RECOUP | Leading a more circular plastics value chain

Woodly

Recyclability Assessment

May 2026

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Inspire collaboration by connecting the whole plastics value chain
Lead the continued development of a plastic circular economy, resource efficiency, recycling and reuse
Educate the public and businesses on all aspects of plastics recycling and resource efficiency

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RECOUP

Executive Summary

What is Woodly®?

This report was produced by RECOUP (the UK's leading plastics recycling authority) on behalf of Woodly - a company that makes a new type of packaging material from wood. The goal was to understand whether Woodly® packaging can be recycled in the UK, and steps which should be taken to improve recyclability in practice and at scale.

Why does this matter?

The UK generates enormous amounts of plastic packaging waste every year. Most of it comes from oil and is either burned or sent abroad. Woodly® offers a potential alternative; a bio-based resin for plastic packaging, with a potentially lower carbon footprint, which could eventually be recycled alongside conventional plastics. However, the material is so new that the UK's recycling system is not yet set up to handle it.

What did the tests show?

RECOUP tested Woodly® packaging at three UK recycling facilities and found:

- The specialist hand-held scanner used by RECOUP correctly identified Woodly® as its own material with up to 99% confidence.
- However, the large industrial sorting machines used at recycling facilities could not reliably detect Woodly®. Most samples were either missed entirely or incorrectly sorted alongside other plastics. This was to be expected as Woodly® is not yet selected as a target material by NIR.
- The flexible sandwich bag was consistently captured as a flexible plastic (correct category), but there are currently limited routes for recycling it commercially.
- Rigid Woodly® items (cups, bottles) were largely undetected and would end up as residual waste; most likely sent for incineration.

The Key Barriers

- Recycling facilities need large, consistent volumes of a material before it is worth investing in new equipment or changing settings. Woodly® is not yet sold in sufficient quantities in the UK to meet that threshold. Estimates suggest Woodly® would need 5–10% of the flexible packaging market (50,000–100,000 tonnes) before dedicated sorting becomes financially viable.

- Under the UK government's Extended Producer Responsibility (EPR) rules, packaging producers pay fees based on how recyclable their packaging is. Because Woodly® is new and not yet widely recycled in the UK, it is automatically given a 'red' rating; the highest modulated fee, which would see producers who use Woodly® face higher costs, despite it's technical ability to be recycled.

- Even conventional plastic films and bags are currently rated as red under RAM, and they are not widely recycled in the UK. Only around 16% of local councils currently collect flexible plastics from doorsteps. The economics are challenging: recycling flexible plastics costs around £1,671 per tonne, while simply burning them for energy costs as little as £120 per tonne. This makes it very hard to build a commercial case for recycling any flexible material; including Woodly®.

Where would Woodly® sit under the current rules?

The report assesses Woodly® in three different packaging formats against the UK's Recyclability Assessment Methodology (RAM):

Format	Likely Rating	Main Reason
Rigid (cups, bottles)	**AMBER**	Detectable, but limited reprocessing routes
Flexible (sandwich bag, film)	**RED**	Does not meet polyolefin composition rules; economics favour incineration
Coating on paper/card (thin layer)	**GREEN (potential)**	Could qualify if used as a thin coating on fibre-based packaging (<10% by weight)

What needs to change?

The report recommends a combination of industry collaboration, policy reform, and infrastructure investment:

- Collaboration: Woodly should work with recycling operators, policymakers, and industry bodies to build the commercial case for sorting and reprocessing its materials.
- Policy reform: The government's recyclability rules (RAM) need to be updated to recognise bio-based materials fairly. A review of bioplastics is planned for 2029, but Woodly should push for earlier engagement.
- Smarter use of existing infrastructure: Redundant sorting lines at recycling sites (freed up by falling newspaper volumes or the upcoming Deposit Return Scheme) could be repurposed for bio-based materials at lower cost.
- End-market commitment: Woodly's commitment to buying back recycled material from the waste chain is a positive step in creating the commercial certainty that recyclers need before they will invest. Acceptance into mixed plastics recycling feedstocks is a viable route if accepted through either kerbside collections or takeback schemes.

The Bottom Line

Just as is the case with conventional PE and PP flexible packaging, Woodly® is technically recyclable, but the UK system is not yet ready to recycle it at scale. The material is caught in a 'chicken-and-egg' situation: recyclers will not invest in the infrastructure until there is enough Woodly® material to make it worthwhile, but producers will not adopt Woodly® on a large scale until it has a credible recycling route. Breaking this cycle will require a coordinated effort between Woodly, the recycling industry, and government; similar to how RECOUP and industry partners built the plastic bottle recycling system in the 1990s.

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1.0 Introduction

1.1 Woodly

Woodly is a manufacturer of wood cellulose–derived bioplastic resins focused on enabling carbon reduction and defossilisation at scale. Rather than replacing plastics, Woodly aims to improve them by using the world's most abundant natural polymer; cellulose as a sustainable alternative to fossil-based inputs.

Woodly's patented bioplastic resins are 40–60% bio-based (with a pathway to 100%), FSC and EUDR compliant, and food safe. The materials are free from PFAS, bisphenols, phthalates, and CMR chemicals. They are mechanically recyclable and designed for durability, not biodegradability or compostability.

Image: flexible Woodly® samples

The resins are compatible with existing extrusion, injection moulding, and blow moulding processes, enabling a true drop-in solution for packaging and non-packaging applications. Woodly's primary target market are extrusion converters manufacturing plastic film for supply in to food packaging. Woodly® made packaging films offer optimised and tunable permeable properties, which has demonstrated the ability to considerably extend shelf life of certain fresh food products—particularly sandwiches, bakery products, and fresh produce—helping to reduce food waste, reduce emissions and add value to the food supply chain.

Woodly® materials are proven to be mechanically recyclable, density separable, and NIR detectable. With sufficient scale, the material is compatible with existing recycling infrastructure and can be effectively targeted within mainstream recycling systems. To support the development of robust end markets, Woodly is committed to stimulating demand by buying back recycled Woodly® materials from the recycling value chain and partnering with recyclers to convert them into applications such as construction products and plastic lumber.

Developed in Finland, and with more than 20 million products made from Woodly® sold to date, the company is now expanding across the UK, Europe, and other international markets, with a particular focus on the UK packaging sector.

1.2 Challenges

Within the Defra Recyclability Assessment Methodology (RAM), Woodly® materials are not clearly defined. By definition, products made from Woodly® resins are considered plastic, as they utilise chemically modified cellulose feedstocks. Bioplastics generally fall under the category of plastics, but the existing descriptions do not accurately reflect Woodly's specific material characteristics. Defra and PackUK indicate that packaging made from Woodly® may be reported under the category "other," as it does not align clearly with current material definitions.

Under the current Extended Producer Responsibility (EPR) framework and the RAM, products made from Woodly® materials are likely to receive a "red" rating and be subject to the highest level of eco-modulation. This acts as a barrier to producer adoption, as producers are seeking to reduce EPR costs across their product portfolios rather than increase them.

Although products made from Woodly® are technically recyclable, they are not yet actively targeted within the mainstream recycling system. This is due to the material having not reached sufficient scale and therefore not having enough volume or viable economics for waste management companies or reprocessors to target it for recycling.

At present, there are no limited mechanisms or incentives to encourage the adoption of innovative, sustainable materials by producers. In fact, such materials may face higher compliance costs under the current EPR framework. However, Woodly®'s advantage is the value added to the food supply chain through extended shelf life, which may outweigh the cost of compliance.

Woodly seeks to explore this area further in collaboration with policymakers and industry associations, with the aim of mapping future policy pathways that could better support Woodly and the wider bio-based materials sector, including potential alignment with instruments such as the Emissions Trading Scheme.

1.3 Aims

Woodly believes its solution can be scaled to support the long-term decoupling of plastics from fossil-based feedstocks, and reduction of food waste through the realised functional benefits of the material.

This transition enables carbon reduction through food waste prevention, and the use of a circular biogenic carbon cycle rather than a linear fossil carbon process. This transition is a necessary step on the path to net zero and is expected to become an increasing priority for companies as they further develop and refine their Scope 3 emissions methodologies.

