

Plastic Waste - A Global Problem

By

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(Source: The mountain of garbage at the Randiwala Mountain.

Picture by Saman Wijayabandara. Daily News, Sri Lanka, 23 Feb 2018)

Introduction

This Article is composed of two parts. **First**, to provide a brief overview of the problems of global plastic pollution. **Second**, to describe the eleven (11) different types of commonly used plastics in the World. However, it is mentioned that plastic can be manufactured in thousands of different variations to suit the requirements of diverse customers. These entail the mixing of additives such as antioxidants, flame retardants, heat stabilisers, pigments and many others.

Brief Overview of Problems of Global Plastic Pollution

It has been scientifically estimated that from 1950 to 2017 a total of 8,300,000,000 metric tons (8.3 Billion metric tons) of plastics have been produced (see Geyer, et al 2017). The COVID-19 Pandemic has led to a further large increase in plastic waste (Silva, et al, 2021). A substantial percentage of the plastic produced has been used for single-use purposes such as drinking straws, yoghurt cups, shopping bags, cigarette filters, microbeads for cosmetics, drinking water bottles, shampoo bottles and thousands of other day-to-day consumer products. These products are used once or a few times and are then discarded into the environment where they exist for hundreds of years. Over time they break-up into smaller and smaller fragments – *macroplastics* to *microplastics* to *nanoplastics*.

For the packaging industry plastic is the material of choice. Plastic is used in the packaging of many thousands of consumer products ranging from torch batteries, shaving kits, toys, smartphones and ready-made clothes. Once the product is purchased the plastic packaging is removed and is discarded. In effect this plastic packaging is a single use plastic.

Further, there are numerous products, devices and tools are made by combining plastics with metals (such as copper, steel, and aluminium), glass, wood and rubber. Computers, refrigerators, air-conditioning units, TV sets, LCD and LED screens, durable plastic fitting used in cars and trucks, LCD and LED light bulbs, vehicle tyres and ballpoint pens are among many thousands of such products. Once these products reach the end of their lives they are discarded.

Recycling the plastic in these products has proven to be very difficult due to the plastic being combined with other materials.

From the 1950s onwards the vast majority of all discarded plastic has ended-up in landfills, or haphazardly scattered on land, or in the Oceans of the World. The balance plastic waste has been incinerated, or, haphazardly burnt in open fires mixed with other waste by consumers and cleaners. If incineration is not done at high temperatures it releases dangerous gases into the atmosphere. The open burning of plastic releases dioxins and other dangerous gases into the atmosphere.



Indonesia, Unsegregated waste in a landfill. (Image: Tom Fisk via Pexels)

The eleven (11) different types of commonly used plastics in the World

As mentioned earlier there are many thousands of different plastics. These are different types of plastic made to the specific requirements of manufacturers who use that plastic to make products. For example, plastic mixed with flame retardants are required by manufacturers who need plastics resistant to fire. Plastic mixed with heat stabilisers are needed by manufacturers to make products which have to operate in high temperature environments. Plastics are not merely a single substance that is produced in just one way all the time. As in the case of bread where there are many thousands of different types of bread, plastic too can be made in thousands of variations depending on what a customer requires (Source: 'Types of Plastic: How Many Kinds of Plastics are There?', Globenewswire.com, 15 Dec 2015).

This being said, however, there are a number of basic plastics which are widely manufactured throughout the world. Given below are the eleven (11) mostly widely used.

1. Polyethylene Terephthalate (PET or PETE)



PET's Recycling Code = 1

PET is a very widely used commercial plastic and is used in many products. The clothing fibre 'polyester' and water and soft drink bottles are among the most common PET products. In addition PET is used in electronic devices, manufacture of car and truck parts and the packaging industry.

