounds produced by polymerisation. They are capable of being moulded, extruded and cast into various shapes and films, or drawn into filaments and then used as textile fibres.



## Raw materials

Oil and natural gas are the major raw materials used to manufacture plastics. Plastics production process often begins by treating crude oil or natural gas in order to convert basic components into monomers such as ethylene and propylene. Such monomers are then chemically bonded into long chains called polymers. The different combinations of monomers yield plastics with a wide range of properties and characteristics.

## Plastics production

Petroleum and/or natural gas are transported to a refinery.



Crude oil and natural gas are refined into ethane, propane, hundreds of other petrochemical products and, of course, fuel for your car.



Ethane and propane molecules are “cracked” into ethylene and propylene monomers at high-temperatures.



Monomers of ethylene and propylene are combined using a catalyst in a reactor, resulting in a powdered material (polymer) resembling laundry detergent.



The powder is combined with additives in a continuous blender.



Polymer is fed to an extruder where it is melted.



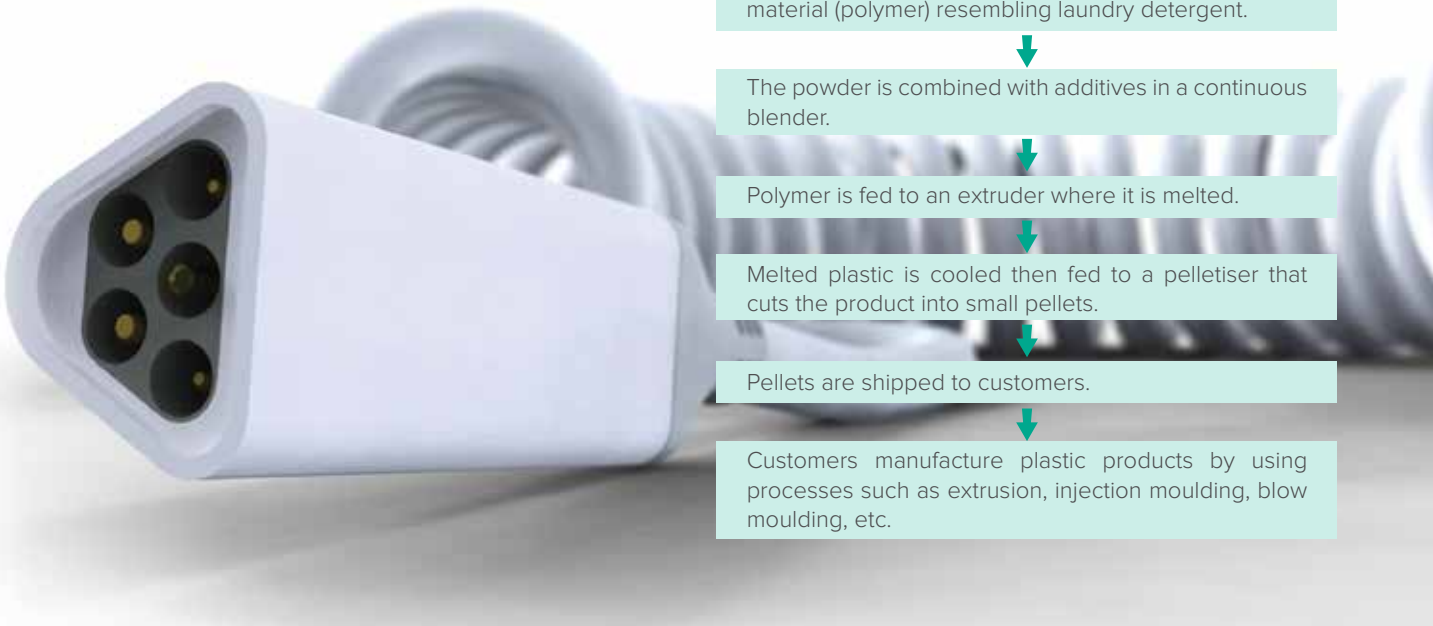
Melted plastic is cooled then fed to a pelletiser that cuts the product into small pellets.



Pellets are shipped to customers.



Customers manufacture plastic products by using processes such as extrusion, injection moulding, blow moulding, etc.





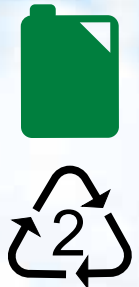


## Plastics coding

The Coding System for Plastic Products is a method of labelling all plastic products with a code to identify the primary resin. The Malaysian Standard on Coding System for Plastic Products (MS1405:2008) consisting of seven different codes, makes it easier for recyclers to identify and separate plastics for recycling.