Woodly® materials are capable of being recycled within a circular economy once sufficient scale is achieved. However, the company's ability to scale is currently constrained by packaging waste policies that primarily focus on standardising polyolefins already established in the market.

In addition, there is limited clarity around the definitions and criteria required to determine the scale necessary for inclusion within mainstream recycling systems.

For the first phase, RECOUP will use its network of contacts within the waste management industry to conduct a series of interviews. These interviews will gather industry perspectives on Woodly® materials and assess how packaging made from these materials is likely to be handled within existing waste management systems. In addition, RECOUP will explore the development of a model capable of accommodating Woodly® materials, including identifying the infrastructure requirements and investment needed to enable this.

Considerations will include other collection schemes and guidance to the consumer specifically for films and flexibles and how current policy within the packaging industry affects this type of material.

Image: Sherbourne Recycling Facility

RECOUP will work with Woodly to:

- Assess the **current compatibility with existing collection, sorting and reprocessing infrastructure** in each of the above segments.
- Conduct **sorting and reprocessing tests with industry** to understand acceptance/tolerance levels.
- **Gap analysis and recommendations** for achieving widespread recycling, sorting, and collection.
- Identify the **critical volume required for a material to become a viable recycling target**.
- What other **conditions may be required to achieve widespread recycling** e.g. investment, regulatory intervention, collection systems/takeback, etc.
- What **percentage collection and recycling rate** could be achieved.

2.0 Samples

2.1 Samples

Woodly provided RECOUP with a selection of products produced with Woodly® materials. The products covered a wide scope of packaging and reuse options:

Image of Sample:			
Sample ID:	Woodly® reusable cup	Woodly® sandwich bag	Woodly® clamshell

Image of Sample:		
Sample ID:	Woodly® rigid bottle	Woodly® pint cup

2.2 Testing of Samples

To provide a comprehensive analysis of the sorting performance of the Woodly® material RECOUP proposed to perform an NIR analysis using the Iosys mIRoGun 4.0 to determine the potential sorting performance of the range of Woodly® samples. Following the initial trials a selection of material recovery facilities would support with trials on active sorting lines, using a range of different sorting technology manufacturers. Woodly also provided their own testing results including NIR trials with Cyclos-HTP and extrusion trials performed by VTT and NGR.

NIR Analysis - RECOUP

To determine the potential detection or classification gaps in the NIR-based identification of a novel plastic like Woodly® a series of tests were conducted. A variety or specifications of the target material and selected reference polymers were analysed using an Iosys mIRoGun 4.0 handheld near-infrared spectrometer. The objective was to determine whether the new material produces a distinctive spectral signature, or presents an overlap with commonly recycled polymers, potentially leading to sorting contamination.

The Iosys mIRoGun 4.0 is a portable NIR spectrometer designed for rapid, non-destructive polymer identification. It operates within the short-wave near-infrared range, using diffuse reflectance to capture material spectra. The device uses a neuronal network containing over 1000

Image: RECOUP's Iosys mIRoGun 4.0

spectra of known materials including PET, PP, PE and other common plastics used for packaging.

During analysis, the instrument emits NIR radiation toward a reference material. Molecular vibrations within the polymer cause characteristic absorption bands, which are recorded as a reflectance spectrum.

This spectrum relates to the specific chemical structure of the material, generating a unique reference spectrum which can be used to identify the material. The mIRoGun can rapidly compare captured spectra with the reference library and displays the closest match and a hit percentage to present a confidence value.

Test samples of Woodly® were selected for analysis and scanned with reference to the existing polymer spectral library. Five replicate scans were collected from each sample to take into account minor positional and surface variations. The scans were then stored for further comparison and analysis.

Reference spectra were then generated of

each Woodly® specification to be stored within the RECOUP NIR spectral library. A series of blind scans were then completed using known polymer samples including PET, PP, PE and PLA to determine if there were any mismatches between the materials.

The spectra are matched during optical sorting by matching the shape profiles of each material and the representative minimum pixel result. Each material is matched within the spectral database with a capture defined by the purity settings used by the MRF. A typical MRF will run between 70-85% purity depending on the quality of the materials being captured. The mIRoGun can be calibrated to account for different purity settings to make comparisons that reflect the results that can be expected during MRF sorting.

Sample ID	Top Match	Confidence Percentage	Secondary Match
Woodly® reusable cup	Woodly®	99%	PP 58%
Woodly® sandwich bag	Woodly®	98%	PP 57%
Woodly® clamshell	Woodly®	99%	PE 76%
Woodly® rigid bottle	Woodly®	97%	PP 59%
Woodly® pint cup	Woodly®	99%	PP 57%

MRF Testing

The samples provided by Woodly were tested at several MRFs in the UK selected to present a representative perspective of the common UK recycling infrastructure. The testing was conducted in line with the RECOUP Recyclability Sorting Protocol for optical, AI and static sorting trials[1].

Sherbourne Recycling - Coventry

Sherbourne Recycling processes 47.5 tonnes per hour using Machinex MACH Hyspec and SamurAI systems for high precision sorting of mixed recyclables. The MACH Hyspec optical sorters capture full spectra across the short-wave infrared spectrum. Unlike standard NIR, the spectra are captured in hyperspectral mode, which can detect subtle differences in multilayer plastics[2].

The SamurAI sorting robots integrate robotic arms with high-resolution cameras and AI vision handling complex machine learning algorithms to detect target and non-target materials. Each robot uses deep machine learning on millions of images for 99% accuracy at 60+ items per minute.

Sample ID	Top Match	Secondary Match	Notes
Woodly® reusable cup	Not detected	PP	
Woodly® sandwich bag	Flexibles	Residual waste	AI sort by shape and wind sifter
Woodly® clamshell	Not detected	PP	
Woodly® rigid bottle	Mixed plastics	PP	AI sort by shape
Woodly® pint cup	Not detected	PP	

NEWS – Norwich

NEWS Recycling (Norse Environmental Waste Services) in Norwich is able to process up to 140,000 tonnes of comingled recycling annually, achieving 83% recovery rates through automated sorting systems.

The site uses Machinex optical sorters, installed in 2014[3], upgraded to include a Recycleye AI robot in 2024[4]. The optical sorters are early MACH Hyspec optical sorters offering a comparison to the newer spec units used at Sherbourne. The Recycleye units are installed on the fibre line, recirculating target materials such as aluminium and rigid bottles back into the sorting process.

Sample ID	Top Match	Secondary Match	Notes
Woodly® reusable cup	Not detected	None	
Woodly® sandwich bag	Flexibles	None	
Woodly® clamshell	Not detected	Mixed plastics	
Woodly® rigid bottle	Not detected	None	
Woodly® pint cup	Not detected	None	

Casepak Recycling - Leicester

Casepak in Leicester processes up to 300,000 tonnes annually across two sites in the city, achieving 97.5% purity using NRT optical sorters integrated with Bulk Handling Systems (BHS)[5].

The site uses NRT's SpydIR HS optical sorters combined with Max-AI VIS modules. The NRT equipment uses in-line cameras to capture the full hyperspectral spectra ensuring high purity ratings with in-flight capture reducing missed captures through tumbling objects moving on the belts. The Max-AI VIS units act as quality control removing contaminants and ensuring high purity of target materials such as HDPE natural milk bottles.

Sample ID	Top Match	Secondary Match	Notes
Woodly®reusable cup	Not detected	None	
Woodly® sandwich bag	Flexibles	None	
Woodly® clamshell	PET pots/tubs/trays	None	
Woodly® rigid bottle	Mixed plastics	None	
Woodly® pint cup	Not detected	None	

Image: NRT's SpydIR HS at Casepak Recycling

Key Takeaways:

1. **Woodly® has a distinct NIR signature:** RECOUP's handheld spectrometer identified all five samples as Woodly® with 97–99% confidence, confirming the material produces a unique spectral fingerprint separable from common polymers.

2. **Industrial MRF sorting cannot currently detect Woodly® rigids:** Across all three facilities tested (Sherbourne, NEWS, Casepak), rigid Woodly® items — cups, clamshells, bottles, pint cups — were largely undetected by optical sorters, defaulting to residual waste or mixed plastics.

