

Plastics

101

Names, Properties and Uses

Conventional Plastics

PA (Polyamides) - Nylons: fibers, toothbrush bristles, tubing, fishing line,

PC (Polycarbonate) - Compact discs, eyeglasses, riot shields, traffic lights

PES (Polyester) - textiles

→ PE (Polyethylene) - plastic bags, bottles

→ HDPE (High density polyethylene): detergent bottles, milk jugs

→ LDPE (Low density polyethylene): outdoor furniture, shower curtains

→ PET (Polyethylene): Carbonated drink bottles, plastic film, microwavable packaging

→ PP (Polypropylene): bottle caps, drinking straws

→ PS (Polystyrene): foam peanuts, disposables

PU (Polyurethanes): insulation, cars

PVC (Polyvinyl chloride): plumbing pipes and guttering, electrical wire insulation,

→ PVDC (Polyvinylidene Chloride): Food packaging

PE (Polyethylene) - plastic bags, bottles

Produced from: Mainly Petroleum or natural gas

Properties

- Low melting point compared to other microplastics
- Polyethylene is of low strength, hardness and rigidity
- High ductility and impact strength as well as low friction

Current End of Life

- Synthetic plastic - accumulates in landfill

NOT Recyclable

HDPE (High density polyethylene): detergent bottles, milk jugs

Produced from: Mainly Petroleum or natural gas

Properties

- High strength to density ratio
- Most versatile
- Resistant to corrosion

Current End of Life

- Easy to recycle
- Easy to melt and remould
- Recycled in UK



LDPE (Low density polyethylene): outdoor furniture, shower curtains

Produced from: Mainly Petroleum or natural gas

Properties

- Strong
- Waterproof
- Chemical resistant

Current End of Life

- Easy to melt and remould
- Not recycled in UK currently



Recyclable Depends on local authority

- Not currently in UK

PET (Polyethylene): Carbonated drink bottles, plastic film, microwavable packaging

PET is transparent, recloseable and can be designed to be reusable with the added advantage of being **shatterproof.**

PET bottles are infinitely recyclable.*

PET bottles drive big transportation savings. **1.5 - 2X** per truck more than glass bottles.



PET bottles have up to **70%** less greenhouse gas emissions than other packaging types**

Produces **less product waste** due to its resistance to breakage and denting.

90% of PET in the U.S. that goes into the recycling bin is **recycled.**



Recyclable
Currently recycled in UK

PP (Polypropylene): bottle caps, drinking straws

Properties

1. Polypropylene is readily available and relatively inexpensive.
2. Polypropylene has high flexural strength due to its semi-crystalline nature.
3. Polypropylene has a relatively slippery surface.
4. Polypropylene is very resistant to absorbing moisture.
5. Polypropylene has good chemical resistance over a wide range of bases and acids.
6. Polypropylene possesses good fatigue resistance.
7. Polypropylene has good impact strength.
8. Polypropylene is a good electrical insulator.

End Of Life

- Recyclable



Recyclable

PS (Polystyrene): foam peanuts, disposables

General Polystyrene

- CD Cases
- Plastic forks
- Yoghurt pots (check the plastic before recycling as some can be made from recyclable plastics)

Expanded Polystyrene

- Foamy Takeaway Packaging
- Meat trays
- Packing Peanuts
- Styrofoam
- Insulation



NOT Recyclable

PVC (Polyvinyl chloride)/PVDC (Polyvinylidene Chloride): Food packaging

You can find this plastic in:

- Cling film
- Blister packaging
- Hoses
- Table Protectors
- Plastic pipes
- Plastic outdoor furniture

PVDC provides a great moisture and oxygen barrier so great for linings/coatings on food packaging.

It is use on coatings for PVC.

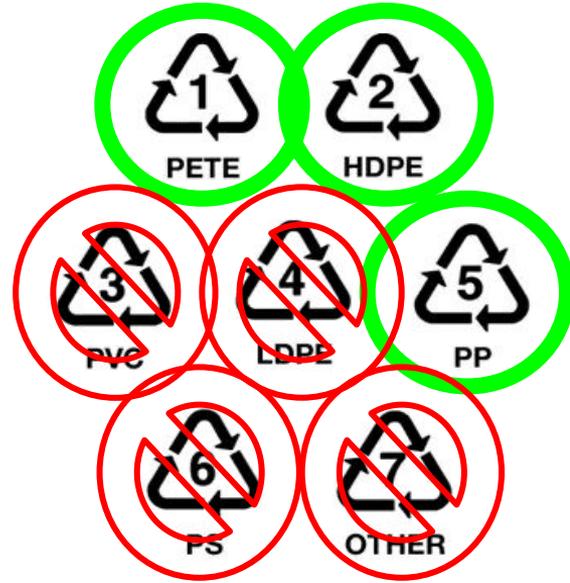
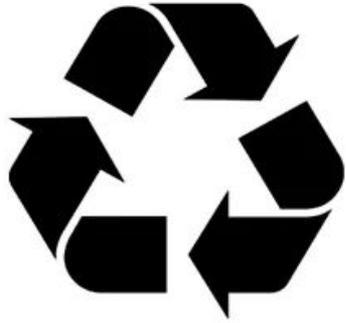
PVC can be coloured and it great for blister packaging etc.

End of Life

- The recycling of PVC is very intensive and currently not feasible.
- Due to high chlorine content and hazardous additives, it is separated from other plastics in recycling streams.

