

What Are Plastic Polymers?

We're all familiar with plastics and use them in many ways in our daily lives. But what are they and how are they made?

What are plastics?

Plastics are a wide range of synthetic or semi-synthetic materials primarily made from polymers.

What is a polymer?

Almost all types of plastic contain the word 'poly'.

This is because plastics are a type of polymer. A polymer is a material composed of many repeating units. The term 'polymer' is derived from two Greek words: 'poly', meaning 'many,' and 'meros', meaning 'parts'. A polymer is a large molecule made up of repeating identical smaller units called monomers. These monomers are linked together by chemical bonds to form long chains or structures.

How are polymers made?

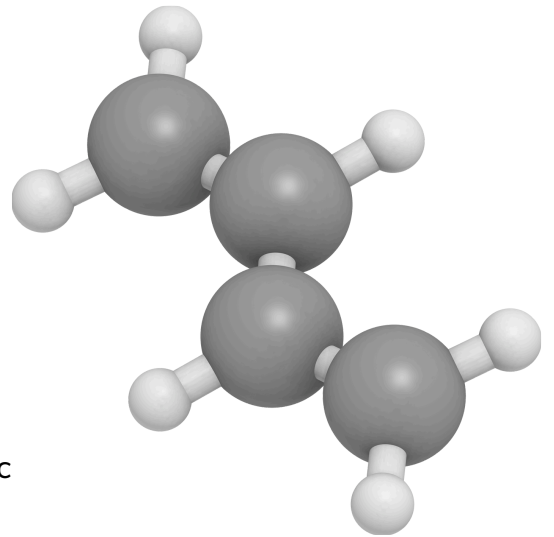
Polymerisation is the process where small molecules (monomers) join together to form a larger polymer. There are two main types of polymerization:

1. Addition polymerisation: Monomers with a double bond open up and join together to form long chains. An example of this is found in the production of polyethene (e.g. plastic bags).
2. Condensation polymerisation: Monomers join together by losing small molecules (like water) to form a polymer. An example of this occurs in the production of nylon fabrics.

Where are polymers found?

Polymers play a crucial role in both the natural world and in human-made products. You can find polymers in plants, animals, and even in the genetic material of your own body! Examples of natural polymers include spider silk (used to make webs), cellulose (which helps plant cells maintain their structure), hair, DNA, and starch.

Human-made polymers include materials like plastic (e.g. bottles, packaging, devices), synthetic rubber, polyester and nylon fabrics, and foams (such as Styrofoam). Without polymers, we wouldn't have any of the plastic products and materials we use in our daily lives.



What's so special about plastic polymers?

Since first being manufactured in the early 1900's, plastic polymer production has exploded. This is because plastics are incredibly versatile and can be moulded into numerous shapes, colours and textures (just think of the difference in texture between a plastic pipe, a plastic bag, a plastic bottle, a polyester jumper and a squishy toy).

Other benefits of plastic include the ability to be waterproof, flexible (stretchy or bendy), lightweight and insulating.

Different types of plastic polymers

There are multiple types of plastic polymers that are produced using different ingredients and processes. The seven most common types of plastic polymers are:

1. Polyethylene terephthalate (PET) - A thermoplastic that is lightweight, transparent, and recyclable. It's often used in food packaging, beverage bottles, and polyester fibres.
2. Low-density polyethylene (LDPE) - A soft, flexible, and transparent plastic that's easy to mould and process. It's used in plastic bags, plastic wrap, squeeze bottles, and paper cup and carton coatings.
3. Polystyrene (PS) - A synthetic aromatic hydrocarbon polymer that can be solid or foamed. General-purpose polystyrene is brittle, clear, and hard.
4. High-density polyethylene (HDPE) - A solid material that's strong for its density and can tolerate high temperatures and strong chemicals. It can be recycled in many ways and converted into many different things.
5. Polyvinyl chloride (PVC) - A polymer that can be rigid or flexible and is known for its ability to blend with other materials. It's the world's third-most produced synthetic plastic polymer.
6. Polypropylene (PP) - A low-density material that's often used for packaging and other applications where low weight and resistance to tearing are desired. It's also resistant to chemicals.



The problems with plastic polymers

Most plastics are bad for the environment because they don't biodegrade and can take up to 1,000 years to break down. Rather than breaking down, they break into smaller and smaller parts (microplastics) that enter the food chain by being ingested by animals. Other larger pieces of plastic can harm animals through entanglement and suffocation. Plastics left to break down in our environment may also leach chemicals into soil and waterways.

Plastics are made from oil and natural gas. The production and conversion of fossil fuels into new plastic products is responsible for 90% of plastic's greenhouse gas emissions.

Many plastics are designed to be used once and discarded. Ideally, plastic will make its way into a recycling bin rather than a landfill bin or the natural environment. But even in the recycling bin, things aren't straightforward: the main challenge with recycling plastics is that they need to be manually sorted, which is both time-consuming and energy-intensive. Many plastic products are made from mixed polymers, which can't be easily recycled and are often discarded. Additionally, once plastic is recycled, it may become 'downcycled' meaning its quality is reduced with each reuse.