Pet Bottles



(Google Images)

Discarded Pet Bottles



(Google Images)

Polyester Fabrics made from PET



(Google Images)

2. Polyethylene (PE)

Polyethylene (PE) is widely used in the packaging industry. It is used in making plastic milk flacons, water containers, some types of plastic bags, shampoo, cosmetic cream and detergent bottles. PE is also used to insulate cables and wires. There are a number of different varieties of PE. The three variants are (2.1) **Low density Polyethylene (LDPE)**; (2.2) **High Density Polyethylene (HDPE)** and (2.3) **Ultra High Molecular Weight (UHMW) Polyethylene**. UHMW is a very strong plastic which is used for mechanical components which need to be very durable and high strength.

2.1: LDPE (Low density Polyethylene)

LDPE is the plastic used for plastic grocery bags and many containers for liquids.



Low Density PE (LDPE)'s Recycling Code = 4

LDPE shopping bags (above)



(Google Images)

LDPE plastic bottles



(Google Images)

(2.2) HDPE (High Density Polyethylene)

HDPE is a stiff and tough plastic which is used for plastic bottles and containers for petroleum products, laundry detergent containers, paints and such products.



High Density PE (HDPE)'s Recycling Code = 2

Stiff and strong liquid and powder containers



(Google Images)

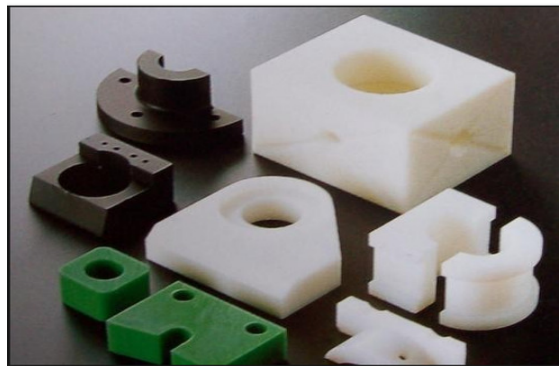
(2.3) Ultra High Molecular Weight (UHMW) Polyethylene

UHMW is very strong plastic which is used to manufacture mechanical components that need to be very durable and high strength.



UHMW's Recycling Code = 7, the overall category reserved for all other plastic.

Various engineering components made from UHMW



(Google Images)

3. Polyvinyl Chloride (PVC)



PVC's Recycling Code = 3

Polyvinyl Chloride (PVC) is widely used in housing and building construction for pipes and plumbing. Other applications are in electronics, automobiles, wire and cable insulation, and in health care products. PVC is very durable and will last in the environment for hundreds of years.

PVC Pipes



(Google Images)

5. Polypropylene (PP)



Polypropylene (PP) Recycling Code = 5

PP can be manufactured as fibre or used to make solid products like plastic chairs. As fibre it is used to manufacture tape, cloth, twine, carpets, upholstery and ropes. PP has waterproof qualities. Accordingly it is widely used in the fishing and other aquatic industries. PP is used to manufacture camping equipment for recreational and professional use. PP is a good electrical insulator and is used in the manufacture of electrical wire and cables. PP is used to make parts for trucks and other types of vehicles. Polypropylene (PP) is widely used for packaging consumer products, which as mentioned earlier are used only once and then discarded.

Products made from Polypropylene PP



(Google Images)

6. Polystyrene (PS)



Polystyrene's (PS) Recycling Code = 6

Polystyrene is very light in weight but high in volume. It is ideal as a cushioning material for transporting packages. It is widely utilized in packaging to keep products such as laptop computers and stereo electronic systems tightly fitted within their cardboard boxes. Polystyrene is also referred-to by trade names such a 'rigifoam' and 'styrofoam'. It was widely used as a single-use food container in the food industry but is now been banned in Sri Lanka.

Polystyrene food containers



(Google Images)

All the plastics below are in Recycling Code '7' which is the overall category reserved for all other plastic.

7. Polylactic Acid (PLA)

Unlike most other plastics which are made from petroleum Polyactic Acid (PLA) is manufactured from material like corn starch, sugarcane, cassava, maize, or sugar beet pulp. Its characteristics are similar to Polyethylene (PE), Polypropylene (PP) and Polystyrene (PS). PLA is used in a wide variety of products such disposable forks and spoons, compost bags, disposable garments, food packaging fishing line and fishing nets.

