

# Recyclability of Black Plastics

## An Overview



**An overview of the work carried out by WRAP and their partners on the recyclability of detectable black plastic and the impact this material has on the supply chain.**

# Glossary

HDPE	High Density Polyethylene
MRF	Materials Recovery Facility
NIR	Near Infrared
PE	Polyethylene
PET	Polyethylene Terephthalate
POM	Placed on Market
PP	Polypropylene
PPM	Parts Per Million
PRF	Plastics Recovery Facility

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## 1. Overview

**A key part of the guidance<sup>1</sup> and strategy for WRAP in the delivery of the UK Plastics Pact, is that black plastic is only used when appropriate, and when used that it is always NIR detectable. When it comes to aPET, whenever possible, clear plastic should be used since it has the greatest opportunity to be recycled back into plastic packaging, reflecting in its market value. When it comes to cPET, HPDE and PP however, it is not as straight forward. UK Plastics Pact members, representing more than 85% of plastic packaging sold through supermarkets have been requested to move out of non-NIR detectable black plastic and to a large extent this has happened. The end goal is that the only black plastic placed on the market is recyclable. In order to be deemed recyclable it must be collected, sorted and processed at scale, and therefore consideration must also be given to end markets.**

It is estimated that of the 512ktn/yr<sup>2</sup> of plastic packaging placed on the market (POM) in the years between 2016-2019, the level of black plastic has dropped from 36ktn/year (7%) to 19ktn/yr (3.7%<sup>3</sup>).

This move by brands and retailers to reduce black plastic packaging is due to the fact that the masterbatches used within black plastic contains carbon black which is problematic at the sorting stage of the recycling process. It is viewed as being not recyclable because Near Infra-Red (NIR) sorting systems, used in sorting plants to detect and separate individual polymers streams, are effectively blind to plastic items made using Carbon Black pigment.

Although there has been a trend of moving out of black plastic packaging altogether, there are alternative Black pigments available that will enable conventional NIR detectors to successfully recognise and effectively sort Black plastic items according to polymer type. In 2011, WRAP published a report '[Development of NIR Detectable Black Plastic Packaging](#)' which described the development of a solution that enabled the mechanical recycling of black plastic packaging that hitherto was destined only for landfill or energy recovery.

Despite this breakthrough, widespread adoption of detectable Black pigments in the manufacture of plastic packaging failed to take off. This was in part due to the additional cost of such detectable pigments but also because there remained the perception that there was no end market for Black plastic and that, if it became detectable, it would contaminate and potentially devalue the existing secondary markets for PET, PP and PE rigid packaging.

This paper provides a summary of the most recent WRAP research on black plastic:

- [NIR Detectability of plastic packaging](#)
- [Increasing the recyclability of Black Polypropylene packaging](#)
- [Increasing the recycling of NIR detectable black and cream PET](#)

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<sup>1</sup> *Polymer choice and recyclability guidance, WRAP 2019*

<sup>2</sup> *Plastics Market Situation Report 2019, WRAP 2019*

<sup>3</sup> *Composition of Plastic Collected via Kerbside in MRFs and PRFs, WRAP 2018*

## 2. Detection and sorting

For packaging to be classed as recyclable, it must have the ability to be collected and sorted before being sold on to a reprocessor. Sorting is carried out in Material Recovery Facilities (MRFs) and Plastic Recovery Facilities (PRFs) using NIR sorting technology; this uses infrared light to analyse the packaging at high speeds, detecting and ultimately separating the different polymers.

NIR is a very well-established technology and used by virtually all UK MRFs to sort packaging into different polymer fractions. For an item of packaging to be recycled, it must be identifiable using NIR technology. Otherwise, the packaging will be treated as residue and burnt in Energy from Waste plants or landfilled.

The report on 'NIR detectability of plastic packaging' looked at the different properties that effects the ability of NIR equipment to detect materials:

- Colour
- Surface finish
- Labels (PET bottles)
- Labels (HDPE bottles)

A summary of the laboratory and real-world testing are outlined below:

Property	Acceptable	Unacceptable
Colour	Any non-carbon black based pigment or masterbatch	>0 ppm carbon black masterbatch
Surface finish	Any matt or gloss finish	Metallised surface on the outside of the pack
Labels (PET bottles)	<60% coverage of packaging. Label to be made of material with density <1g/cm	PVC full body sleeve. Any sleeve >0.05mm thick
Labels (HDPE bottles)	Up to 100% coverage of any non-PVC polymer <0.05mm thick	>70% coverage of a label thicker than 0.05mm OR any size PVC sleeve

There is no "one size fits all" approach to how MRFs and PRFs are set up, however we can broadly say that detectable black packaging when run through such facilities should end up in either the jazz plastics stream or into the mixed plastics stream for further sortation.