3. **Flexible Woodly® is captured as film, but with limited onward routes:** The sandwich bag was consistently sorted into the flexibles stream at all three sites, but this category currently has very limited commercial reprocessing routes in the UK.

4. **Misclassification risk is low but present:** Where rigid Woodly® samples were detected, they were routed into mixed plastics or PP streams rather than correctly identified, posing a potential contamination risk.

5. **Sorting technology generation matters:** Results varied across sites, with newer hyperspectral and AI-assisted systems (Sherbourne) performing differently to older optical sorters (NEWS), highlighting infrastructure inconsistency across the UK.

3.0 UK Market in Context

3.1 Current UK Market

The UK flexible packaging market is estimated to reach 1.5 million tonnes by the end of 2025, increasing to 1.7 million tonnes by 2030, with a compound growth rate of 3.05%. Flexible packaging currently accounts for almost a quarter of all UK plastic packaging, but according to RECOUP collection surveys and other sources only around 15% of local authorities currently collect flexibles kerbside with a 7% recycling rate[6].

Under the UK's Extended Producer Responsibility for Packaging (pEPR) scheme that has been in operation since 2025, producers must pay for the costs of collection, sorting, recycling and disposing of household packaging waste. This shifts the burden of costs from local authorities to producers, with local authorities receiving payments from modulated fees calculated via RAM ratings.

Critical Threshold for MRF Sorting Viability

To estimate the potential volume benchmark for MRF sorting viability several criteria need to be considered:

1. **Daily throughput:** MRF facilities have a specific tonnage capacity for sorting, for example, Sherbourne Recycling can process 47 tonnes per hour, which equates to around 480 tonnes per day allowing for downtime.
2. **Equipment investment:** Operational infrastructure such as optical sorting, AI robotics or wind sifters can range between £150k - £350k, with retrofitting potentially more expensive and complicated than new installations.
3. **Market share:** For Woodly® specifically, the material would need to achieve a sufficient volume to justify dedicated sorting infrastructure investment for capture at a MRF. Novel materials risk being sorted into residues and end up in energy recovery unless they reach a threshold to be sorted as a target material.

To make viable economic sense, Woodly® would likely need to achieve:

- **5-10% market share of flexible packaging**, assuming 1 million tonnes this range is 50k to 100k tonnes.
- **Minimum throughput** for a medium MRF would be **around 50-100 tonnes per day** of Woodly® material.
- **Critical mass would be required to achieve a dedicated sorting line** at a sorting facility dealing with flexibles.

3.2 Cost Structure

Local authority collection faces costs such as logistics, vehicle, crew and maintenance costs for the collection of materials kerbside. In addition to these costs MRF operators will incur operating costs including:

Capital investments

- Optical sorting equipment can cost between £150k - £350k per unit for new lines.
- Additional conveyors and hoppers can cost an additional £200k where required.
- AI units can cost between £150k - £600k to install on new lines.
- Upgrades to existing optical lines can cost between £15k - £50k to calibrate for new materials.

Operating costs

- Manual labour at MRF sites is generally paid at the living wage or £1 above, with night workers receiving a £3 - £4 uplift. For FlexCollect type sorting, one or two additional workers will cost around £13 per hour each.
- Automated systems can operate with minimal maintenance requirement and intervention, reducing the labour costs above.
- Maintenance, utilities and overheads of the new equipment.

Material costs/revenues

- Flexible packaging attracts lower values compared to other materials such as rigid plastics, with PET bottles attracting rebates of around £200 per tonne and HDPE natural a rebate of up to £500-£600 per tonne. MRF film on comparison attracts a value of -£100 per tonne.

Revenue potential

For economic viability we need to consider:

- Material sales values for sorted materials, pEPR fees and PRN/PERN revenue from recycling.

Proof of concept for the recycling of Woodly®

Woodly® can be recycled both mechanically and chemically. Recycling of Woodly® has been demonstrated through sorting trials at variety or MRF facilities in the UK by RECOUP and in Europe by Cyclos. Reprocessing trials show **compatibility with the polyolefins streams** as well as source segregated recycling.

Woodly® can be **identified and separated by existing optical sorting equipment as a target material and separated by NIR signature from other flexibles, rigids or fibre materials**. The risk of contamination with other materials is low, with sorting calibrations required to be reduced to between 50-60% for Woodly® to be sorted into the polyolefin streams unintentionally.

3.3 UK Household Plastic Recycling Infrastructure

Understanding the structure and limitations of the UK's plastic recycling system is essential context for assessing where Woodly® — as a cellulose-based, bio-derived polymer — sits within the current landscape, and what barriers or opportunities exist for its integration into domestic recycling streams.

Material Recovery Facilities (MRFs)[7]

Material Recovery Facilities are the first point of sorting for Dry Mixed Recycling (DMR) collected from households. Mixed recyclables are mechanically and sensor-sorted using a combination of:

- **Magnetic separation** to remove ferrous metals.
- **Ballistic separation** to split 2D from 3D materials.
- **Near-infrared (NIR) technology** to identify and separate different polymer types.

Sorted fractions are baled and sent onwards to a Plastics Recovery Facility (PRF), directly to a reprocessor, or exported. It is worth noting that NIR technology, the dominant sorting mechanism, is calibrated to identify specific fossil-derived polymers (PET, HDPE, PP etc).

Novel materials such as cellulose-based polymers may not be reliably detected or correctly routed by current NIR systems without specific configuration, a point of direct relevance to Woodly®'s recyclability profile.

Scale and Market Structure

As of December 2023, there are an estimated 99 MRFs in the UK capable of sorting mixed plastic packaging, with England accounting for 78% of sites and 87% of total tonnage. The market is dominated by a small number of large operators — Biffa holds the largest market share by both number of MRFs and tonnage, followed by Veolia.

MRFs are categorised by annual throughput capacity:

- **Small**: under 20,000 tonnes per annum
- **Medium**: 20,000–50,000 tonnes
- **Large:** 50,000–125,000 tonnes
- **Extra-large**: over 125,000 tonnes

While small and medium sites make up 73% of MRFs by number, they account for only 27% of total tonnage. Large and extra-large facilities, just 28% of all MRFs, handle over 70% of qualifying tonnage. This concentration has implications for the pace at which new material categories can be accommodated, as decisions made by a handful of large operators effectively determine what is and is not sorted nationally.