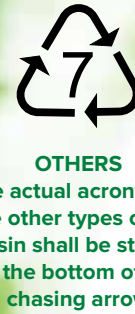


**Polyethylene  
Terephthalate  
(PET)**



**PE-HD  
Polyethylene,  
High density  
(PE-HD)**





## Characteristics of plastics

Plastics are divided into two distinct groups: thermoplastics and thermosets. The majority of plastics are thermoplastic, meaning that once the plastic is formed, it can be heated and reformed repeatedly. Polypropylene and Polyethylene are thermoplastics. This property allows for easy processing and facilitates recycling.

Thermosets, on the other hand, cannot be remelted. Once these plastics are formed, reheating will cause the material to decompose rather than melt. Rubber tyres are thermosets.

The versatility of plastics has made them ubiquitous.

### **Plastics can be very resistant to chemicals**

Consider the cleaning fluids in your home that are packaged in plastics. While some solvents can easily dissolve packaging materials, most plastics provide safe, non-breakable solutions for containing aggressive cleaning materials.



## Plastics can be both thermal and electrical insulators

A walk through your house will reinforce this concept. Consider all the electrical appliances, cords, outlets and wiring that are made of or covered with plastics. Thermal resistance is evident in the kitchen with plastic pot and pan handles, coffee pot handles, the foam core of refrigerators and freezers, insulated cups, coolers and microwave cookware. The thermal underwear that many skiers wear is made of polypropylene and the fibrefill in many winter jackets is acrylic or polyester.



### **Plastics can be processed in various ways to produce thin fibres or very intricate parts**

Plastics can be moulded into bottles or components of cars, such as dashboards and bumpers. Some plastics and elastomers stretch and are very flexible. Other plastics, such as polyethylene, polystyrene and polyurethane, can be foamed. Plastics can be moulded into drums or mixed to become adhesives or paints.



### **Plastics are light weight with varying degrees of strength**

Consider the range of applications, from toys to the frame structure of modern airplanes, or from delicate nylon fibre in pantyhose to Kevlar®, which is used in bulletproof vests. Some polymers float in water while others sink. All plastics are light weight when compared to stone, concrete, steel, copper or aluminium.





**Polymers  
are usually  
made from  
petroleum, but  
not always**

Many polymers are made from natural gas, coal or crude oil. But they can sometimes be made from renewable materials such as polylactic acid from corn. Some plastics have always been made from renewable materials such as cellulose acetate used for screwdriver handles and gift ribbon.

**Polymers are materials with a seemingly  
limitless range of characteristics and  
colours**

Polymers have many inherent properties that can be further enhanced using a wide range of additives. Polymers can be made to mimic cotton, silk, and wool fibres; porcelain and marble; and aluminium and zinc. Polymers can also enable products not typically found in nature such as clear sheets, foamed insulation board, and flexible films. They may be moulded or formed to produce many products with application in many major markets.





**WE  
RECYCLE**



# Recycling plastics

Because of their durability, most plastics do not degrade. For this reason, recycling is important.

New uses for existing plastic bags and containers can give plastics a new life. Alternatively, these plastics can be sent to a recycling plant to be remade into 'new' products.

What does it take to turn plastics into something new?

Here is a quick rundown of what happens to plastic products in a recycling plant. This recycling process is applicable for various plastic items like plastic bottles, plastic containers, plastic pipes etc.



THINK RECYCLE

## The 5-step process for plastic recycling



### 1. Collection

Facilities gather available recyclable plastic material in their area, from roadside collections, special recycling bins, or directly from industries. This way, both post-consumer and post-industrial plastic items are collected.



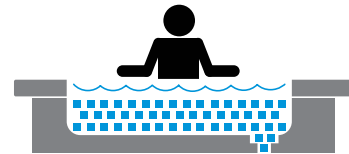
### 3. Chipping

Plastic items are fed into a machine that slices material into tiny bits.



### 2. Manual sorting

Collected items are sorted according to the various types indicated by their plastics recycling symbols and codes. Unwanted, non-plastic materials are promptly taken out.

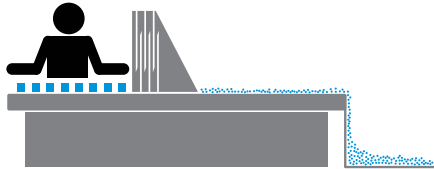


### 4. Washing

At this step in the process, all residue and 'contaminants' are removed.

