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## Addressing plastic additives – policy recommendations

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### Context

The UK government is taking steps to reduce plastic pollution and increase plastic recycling by banning **specific single use objects** in England, **increasing plastic waste collection** and **disincentivising the use of virgin plastic**. The government have however agreed that **the current strategies to regulate plastic consumption are not effective enough**.

We argue that there is an additional factor here, which is contributing to the toxicity of plastic pollution and limiting recycling rates. This is the wide variability of additives present in plastics currently used in the UK.

### Additives

All plastics contain additives. These are **chemicals which are added to change the properties** of the plastic, for example flexibility, colour, UV-resistance or flame resistance. These additives leak into the environment during the production, use or disposal of plastics. Plastic additives have been detected in **air, rivers, oceans, soils, animals** and in human bodies.

**More than 10,000 chemicals are used as additives**. The **most significant groups of additives** are fillers, plasticisers, flame retardants, colourants, stabilisers, lubricants and surfactants. A number have been shown to be potentially or actually toxic to human health and the environment, for example, being carcinogenic, toxic or having endocrine-disrupting properties. Some are persistent in the environment and accumulate in living organisms over time,

for example **poly- and perfluoroalkyl substances (PFAS)**. These additives are used in a wide range of products, so it is not possible to manage exposure by banning specific object types.

Recycling mixes plastic from various producers and uses together. Even if the plastic is correctly sorted by polymer, the mixture of additives creates a recyclate of lower quality than the original, grey in colour, with poorer material performance and **variable chemical composition**. If the value of the recyclate is lower than the investment in energy and resources needed to produce it, then collecting plastics for recycling will be economically challenging and will result in losses and downcycling.

### Key findings

- Reduce the range of additives permitted for use in the commonest plastics in the UK,
- Establish standardised sustainability assessment of plastic performance,
- Invest in R&D to develop better alternatives for complex plastics that are hard to simplify,
- Align the UK's additive regulatory system to the EU's as much as possible.

## Reduce the number of permissible additives for use in plastics

Simplifying and standardising the range of plastic additives would simplify and standardise the range of circulating plastic formulations, enabling a more circular economy for plastics. Representatives from **academia and waste management companies** have already indicated that this would enable more effective and efficient post-consumer processing and a closed-loop recycling system. These changes should focus in the first instance on those plastics used in the greatest bulk. These are polyethylene (PE) and polypropylene (PP), mostly from food packaging, and polyester (PET) from clothes. These changes would enable a greater proportion of UK plastic waste to be recycled, boost the domestic plastic recycling industry, and reduce the quantity of plastics and additives leaked into the environment.

### Recommendations

- The UK Government should open a call for evidence on which additives should be preferred for use in the plastics used in the greatest bulk in the UK.
  - This process should focus on eliminating the most harmful additives, but also consider limiting the use of additives which are least critical.
  - This process should generate a set of key plastics formulations that are compatible with existing mechanical recycling infrastructure or composting.
- The UK government should legislate to limit the range of additives permitted for use in the plastics used in the greatest bulk (PE, PP, PET) in the UK.
- The UK government should consider ways to use the Plastic Packaging Tax and the Extended Producer Responsibility scheme to restrict the most harmful/least critical additives.
- The UK government should ban waste plastics with the most harmful additives from being exported.
- Speciality additives and plastics should remain permissible for applications in relatively low volume in line with current regulations.
- Speciality additives and plastics should remain permissible for applications with high technical specifications, where reduced plastic performance would negate any health or environmental benefit from reformulating the plastic (e.g. increased food waste from poorer quality packaging).
- Emerging new plastics or additive types should be permitted (with volume-based exceptions) while the material is evaluated by the HSE.

## Invest in R&D to replace complex plastics or recycle them

It may be relatively easy to simplify and standardise some plastic types. For others this may not be possible without significant loss of functionality and/or increase in price (see box). The UK should invest in research into replacement plastic types, as well as into new recycling technologies.

### Recommendations

- UKRI should ramp up investment in research to generate replacements for current hard-to-recycle and hard-to-replace plastic formulations. These should be effective, non-toxic and recyclable, i.e. they should have improved health and environmental footprints for production, reuse and end-of-life compared to current market standards, with little or no loss of performance.
- UKRI should invest in recycling technologies focusing on additives, e.g. sorting for mechanical recycling by additive type (in addition to polymer type), or methods to separate additives from bulk polymers so both can be recycled independently.

### Case study

#### Easily simplified plastic

Shampoo bottles are typically composed of polypropylene and are usually coloured and opaque. Simplifying the plastic formulation could eliminate dyes or allow standardised colours. The plastic will also include stabilisers and plasticisers. Reducing the permitted range of chemical options here would create a more standardised recyclate and allow closed loop recycling, where shampoo bottles can be recycled into more shampoo bottles multiple times.

#### Hard-to-simplify plastic

Multi-layered plastic (MLP) packaging is used in flexible crisp/confectionary packaging. It typically contains a metallic UV-protection layer made of aluminium. This layer has excellent barrier properties, especially for oxygen. These types of plastics are recycled by melting, when the metallic layer is reduced to dispersed nanoparticles inside the plastic. Producing transparent recycled films from this material is impossible. Replacing the metallic layer, or being able to separate it efficiently, would reduce the difficulty of recycling these materials.

## Develop environmental labelling for plastics

Producers and consumers should have access to information about the environmental impact of plastic in order to make informed decisions on its use, in addition to considering price, appearance, and performance. The total environmental impact of a plastic formulation should be established via cradle-to-cradle **life cycle assessment** of the entire formulation. This should consider toxicity, energy use, GHG emissions, water use, land use and circularity using current technologies. New plastics should exceed the performance of existing plastics on sustainability criteria to be used in substantial volumes.

### Recommendations

- The UK government should mandate assessment and reporting of the full environmental impact of plastic formulations used in bulk in the UK. Plastics used in small quantities could be exempt in order to avoid placing too great a regulatory burden on small businesses.
- The UK government should work with stakeholders to develop a system for certifying and labelling the recyclability (or suitability for composting) of all plastics used in the UK. Formulations that are not compatible with recycling infrastructure should be clearly labelled as non-recyclable.
- UKRI should invest in research to develop and refine methods to accurately assess and communicate plastic and additive harm, recyclability and cradle-to-cradle impact.
- While the national system is being developed, commercial companies using plastic should voluntarily develop environmental labelling for plastics, as is being **tried for food products**.
- The public should call for clear labelling of plastics with their additive content and total environmental impact.

## Promote alignment with international regulations

International plastic and plastic additive regulations are changing fast, including two major new global initiatives: the **UN intergovernmental panel on chemicals, waste and pollution** (due to start work in 2025) and the **UN global plastics treaty** for 2024. Existing conventions (Stockholm, Rotterdam, Basel) continue to be updated, as does **EU REACH** which regulates additives in the UK's single biggest export market. Since Brexit, UK regulation of additives in plastic is covered by UK-specific legislation, **UK REACH**. Over time, **this legislation is diverging from EU legislation**. This divergence will cause added costs to UK businesses to comply with two (or more) sets of regulations.

Most chemicals and plastics manufacturing is carried out by companies which trade internationally. Given the size of the EU plastics market, all will be making arrangements to comply with EU REACH. As the UK market is much smaller, these companies are unlikely to develop materials specifically for use in the UK, if regulations differ significantly from the EU's. This may restrict the availability of plastic products for the UK.

### Recommendation

- UK REACH should remain as aligned as possible to EU REACH, to reduce costs to British businesses and ensure that plastic products from international markets remain available in the UK.

## Read the full paper



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