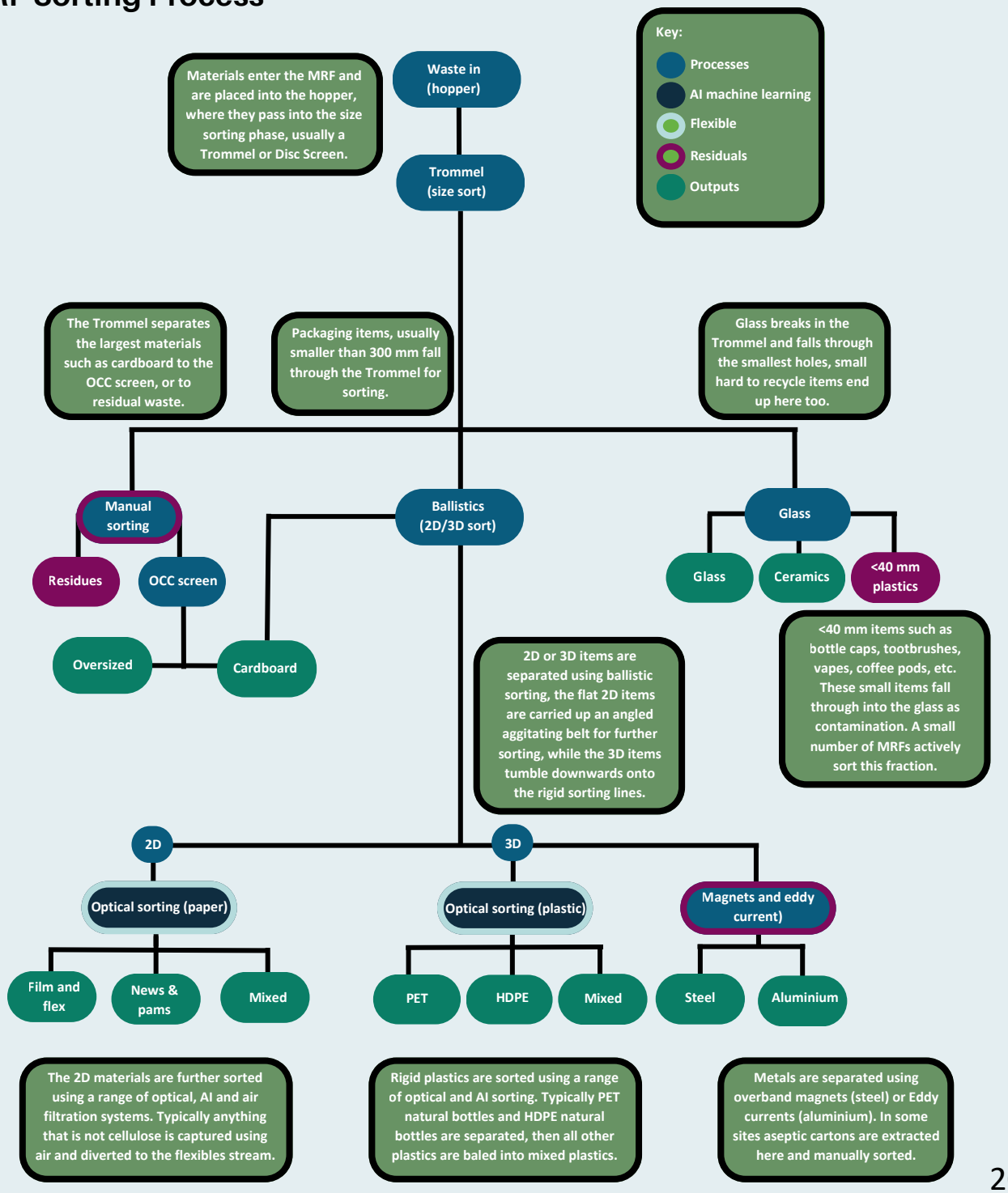
Most MRFs are assumed to focus on sorting rigid plastics. Films, flexibles, and novel bio-based polymers are typically not accommodated in standard MRF sorting configurations.

Sorting Capacity and Actual Output

Due to MRFs accepting multiple material types, the precise volume of plastics in the stream is difficult to measure. Based on average plastic fractions from primary data sources, the UK's estimated annual sorting capacity is 1.7–2.1 million tonnes of plastic packaging (from household and some non-household sources).

However, accounting for commercial drivers, real-world throughput constraints, and yield losses - actual sorted output is estimated at only 0.9–1.1 million tonnes per year. This is a significant utilisation gap that reflects the operational and commercial pressures the sector faces.

MRF Sorting Process



3.4 Plastic Recovery Facilities (PRFs)

Role and Function

Plastic Recovery Facilities receive baled rigid plastics from MRFs and carry out more detailed sorting to enhance material quality. These facilities typically deploy multiple NIR sorters, colour sorting systems, and paper and metal removal technologies, with the goal of producing cleaner, higher-purity plastic fractions suitable for reprocessing.

In 2022, the UK had 7 operational PRFs sorting rigid plastic packaging, with a combined capacity of approximately 355,000 tonnes per year. It should be noted that some advanced MRFs can now achieve output quality comparable to PRFs, meaning not all bales require PRF processing — though PRFs remain important for upgrading lower-quality or more complex input streams[8].

Plastic Reprocessing

Plastic reprocessing is where sorted material undergoes mechanical treatment to remove impurities and convert it into usable secondary raw materials.

This process typically involves:

- **Shredding** - breaking plastics into smaller pieces.
- **Washing** —removing labels, adhesives, dirt, residual contents, and contaminants.
- **Separation**—sorting polymers by type, using density separation or similar technologies.
- **Output creation**— producing regrind//flake (sold directly).

UK Reprocessing Landscape

As of 2022, an estimated 400+ accredited reprocessors handled plastic packaging in some form. Of these, 78 processed both commercial and industrial (C&I) and household plastic packaging, while 16 specifically handled household plastic packaging. Annual capacity for household packaging reprocessing stands at approximately 455,000 tonnes, against an actual throughput of around 288,000 tonnes — again illustrating a meaningful gap between theoretical capability and real-world output.

Determining exact reprocessing capacity is complex. Facilities commonly report higher theoretical capacities than they achieve in practice, and feedstock quality significantly affects throughput. Yield losses from washing, separation, and contamination removal mean that not all inbound plastic becomes sellable product — all factors that create a meaningful gap between nominal capacity and real-world output.

Reported Recycling Volumes

Data from the Environment Agency's National Packaging Waste Database (NPWD) found that 1,154,000 tonnes of plastic packaging was reported as recycled in 2024, of which 569,205 tonnes (49.3%) was exported for reprocessing overseas.

This level of export dependency represents a structural vulnerability in the UK system — and raises legitimate questions about the quality and traceability of material counted as "recycled".

3.5 Biogenic Carbon and Bio-Based Polymers

For a material like Woodly® — derived from wood pulp and constituting a cellulose-based polymer — the concept of biogenic carbon is directly relevant to how its environmental credentials are understood and communicated within the recycling value chain.

Biogenic carbon refers to carbon that originates from living or recently living biological sources, as distinct from fossil-derived carbon. Crucially, biogenic carbon is generally considered carbon neutral: it was absorbed from the atmosphere during the growth of the biological source (in Woodly®'s case, trees), and any re-release simply returns that carbon to the cycle rather than adding net CO_2 as fossil carbon does.

This distinction matters for the recycling infrastructure context in two ways:

- **Material identity at sorting**: NIR-based sorting systems are not configured to identify or route bio-based polymers. Woodly® entering a conventional MRF stream would likely be misidentified, rejected as contamination, or sent to residue. This is a fundamental infrastructure gap that needs to be addressed through either material labelling, dedicated collection, or technology adaptation.
- **End-of-life value proposition**: If Woodly® is recycled and its biogenic carbon remains in the material loop, it has a stronger environmental benefit than incineration or composting, which release stored carbon. Recycling biobased polymers preserves carbon sequestration for longer.

3.6 Systemic Challenges and Future Development Needs

Disparities in Plastic Collection and Recycling

A significant and well-documented gap exists in the UK system between the recycling of high-value, high-quality plastics (such as food-grade PET and HDPE) and low-value or hard- to-recycle materials — including films, flexibles, and novel polymers[9].

Pots, tubs and trays are collected in large quantities but lack robust, commercially viable processing pathways, restricting overall recycling performance. Bio-based and cellulose-derived polymers currently sit in this underprovided category.

Infrastructure Pressures

Several factors are creating headwinds for the development of new recycling infrastructure in the UK:

- **Rising energy costs**, which disproportionately affect energy-intensive operations such as sorting, reprocessing, and chemical recycling.
- **Delays in implementing new legislation**, reducing investment certainty across the sector.
- **Falling demand and prices for recycled plastics**, which erode revenue streams and challenge business cases.
- **Increased imports of recycled materials,** intensifying competition and squeezing margins for domestic operators.

These pressures have already led to plant closures, including Viridor's Avonmouth facility and Biffa's Washington site in Sunderland in 2025, reducing domestic capacity at a time when processing infrastructure needs to grow.

Priority Areas for UK Action

To improve national recycling rates and reduce export dependency, the UK requires focused investment and policy reform across several areas:

- **Infrastructure investment** targeted at films and flexibles, non-bottle PET, and food-grade plastic packaging—categories where current processing capability is most deficient
- **Review of the export system** to ensure transparency and reduce reliance on overseas reprocessing
- **Reform of the PRN/PERN system** to incentivise high-quality domestic reprocessing rather than simply volume-based compliance.

The structural gaps identified above define the environment into which Woodly is seeking to position its product. The following sections assess where Woodly®'s material properties align with or diverge from these infrastructure realities.