While PLA is advertised as biodegradable, it does so only under specific conditions of a moist environment and a temperature of 60 degrees Celsius. In the absence of such conditions PLA does not decompose.



PLA's Recycling Code is = 7, the overall category reserved for all other plastic.

Products made from Polylactic Acid (PLA)



(Google Images)

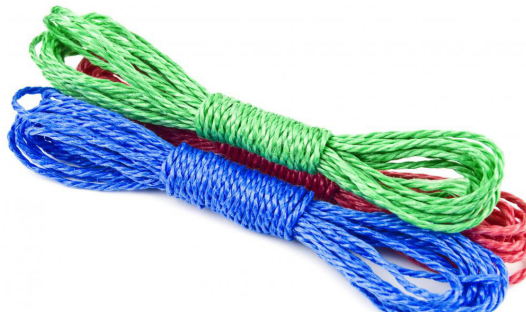
8. Nylon (PolyAmide)

Nylon is used for a variety of applications to include clothing, reinforcement in vehicle tires, rope, thread, cloth, and for a number of injections molded parts for vehicles and mechanical equipment. It is often used as a substitute for low strength metals in applications like car engines because of its high strength (relative to other plastics), high temperature resilience, and high chemical compatibility.



Nylon's Recycling Code is = 7, the overall category reserved for all other plastic.

Ropes made from Nylon fibre



(Google Images)

Cloth made from Nylon fibre



(Google Images)

9. Polycarbonate (PC)

Polycarbonate (PC) plastic is a transparent material. It has a high impact strength compared to other plastics. It is widely used in greenhouses and as roofing sheets where high strength and high transmission of light are needed.



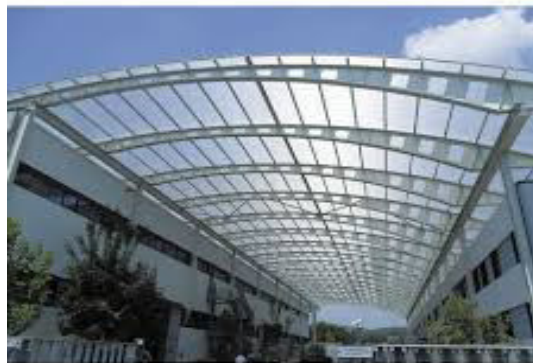
PC's Recycling Code is = 7, the overall category reserved for all other plastic.

Polycarbonate greenhouse



(Google Images)

Polycarbonate roofing



(Google Images)

4. ABS (Acrylonitrile Butadiene Styrene)

Acrylonitrile Butadiene Styrene (ABS) is a plastic used for a wide range of Products for both domestic and industrial purposes. ABS can be used to manufacture housings for electronic goods, automobile body parts, pipes and fittings, LEGO toys, helmet outer coverings, food mixers, TV cabinets, telephone sets and vacuum cleaners.



ABS's Recycling Code is = 7, the overall category reserved for all other plastic

Toys made from ABS plastic



(Google Images)

10. Acrylic



Acrylic's Recycling Code is = 7, the overall category reserved for all other plastic

Acrylic - Poly (methyl methacrylate) (PMMA) - is best known for its use optical instruments. It is also known by several trade names such as Perspex and Plexiglas. It is highly transparent and scratch resistant. It has many uses among which are paints, lighting fixtures, picture frames, sinks, bathtubs and furniture.

Sheets of Acrylic plastic



(Google Images)

11. Acetal (Polyoxymethylene, POM)

Acetal is a very high tensile strength plastic. It is known as a material that bridges the gap between the properties of a majority of plastics and metals. Acetal also has low friction which, associated with its other qualities makes its very useful for products that use gears.



ABS's Recycling Code is = 7, the overall category reserved for all other plastic

Gear wheels made from Acetal



(Google Images)

References

Geyer, Roland et al, (2017)

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Globenewswire.com, 15 Dec 2015,

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