## 3. Recyclability and impacts on end markets

### 3.1 Polypropylene (PP)

In 2018 it was estimated that 85kT of post-consumer PP pots/tubs/tray packaging was placed onto the market <sup>4</sup>, and 6.5% was estimated to be black. Black and dark coloured products already represent a large proportion of end markets for post-consumer rigid PP packaging.

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<sup>4</sup> *Plastic Packaging Flow Data Report, WRAP 2018*

Moving from carbon black to detectable black pigments or masterbatch would not only increase recycling rates for post-consumer polypropylene packaging, but it would not have any significant effects on the colour or quality of the recyclate generated from kerbside collections<sup>5</sup>. It is believed that levels of up to 10% detectable black would not have any adverse impacts on the end uses of the material stream, whilst anecdotally when tested users have been satisfied with the performance when black is introduced at levels up to 20%.

### 3.2 Polyethylene Terephthalate (PET)

Polyethylene Terephthalate (PET) is one of the most commonly recycled plastics used in household packaging. Much of the focus has been on recycling PET bottles, primarily the clear bottles. As demand for recycled clear PET grows, and as more brands and retailers are committed to placing recyclable packaging on the market, there is a need to focus on non-bottle PET.

Within the non-bottle PET, crystalline PET (cPET) and coloured amorphous PET (aPET) make up a significant proportion.

Where possible, WRAP advocate that clear aPET<sup>6</sup> & uncoloured cPET should be used in bottles and trays in both food and non-food applications, to maximise the value of recycled material. When utilising recycled content from a coloured source it is recommended that no additional pigment should be added.

Driven by initiatives such as The UK Plastics Pact and customer demand for recyclable packaging, brands and retailers are moving away from carbon black. This is being done primarily in three ways:

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- Move away from black into clear or other colours such as cream;
- Eliminate the use of any pigment to give a "no-added pigment" cPET of varying colour depending on the recycled content; and
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- Replace the carbon black with a detectable black.

There has been some concern that moving into other colours, particularly cream, or detectable black might result in issues further down the supply chain, affecting recyclability within the jazz PET stream.

Through desk and lab based research and testing on the jazz PET stream containing varying levels of cPET as well as the detectable black and cream PET material, WRAP has concluded that there is no negative effect on material intrinsic viscosity (IV)<sup>7</sup>, which was an initial concern of end users.

One significant impact that increasing levels of black and/or cream into the PET jazz stream is the change in colour. This is thought to potentially be a limiting factor on its end use as

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<sup>5</sup> *Increasing the recyclability of Black Polypropylene packaging, WRAP 2018*

<sup>6</sup> *Polymer choice and recyclability guidance, WRAP 2019*

<sup>7</sup> *Increasing the recycling of NIR detectable black and cream PET, WRAP 2019*

manufacturers make products and packaging to their customers specifications. Consumers tend to pick products where packaging is consistent in look (i.e. colour), as a result retailers and brand owners supply products to meet that demand.

However, market trends show that as consumers become more environmentally conscious cPET trays with no added pigment (i.e. vary in colour dependant on the recycled content) are becoming more popular. This is shown by major UK retailers now stocking cPET trays which vary in colour from batch to batch.

**4. Recommendations**

The latest three reports carried out by WRAP to look into the recyclability of black plastic packaging show that it is possible to move away from non-recyclable non-detectable black plastic packaging. However, there are a number of steps that need to be taken throughout the supply chain.

- Where functionality permits, all packaging should follow the [WRAP Polymer choice and recyclability guidelines](#);

Polymer	Best in Class
Food grade aPET	Clear PET
Non-food grade aPET	Clear PET
cPET	'Natural' or unpigmented
Food grade HDPE (i.e. milk bottles)	Natural or uncoloured (not white)
Non-food grade HDPE	Any NIR detectable pigment
PP	Any NIR detectable Pigment

- Move from carbon black pigments and masterbatches to detectable additives, preferably using "no-added pigment" non-pigmented for cPET, regardless if content is from virgin or recycled sources;
- Users of recycled content material to modify their specifications to allow for variations in colour. This is particularly feasible for non-consumer facing products (i.e. strapping and tertiary packaging) in which colour specifications are not always a necessity. This will help build a strong demand for recycled material;
- Waste managers and sorting facilities to liaise with equipment manufacturers to make the necessary adjustments to installed NIR sorting equipment to ensure recovery of polymers using detectable black pigments;
- Local Authorities and waste management companies to amend contracts where feasible to accept the collection of black plastic at the kerbside. Levels of carbon black plastic continue to fall and the use of detectable black pigments rise as a result of consumer pressure and work carried out by UK Plastic Pact members.
- Greater levels of sorting of mixed plastics to recover high quality material rather than exporting low quality mixed plastics stream;

[www.wrap.org.uk/content/the-uk-plastics-pact](http://www.wrap.org.uk/content/the-uk-plastics-pact)

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