4.0 Interviews

Interviews with RECOUP members covering the waste management industry and associated industries took place between October 2025 and January 2026.

These interviews focused on the operational and commercial viability of sorting Woodly® material in the waste management infrastructure. This is not taking into account reprocessing, or density separation.

If Woodly® was to appear at a site today, what would the outcome be?

- "The film is a very simple answer. If it behaves like film, then you will be extracted. The problem is it is not going to get recycled because nobody will want the material."
- "Depending on the format the material is in, if it is a rigid 3D and blended with some kind of plastic, it would be sorted into the mixed plastics but would contaminate the waste stream. If it is in the format of flexible plastic, it would be sorted into the waste stream."
- "If it is not showing up as target polymer - PP, HDPE, PET etc... - it would automatically flow down the waste category to go to waste."
- "The plant is designed to seperate 2D from 3D material. If the materials are 3D I would assume they would travel through to the optical sorter. If NIR detectable, they would then be captured into our pots, tubs and trays grade. If not captured by optics, then they would fall into the residual waste stream."

What changes would be needed to accept or sort this material in the future?

- "The question is value. If they're preparing to pay sufficient amount, then it will depend. The price and the weight is going to be directly linked. The more material they have got, the lower the price they can have."

- "When they design this material, did they think about the full life cycle of a product and that you have a way to turn it back into something? Or are they expecting somebody else to solve that problem?"

- "One issue I have with celluose-based materials is usually once it's heated above 220-230 degrees, it will burn. It will go off to be carbon dioxide and water. And you just lose it in your mass balance."

- "If you still have old TiTech machines which are 20 years old, then for sure you are not able to sort specific materials like you can do with the last generation. The sensor development has changed in the last 20 years. At a certain point, you need to update or upgrade hardware too".

What changes would be needed to accept or sort this material in the future?

- "To add another bunker, separate the lines and another collection point - £4.2 million".

- "I could put a person on the line at the very end of it and try take that stuff out and make a token bale like we do with Tetra Pak, but it is hardly a solution".

- "The current market position is kind of the baseline. People are basing the gate fees around what is happening now, not what the value of the material is. Until there's actually a market to buy the finished product, its very hard to have a discussion".

4.1 Summarisation

Some of the core gaps mentioned during the interviews relate to the operational and commerical sortability of the material. Both of these are important factors and whilst Woodly® may technically be able to achieve sortability, proving or achieving commerical sortability may be the shortfall.

Value was a significant factor, Woodly® needs to be able to compete on a price-per-tonne level with established polymers to incentivise any facility investing in sorting infrastructure to collect or sort Woodly®. Four conditions were stated bluntly; scale, offtake, price mechanism and buyers, all are currently absent for Woodly®.

Hard infrastructure captial costs were difficult discussions without any background or trial data to compare. Some discussion was directly relevant to sorting infrastructure in general; £4.2 million 'all in' for a new bunker line and collection point. Another site mentioned £2 million for a new line, baler and collection point for bagged flexibles as a mixed collection. There are similarities with Tetra Pak collections, whilst technically recyclable, a token bale is formed, but the offtake volume is low. This means the site is not prepared to invest in higher volume without the promise of returns.

MRF infrastructure is described, with target materials PET, HDPE and PP being the set-up for sorting for 99% or MRFs in the UK. Any materials not on this list will be sorted into residual waste. If a material is not compatible with the current streams, a whole new infrastructure addition is required. However, if the material is compatible with one of the streams, the alterations can be mainly software based to recalibrate NIR sorters.

A reprocessing concern was raised about compatibility of Woodly® within the PP stream, citing that the melt properties and behaviour of the cellulose-based polymer may be incompatible and if thermal degradation occurs at PP/PE extrusion temperatures, it may result in a mass balance loss.

A significant gap might not be simply the sorting and capture of the Woodly® material, the addition of Woodly® to NIR optical sorting libraries and training AI to sort Woodly®, will not necessarily satisfy the requirements of formal recyclability certifications by agencies such as RecyClass.

5.0 Current UK Legislation & Policy

5.1 Kerbside Collections

Flexible plastic packaging is one of the most significant challenges being faced by UK recycling infrastructure and local authorities, with vast changes intended to be implemented as part of Simpler Recycling from April 2027[10].

An estimated 1.7 million tonnes of flexible plastic packaging are placed on the market annually in the UK, with around 50% being considered as in scope consumer packaging for Extended Producer Responsibility payments. Previously it was estimated that just 14% of local authorities in the UK offered kerbside collections of flexible packaging. The 2025 update of the RECOUP Household Plastics Collection Survey announced that this figure has risen to 16%.

The transition to mandated kerbside collections will present a fundamental shift in waste management infrastructure. However, this does not acknowledge the considerable gaps between policy intent and the operational reality. What is particularly concerning is the economic viability of recycling flexible plastics compared to the costs of disposal by energy recovery.

Flexible Plastic Fund – FlexCollect

The FlexCollect project was a UK-based initiative launched in May 2022 by a consortium of brands including MARS, Mondelez, Nestle, Pepsico and Unilever with the aim to pilot household collection of flexible plastic packaging. The project was co-managed by RECOUP, Ecosurety, SUEZ and WRAP and generated data on yields, costs and infrastructure suitability and requirements ahead of simpler recycling mandates from 1 April 2027[11].

Image: FlexCollect trial bag used in the Flexible Plastic Fund's project.

5.2 Legislative Framework

In the UK, the policy landscape is defined by two major legislative initiatives.

1. **Simpler Recycling (England only)**
From March 31 2026, local authorities in England must ensure that four separate material streams are being collected from all households; residual waste, food waste (optional allowance for collection with garden waste), paper and card, and all other dry mixed recyclate (plastic, metal and glass). From March 31 2027, this extends to include flexible plastics from all households in England.

2. **Extended Producer Responsibility (pEPR) for Packaging**
This is the statutory instrument for EPR and came into force from 1 January 2025, and PackUK was formally established as the scheme administrator. In November 2024, local authorities were notified of the estimated EPR payments for 2025-26, at an estimated £1.4 billion.

These EPR fees are estimated based on modulated fees which are determined by the recycling performance of packaging placed on the market in line with the Recyclability Assessment Methodology (RAM). Packaging that performs well achieves a green rating with lower modulated fees, whilst poorly performing packaging would receive a red rating and face higher fees.

This modulation potentially creates a critical policy gap: whilst producers are being incentivised to design recyclable packaging using RAM grading as guidance, councils and MRFs face escalating gate fees that can render the recycling of some material streams economically unviable.

The devolved nations of the UK are implementing complementary, but distinct regulatory pathways:

- **Wales**: The Welsh Government's Collections Blueprint 2025 places an emphasis on source-separated kerbside collections for dry mixed recycling and food waste. This initiative does not mandate for flexible plastic recycling collections.
- **Scotland**: The Waste Scotland Regulations require the collection of glass, metal, plastic, paper and card for recycling.
- **Northern Ireland**: The Northern Ireland Waste Collection Regulations 2025 are administered by the Department of Agriculture, Environment and Rural Affairs (DAERA). The regulations require the collection of dry mixed recycling streams with enhanced sorting to regulate material quality and support local reprocessing.

Image: Casepak Recycling, Leicester

5.3 Conflicting Legislation and Policy

EPR Fee Modulation vs. Recycling Economics

There is a fundamental conflict between the pEPR scheme and the economic viability of recycling operations. Whilst producers will pay higher modulated fees (£320-£520 per tonne) for difficult to recycled plastic packaging, these costs are not proportionately directed towards recycling infrastructure investment. Instead the funding flows to local authorities on a per-capita basis, which generates a mismatch between costs responsibility and funding allocation.

The average gate fee for reprocessing flexible plastics according to the Flexible Plastic Fund report is £650 per tonne, with a documented range between £80-£1000 per tonne depending on the composition of the materials. When this was combined with collection and sorting costs, the average was £1,021 per tonne, the total fee for recycling was £1,671 per tonne. When compared to the cost of energy recovery and the lack of infrastructure development, the cost parity favours energy recovery as the most economically viable route for MRFs sorting flexibles from kerbside collections[11,12].