NOT Recyclable

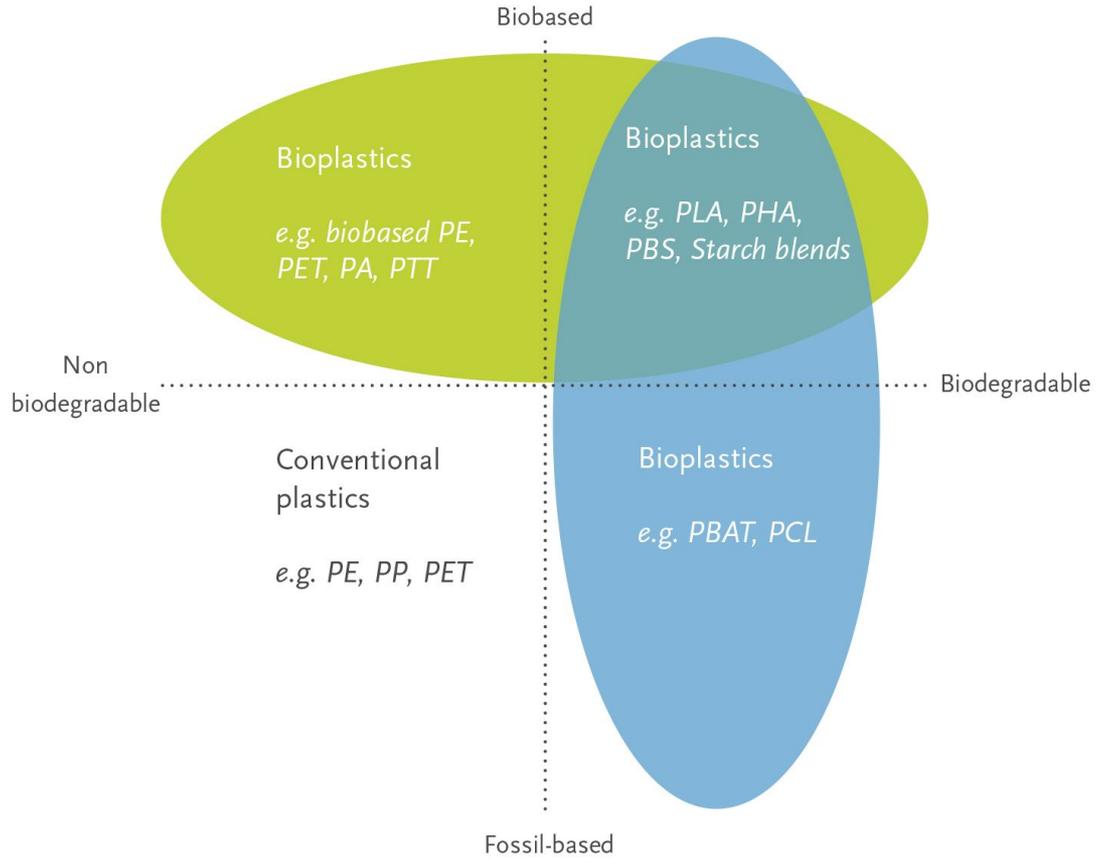
UK Recycling



Bio-plastics

Definition: When we refer to bioplastics, we're addressing a large category of biobased polymers with a variety of unique attributes and applications. There are 3 main groups

1. **Bio-based** (or partially bio-based), durable plastics such as bio-based polyethylene (PE), polyethylene terephthalate (PET) , bio-based technical performance polymers, such as numerous polyamides (PA), or (partly) bio-based polyurethanes (PUR);
2. **Bio-based and biodegradable**, compostable plastics, such as polylactic acid (PLA), polyhydroxyalkanoates (PHA), polybutylene succinate (PBS), and starch blends;
3. **Plastics that are based on fossil resources and are biodegradable**, such as PBAT and PCL, but that may well be produced at least partly bio-based in the future.



Bio-Based

PET }
PE } Technically the same as fossil fuel counter parts but less carbon footprint.
PVC } Is recyclable BUT potential for plastic pollution stays the same. Often corn or sugarcane based.

PA (Bio-Polyamides) - Oil and Fats based, used in cable jacketing, pipes etc.

PUR (Polyurethanes) - They can be thermosetting or thermoplastic, Two major drawbacks of PURs are their susceptibility to microbial attack and the tendency of aromatic urethanes to discolor (yellow) when exposed to UV light.

PTT/TPC-ET - (Polytrimethylene terephthalate) - Partly Biobased

PEF (In development) - Made from plant sugars

Bio-Based and Biodegradable

PLA (Polylactic acid) - Similar to PP and PE - Cornstarch/sugarcane derived.

PHA (polyhydroxyalkanoate) - a class of natural (not synthetic) polyesters that are derived from bacterial fermentation. Basically, microorganisms synthesize polyesters in nutrient-deficient conditions, and these PHAs can then be harvested. PHAs are both bio-based *and* biodegradable

PBS (Polybutylene succinate) - Bio-based succinic acid derived from natural substances, such as sugarcane, cassava and corn.

PVOH - synthetic polymer and plastic that is water soluble and biodegradable under both aerobic and anaerobic conditions. Made from a natural gaseous hormone given off by plants that causes the fruit to ripen.

Biodegradable but based on fossil fuels

PBAT (Polybutylene Adipate Terephthalate) - While PBAT can decompose completely without leaving toxic residues, it is not technically renewable.

PCL (Polycaprolactone) - is a biodegradable polyester