During washing, a wash tank agitator strips the adhesive of any labels and shreds any paper mixed in with the plastics.





## 5. Pelletising

The cleaned and chipped pieces are melted and put through a machine called an 'extruder'. The extruder shapes the melted plastics into thin noodle-like strands which are then cut into small pellets by a set of rotating knives. The pellets are then ready to be remade into new items.



### **What happens to plastic bags?**







Plastic bags go through the same five-step process as other plastic products. They too are sorted into various types, washed and rinsed. However, in the case of plastic bags, they are shredded rather than chipped. The shredded plastic bags are then melted during the pelletising stage.

### **What's next?**

Plastic pellets derived from the recycling plastics process are usually sold to businesses which mould them into products for various uses. Some products use a combination of recycled and virgin pellets.



# Types of plastics, primary applications and their corresponding recycled products

Primary applications					
HDPE High Density Polyethylene	LDPE Low Density Polyethylene	PET Polyethylene Terephthalate	PP Polypropylene	PS Polystyrene	PVC Polyvinyl Chloride
 <p>Bottles, especially for food products, detergent and cosmetics, containers, toys, houseware, fuel tanks, industrial wrapping and film, sheets, gas and waste pipes.</p>	 <p>Cling film, shrink film, agriculture film, bags, bin liners, toys, coatings, flexible containers, irrigation pipes and general film.</p>	 <p>Bottles, food packaging, carpets, cords for vehicle tyres.</p>	 <p>Packaging such as yoghurt and margarine pots, sweet and snack wrappers, vehicle battery cases, cereal packet linings, microwave-proof containers, medical packaging, milk and beer crates. Automotive parts, carpets and fibres as well as electrical components.</p>	 <p>Packaging, dairy product containers, electrical appliances, thermal insulation, tape cassettes, cups and plates.</p>	 <p>Window frames, ridged pipes, flooring, wallpaper, bottles, packaging film, guttering, cable insulation, credit cards, medical products including plasma bags.</p>
Typical use after recycling					
<p>Industrial bags, detergent bottles, pipes, containers and wood substitutes, for example, animal flooring and fencing. A method has been developed to incorporate recycled HDPE with virgin polymers.</p>	<p>Waste disposal bags, industrial bags, flexible bottles, pipes, containers, waterproof membranes, agricultural film and wood substitutes, for example, animal flooring and fencing.</p>	<p>Textiles for bags, webbing and sails, jackets, pillows, cushions, sleeping bags, rope, string, carpets.</p>	<p>Milk and beer crates, timber substitutes, automotive components, tool boxes, auto batteries, chairs and textiles.</p>	<p>Thermal insulation, trays, office accessories, rubbish bins.</p>	<p>Pipe fittings, conduits, floor tiles, fencing, rails, containers, footwear, garden furniture.</p>



The Malaysian Plastics Manufacturers Association (MPMA), established in 1967, is a progressive trade association providing leadership and quality service to its members and the plastics industry. MPMA is the official voice of the Malaysian plastics industry, representing its members and the industry in Government interaction, spearheading the plastics industry's growth and providing the platform to assist members to be globally competitive, taking into cognisance its social responsibility towards the environment and community.

MPMA currently has about 800-odd members comprising Ordinary members, which represent about 60 percent of plastics manufacturers in the country and account for 80 percent of the country's total production of plastic products.



ExxonMobil is one of the largest US investors in Malaysia and an active participant in the business sector and the local communities in which it operates.

ExxonMobil is committed to maintaining the highest standards of safety, health and environmental care as it believes that a company's commitment and performance in these areas is indicative of outstanding performance in other aspects of its operations.

ExxonMobil works collaboratively with government and non-government bodies and community leaders to identify areas of need and how best to meet them through its community relations programmes. Whilst human capital development has been the main focus of its community relations initiative, ExxonMobil also supports projects in the areas of energy literacy, health and safety as well as corporate governance.

ExxonMobil's goal is to achieve excellent performance in safety, health and environment across each of its business units, to "Protect Tomorrow. Today." ExxonMobil seeks to further reach its objective to operate responsibly everywhere it does business by implementing scientifically sound and practical solutions that consider the social needs of the communities in which it operates. Accordingly, ExxonMobil seeks to communicate with the public on environmental matters and share its experience with others to facilitate improvements in industry performance.

On the aspects of safety and health, ExxonMobil's policy is to, amongst others, include identification and control of potentially adverse health and safety effects as priority considerations in the planning and development of products and identify and evaluate health risks related to its operations that can potentially affect its employees, contractors or the public.

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