Collection Mandate vs. Infrastructure Readiness

The March 31 2027 deadline for flexible packaging collection mandates that collections should start by that date, without any confirmation or consideration of infrastructure capabilities. The FlexCollect project identified that there is insufficient capacity to meet the placed on market demands for waste management, with no significant investment coming in the near future. Jayplas are building a recycling facility in Swansea with a focus on flexible capacity, but the increase in infrastructure capacity will not come close to the requirements to meet the placed on market demands.

Local authorities are being required to collect materials that will have no commercially viable route to recycling. The economics of the pEPR system will increasingly favour incineration with energy recovery as the most viable destination for mixed flexibles due to the huge cost difference between energy recovery and recycling.

Infrastructure Challenges

It was a recommendation in the FlexCollect report that material recovery facility operators may be able to accommodate collection bags for kerbside flexible plastic collections. The assumption was that there would be no infrastructure adjustments required, with a small increase in manual pickers to capture the bags from the pre-sort cabin at the start of the sorting process.

However, this optimistic assessment masks some significant underlying challenges:

- **Capital Investments**

Sorting modifications were claimed in the FlexCollect report to be

estimated at between £10,000 to £150,000. However, interviews with MRF operators have revealed that one expects to complete modifications costing up to £2 million to introduce additional capacity for the extraction of bagged flexibles at the front end. For fully co-mingled collections, the FlexCollect project predicted an investment requirement to increase dramatically to between several hundred thousand to millions of pounds. With the potential volatility of gate fees and end markets for the flexible collections, this is an increasingly risky use of capital for MRF operators to entertain.

- **Operational Limitations**

Sherbourne Recycling in Coventry is one of the only sites in the UK that is collecting flexibles in fully comingled collections. The design of the site differs from many MRFs in the UK with the use of Trommels and ballistic separators in place of the more common disc and news screens, reducing the downtime caused by flexible materials wrapping around the shafts.

The separation of flexibles using this method is challenging as the flexibles can be mixed with paper and card materials, but the use of short-wave infrared and AI sorting systems are shown to be able to capture the materials and separate them from the streams. Due to the complexity and limitations of the outputs, the flexibles are collected as a single comingled flexibles stream, similar to mixed plastics with no separation of the more sought-after polyethylene or polypropylene films.

- **Staffing and Operational Costs**

Flexible packaging collections come with some form of increased resource requirement. Each MRF would require at least one operative to pick bags from the lines during operational hours. If a MRF was to run two shifts per day, each day and require one picker, the increased cost would equate to around £80,000 in salary costs alone. The sorting of only 10 tonnes per week with a gate fee of £650 would incur costs of £338k per year with a loss of £418,000 allowing for salaries alone, other costs would further increase the losses incurred by the MRF. The ongoing labour costs would not be offset by the material value.

In contrast one MRF interviewed by RECOUP mentioned a change to their fines sort, with the addition of an eddy-current picking aluminium from the fines. This change extracted 40 tonnes of aluminium over a year, with an expected revenue of £400k, turning a waste fee into a rebate.

- **Gate Fees Push the Desire to Burn**

The plastics market has been unstable in recent years, with several large-scale recycling sites closing, such as Viridor closing sites in Rochester and Avonmouth, as well as some smaller operations such as Vanden in Whittlesey also ceasing operations. The end market value of recycled materials has an impact on gate fees, during the FlexCollect project gate fees were high, with potential that gate fees could reduce as volumes increase. However, for gate fees to reduce, the

quality of the recyclates would need to be viable for recyclers. With mixed flexibles posing a considerable challenge and financial burden for recyclers to sort, it is likely that gate fees will remain consistently high for some time.

The FlexCollect estimate was a combined collection and sorting cost of over £1000, with a total recycling cost of £1,671 per tonne. When the composition of the materials is taken into account, a PE recycler can expect at best to receive 400 kg per tonne in PE, with the composition split 40:40:20 for PE, PP and all other flexibles respectively.

In contrast, incineration with energy recovery can be as low as £120 per tonne. For a MRF managing tight margins and looking to cover their costs with their own gate fees or rebates for materials, the incentive to incinerate comes with a cost differential of around £1,550 per tonne cost savings.

The FlexCollect report mentions that four tonnes of material was not deemed as suitable for recycling, and was instead sent for energy recovery. The reality with this insight is not that the quality of the recyclate is going to be the determining factor in the end-of-life destination of the flexibles being collected, as much as the cost of recycling vs. energy recovery. When the cost of recycling exceeds energy recovery by the magnitude expected, energy recovery makes the most viable economic sense.

- **Capacity Constraints in a Volatile Market**

There is insufficient end market capacity to meet the placed on market demand in the UK. FlexCollect anticipated the collection volumes to reach 150,000 tonnes when collections commence in 2027. Insufficient capacity tends to lead to increased gate fees. As demonstrated by the FlexCollect project, 10 local authorities collected over 400 tonnes of flexible materials, attracting an average gate fee of £650 per tonne.

It is estimated that collection volumes from 2027 will hit 150,000 tonnes of flexible plastics. In contrast, a MRF sorting mixed rigid plastics is more likely going to attract a rebate of between £20-£80 per tonne of mixed rigid plastics, with higher rebates for segregated materials such as PET natural, or HDPE natural bottles.

There is little hope for an increase in capacity in the immediate future. Jayplas are building a site in Swansea with an expected capacity of 100,000 tonnes per year of mixed rigid and flexible plastics. This is likely to translate into a sorting capacity of 20-30 kt per year capacity for the sorting of flexibles based on average compositions.

The creation of new sorting facilities from concept through to commissioning can be as long as 8 years. Sherbourne Recycling opened one of the most technologically advanced sites in the UK in 2024 in Coventry, with a throughput of 47.5 tonnes per hour and a capacity of up to

to 250,000 tonnes per year. This site came at an estimated cost of £100 million, and planning started in 2018. Sherbourne Recycling was a participant in the FlexCollect trials and proved that with sufficient investment it is possible to sort flexible materials from comingled kerbside collections.

Key Takeaways:

1. **Woodly® is within scope for kerbside collection:** As a bio-based but conventionally recyclable flexible film, Woodly® falls within the simpler recycling framework for mandatory kerbside collections from March 2027, regardless of current reprocessing and regulatory constraints.
2. **Capacity limitations drive up gate fees:** With limited treatment facilities and inefficient sorting combined with a mandatory collection requirement, recyclers will charge premium gate fees.
3. **Economically unviable MRF operations:** When total system costs are expected to exceed £1,600 per tonne and incineration gate fees cost around £120 per tonne, MRFs face increased financial pressures limiting routes to recycling.
4. **Financial pressure incentivises incineration:** The lack of policy interventions, such as gate fee caps or subsidies means that MRFs will choose the cheapest, economically viable disposal route.
5. **Diversion to incineration reduces availability:** New facilities will be unable to reach economies of scale and reach capacity if materials are diverted to incineration, with the cycle perpetuating without intervention.

6.0 Specific Challenges For Flexible Recycling

6.1 Challenges

Challenge 1:

The MRF adaptation burden will fall on MRF operators without assured funding.

The capital investment to collect and sort flexibles can range from £80,000 for a single picker with no additional adjustments, to £2 million for minor retrofitting on the front end to capture mixed flexibles. Discussions with one MRF operator indicated that to add a specific new material to their sorters costs £15,000 per material. These costs under the current expectation generate no offsetting revenues, with the collected material generating a negative cash flow. The gap in revenues will be absorbed by MRF operators with EPR modulated fees flowing to local authorities and not directly to sorting or reprocessing facilities.

The Gap:

The MRFs will bear the operational financial burden and capital costs for any infrastructure modifications or staffing adjustments without assured revenue returns.

Challenge 2:

Contamination and quality control in mixed collections will be a driving factor in high gate fees and limited end markets.

The FlexCollect trial indicated that 89% of the material collected was target material, with 11% contamination, with 9% of this being non-recyclable. This alone is enough to attract high gate fees from reprocessors. Further quality control issues arise with the material requiring further sorting from mixed plastic streams, which can vary in composition. A PE recycler can face between 40-60% non-target material in comingled flexible collections requiring further sorting before reprocessing.

The Gap:

MRFs with tight operational margins will struggle to manage contamination, attracting high gate fees. Comingled collections with 10% contamination will require further processing and rejected materials will require disposal, increasing costs and reducing yields for recyclers paying for bales by the tonne.

Challenge 3:

Collection variability and non-compliance: Current participation rates from local authorities in 2024 was indicated at 13%, increasing to 16% in the 2025 RECOUP survey.

The collection of flexibles will be mandated in England from 31 March 2027. However, the implementation of this service is open to interpretation with no fixed operational mandate for local authorities to follow. Capacities and sorting ability will depend on the current infrastructure in operation, with some councils indicating that they will either not be ready or have no intention to commence flexible collections by 31 March 2027.

The Gap:

Uneven participation by local authorities combined with inefficient sorting capabilities generates economic scalability challenges. If participation figures are not optimised and collection and sorting efficiency remains low, the unit cost of collection and processing increases, further exasperating the already high gate fees and draw of incineration.

6.2 Gap Closure Strategies

- **Gate Fee Intervention**: Government-backed gate fee subsidies or price caps for materials facing infrastructure deficits reduce the impact of high gate fees on the MRF operators, reducing the financial incentives to energy recovery.

- **Accelerated Sorting and Treatment Capacity Investment:** Provision of capital grants or low-interest loans to accelerate the commissioning of mechanical or chemical sorting or treatment facilities. Private investment or funnelling of EPR fees to local authorities alone will not be sufficient to close the capacity gap.

- **MRF Infrastructure Fund:** The development of a dedicated MRF Infrastructure fund to assist MRF operators with capital costs for modifications, with estimates between £80,000 - £2 million, should be mandated through local authorities to allocate modulated EPR fees to provide the necessary improvements.

- **Extend EPR to Reprocessing:** Currently EPR is focussed on the collection and sorting of materials at the local level from kerbside collections. With flexible collections comingled in collection bags, reprocessors face additional challenges for further sorting before materials can be considered recyclable. Extending EPR provision to reprocessing will provide financial incentives to reprocessors to invest in sorting and treatment capacities increasing end-market value.

6.3 Design Gaps and the Recyclability Assessment Methodology

RAM Overview

RAM v1.1 was updated in April 2025 to remove some aspects of the RAM v1.0, which was released in December 2024. The official line from DEFRA was that the update was to address stakeholder feedback and to make the methodology more practical and simplified ahead of the first reporting deadline (1 October 2025).

DEFRA and PackUK stated that the core aim of the simplification was to ensure usability and simplicity for brands needing to assess thousands of SKUs for reporting by clarifying the guidance and removing some grey areas causing confusion. There was extensive industry feedback across all materials, including responses from both RECOUP and the British Plastics Federation (BPF), with both Paul East (RECOUP) and Brian Lodge (BPF) submitting extensive analysis of key design guidance omitted from the RAM[13].

What does RAM mean for producers...

Packaging producers are required to assess the recyclability of their packaging using the RAM methodology. The use of a RAG (red, amber, green) rating applies to each packaging component and is used to determine modulated EPR fees:

- **RED**: Packaging that is hard to recycle, attracting higher fees.
- **AMBER**: Packaging that displays some recyclability challenges or limitations, attracting moderate fees.
- **GREEN**: Packaging that is widely recyclable, attracting the lowest modulated fees.

Who needs to apply the RAM?

The RAM applies to large producers with a turnover >£2 million and handling 50+ tonnes of household packaging annually. Small producers currently have no reporting requirements and will pay flat EPR fees with no modulation[14].

This framework targets the large producers, who are estimated to be responsible for around 80% of packaging currently placed on the market, shifting the costs to incentivise design for recyclability without placing the burden onto smaller producers and start-ups.

Producer status is determined by the business handling or supplying the packaging, and not the material itself. Woodly may qualify as a small producer if the UK turnover is <£2 million and handles less than to tonnes of packaging. However, end-producers or brands using Woodly® in their packaging that exceed £2 million turnover or 50 tonnes of packaging, would be required to assess all their household packaging, including Woodly® and other novel or biobased materials, regardless of volumes.

Key implications:

- Novel or biobased materials have no

status, RAM rating depends on supply chain factors.

- Large producers or brands >£2 million turnover or 50+ tonnes of packaging will be required to assess all household packaging.
- Small producers or brands i.e. <30t household packaging report data, but have no RAM assessment requirement.
- RAM's producer focus and infrastructure approach does not differentiate or make allowances for sustainable innovation.

RAM Roadmap

The RAM updates annually and is structured into a series of recurring activities or reviews to be assessed through consultations with a Technical Advisory Committee (TAC):

- Annual updates: Policy alignment reviews, followed by RAM updates and revisions, etc.
- 2025 'stand still': PackUK announced that there would be no changes to RAM v1.1 until the 2027 RAM release. This was implemented to allow time for producers to adapt to the new framework and get to grips with the reporting requirements.
- 2026: Core definitions and language clarity; review of v1.0 removals including fibre-based composites and flexible plastics.
- 2027: Rigid plastics; printing inks and security tags.
- 2028: Glass; fibre and board.
- 2029: Bioplastics and compostables.
- 2030+: Alignments with international standards and infrastructure.

Implications for biobased materials

Biobased materials like Woodly® fall under the 'other' category within the RAM framework. This often results in either an amber or red rating due to limitations in collection, sorting, reprocessing and and-market with no dedicated pathways or routes through the existing infrastructure. The roadmap signals an opportunity via the 2029 bioplastics/compostables review, which will explicitly account for materials such as Woodly®. However, whilst this focus will result in tailored decision trees, evidence standards for biobased recycling routes and integration into existing markets, the delay of at least 3 years places enormous financial burdens on businesses that rely on start-up funding or limited resources.

Illustrative fees and classifications

Under the UK EPR modulated fees for 2026/27, the categories of plastic and other apply predominantly for a material such as Woodly®, with some potentially aligning to paper if used as a lining or coating.

As shown by the table below:

- **Plastics**: £415-£545 range – flexibles face high red risk increasing cost gap vs other categories.
- Coatings advantage: ≤5% coating on fibre-based packaging worst case £250 fee saves £295 per tonne compared to plastics fees.

- **Other:** Woodly® is self-classified as a plastic and meets the criteria for plastics RAM assessments, removing cost saving opportunities of £275 worst case other RAM ratings

	Base fee	Green	Amber	Red	Woodly® fit
Plastic	£423	£415	£455	£545	High red risk
Other	£259	£205	£225	£270	Self-classified as plastic
Wood	£280	£410	£450	£540	Poor fit
Paper/board	£196	£190	£210	£250	≤5% coating (best case)
Fibre-based composite	£461	£475	£525	£630	≤5% coating (best case)

6.4 Rigid Plastics - RAM Classification[15]

The RAM v1.1 defines rigid plastics that maintain a defined shape and structural integrity under normal usage conditions, with common examples including:

- Bottles
- Pots
- Tubs
- Trays
- Tubes

Collection

Under the RAM framework collection criteria focuses on the kerbside collection of recyclable materials. Currently 100% of local authorities collect rigid bottles, and 88% collect pots, tubs and trays. There is no specification on the material type beyond the classification as a plastic and collection routes. Under Simpler Recycling, all local authorities in England will be required to collect rigid bottles, pots, tubs and trays. This means that the requirements for collection kerbside would be met for packaging meeting these criteria.

Sorting

The sorting criteria states that packaging must be at least 40 mm in two dimensions. RECOUP's experience of sorting infrastructure is that most sites operate with a minimum size sort of 50 mm^2 rather than the 40 mm requirement. Items measuring the 40 mm RAM requirement are still likely to fall into fines if they are <50 mm.

There is no requirement within the RAM for NIR sortation, or definition of which plastic materials are acceptable within the framework. Woodly® has been shown to be identified using NIR, with an adjustment of settings required to separate the Woodly® packaging into mixed plastics streams. The financial burden to implement NIR sortation setting was estimated to be around £15,000 to update the specifications on existing NIR optical sorting units.

Reprocessing

The reprocessing requirements within the RAM v1.1 specify PVC, Polystyrene, oxo-, bio, or compostable plastics and non-polyolefin foamed plastics as automatic RED. Several material specific reprocessing criteria are listed for PET, PP or HDPE rigid packaging.

Again there is no specific mention of reprocessing requirements or materials within scope.

Application

The application section lists a number of criteria that may be problematic for plastics recycling and may reduce the quality of the recyclates. The inclusion of any use of foils, or the inclusion of ethylene-vinyl alcohol (EVOH) exceeding 5% total packaging weight are an automatic AMBER.

There are a number of specific cases listed for PET, PP and HDPE rigids, bit no mention of any criteria leading to a RED rating for materials not listed.

Image: Sherbourne Recycling's Trommel Screen for Size Sorting

6.5 Flexible Plastics - RAM Classification[16]

The RAM v1.1 definition for flexible plastics is an item that changes shape when filled, common examples include:

- Bags
- Pouches
- Sachets
- Sleeves
- Lidding/top films
- Crisp packets
- Fruit nets

Materials specifically listed as examples are polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC) and metallised films. There are no specific exclusions listed.

Collection

To meet the collection at kerbside criteria, an item or component of packaging must be collected by 75% of local authorities. Currently RECOUP reports this between 14-16% of local authorities for kerbside collection of flexibles, with a mandate for all local authorities to collect flexibles by 1 April 2027 in England.

Take back schemes can be in scope, but such schemes are capped at AMBER within the RAM framework. It had been reported that all flexibles would be considered as RED unless sufficient evidence was provided to show that packaging was accepted and widely reprocessed within a take back scheme.

Sorting

For sortation the only criteria applying to flexible plastics are the inclusion of carbon black masterbatch, or aluminium foil layers triggering an automatic RED.

Reprocessing

The reprocessing criteria for flexibles is heavily polyolefin centric, with one defining factor being the density requirement of flexible packaging triggering an automatic RED if packaging density is greater than 1g/cm^3.

The requirements of material composition state that film packaging must contain a minimum of 80% by weight or polyethylene or polypropylene to be considered for reprocessing. Any item beyond these thresholds are an automatic RED.

This means that any non-PO films are considered as RED, including:

- Woodly®
- PET
- PVC
- PVDC

The inclusion of oxo-degradable additives also triggers an automatic RED.

Application

The application section lists a number of criteria that lead to an AMBER rating:

- Labels or sleeves of a different material

- Adhesives such as polyurethane exceeding 3% applied to PE
- Adhesives such as polyurethane exceeding 5% applied to PP
- Acrylic or natural rubber latex adhesives, as well as non-PE or non-PP based tie layers exceeding 5%.

RAM v1.1 Implications for Woodly®

It was clarified by PackUK after a consultation following a series of guidance documents and public statements suggesting AMBER status for flexibles can be achieved through take back schemes. PackUK confirmed that flexible packaging can only achieve an AMBER rating if there is evidence of all of the following:

- The take back scheme is accessible to at least 75% of the population within a 5-mile radius.
- Robust evidence demonstrates the traceability and recycling of the collected plastics.
- The take back scheme must meet all other requirements within the RAM protocol, with no brand restrictions and no purchase necessary.

This means that evidence would need to be gathered from each participating take back scheme to demonstrate compliance, the schemes cannot be aggregated collectively.

PackUK have specified clear criteria of accepted evidence of most of the points:

- Mapping software such as GIS and census data for population radius.
- Postal take back evidence can be demonstrated by explanation and evidence of the online collection service.
- No brand restrictions can be demonstrated using signage, website links and written declaration from the scheme operator.
- No purchase necessary can be demonstrated by written declaration and signage evidence.

Evidence of recycling is detailed, but the evidence required does not feel robust or achievable with any real certainty. The take back scheme must provide evidence that the materials have been reprocessed and not sent for disposal. This can be achieved using PRNs from accredited reprocessors.

PackUK guidance accepts documented evidence of end-market destinations for packaging waste including:

- Waste transfer notes and other documented evidence from accredited providers that the material has been reprocessed.
- Service providers that will be handling the contaminating material for disposal.
- The reprocessed materials end-product or use, such as packaging or composite construction materials.

Traceability limitations

The certainty that a specific producer's material has been recycled under PackUK guidance requires direct traceability from collection through to verified reprocessing. Generic PRNs or scheme coverage using GIS data can only present evidence of a collection radius but cannot guarantee custody of the material on the market.

In comingled collection systems, certainty of one brand's specific packaging volumes is metronomically improbable due to physical mixing of multiple brands and packaging types. Once consumer sold packaging enters a mixed batch of kerbside or take back collections, brands lose direct traceability of the materials. Sorting by NIR or density separates materials by polymer type or properties rather than origin. Aggregate data can be substituted from scheme-wide recovery rates and estimated using accredited PRN data from reprocessors. However, as no batch identification is possible using traditional sorting and reprocessing methods, certainty of origin is impossible.

Brand tonnage estimations

Scheme participation can be estimated based on brand sales combined with collection radius, sorting yields and reprocessing rates supported by PRNs.

- Brand tonnages: sales records and scheme uptake and collection volumes vs placed on market totals.
- Collection coverage: GIS 75% thresholds met.
- Sorting yields: MRF sorting trials and AI composition data.
- Reprocessing rate: PRN tonnages vs placed on market tonnages.
- Overall brand recycled estimates: brand % x sort yield tonnages x PRN tonnages.

RAM Ratings

Woodly® in rigid formats would be classified under RAM v1.1's plastics – rigid category, as it is a cellulose based polymer and sorts like a conventional rigid polymer.

Following the criteria for collection, sorting, reprocessing and end-markets, the most likely grading for Woodly® would be AMBER with today's infrastructure.

The current RAM reads:

RED

While technically capable of being recycled, other materials are not practically collected, sorted, or reprocessed at scale within the UK household packaging recycling infrastructure.

AMBER

No 'other' material is expected to exceed a RED rating. Producers may appeal this decision with the Technical Advisory Committee.

GREEN

No 'other' material is expected to exceed a red rating. Producers may appeal this decision with the Technical Advisory Committee.

RIGIDS

Stage	Woodly® fit	Woodly® outcome	Barriers
Collection	Widely kerbside collected <75% LA's	GREEN	Not classed as a target material
Sorting	NIR-detectable as a rigid plastic	GREEN/AMBER	Limited calibration with current MRF settings
Reprocessing	Compatibility with reprocessing at scale	AMBER	Tested compatibility in PO streams
End-markets	Limited end-market routes	AMBER	Compatible in mixed plastic PO routes
Overall		AMBER	Limited by reprocessing and end-markets

FLEXIBLES

Stage	Woodly® fit	Woodly® outcome	Barriers
Collection	Widely take back collected	AMBER	Suitable for take back schemes
Sorting	NIR-detectable and captured into flexible streams	GREEN	Limited calibration with current MRF settings
Reprocessing	<80% PO content; density >1g/cm3	RED	RAM qualifies PO flexibles; density <1g/cm3
End-markets	Limited end-market routes	RED	High fees mean energy recovery likely
Overall		RED	Limited by reprocessing and end-markets

COATINGS

Stage	Woodly® fit	Woodly® outcome	Barriers
Collection	Widely collected kerbside	GREEN	<10% weight non-paper
Sorting	Should not hinder sorting	GREEN	>40mm2
Reprocessing	<10% non-paper content	GREEN	<10% weight non-paper
End-markets	<10% non-paper	GREEN	<10% non-paper
Overall		GREEN	Potential to pass all criteria

FEE COMPARISONS

Format	Typical rating	Fee	Savings vs. Flexible Red
Rigid	AMBER	£455	£90 lower
Flexible	RED	£545	Maximum modulated fee
Coating	GREEN	£190	£265 lower

6.6 Viability Case Study Scenarios

Scenario 1:
Intergration into Mixed PP/PE Streams

- **Market share:** 2-3%
- **Additional MRF investment:** £15k-£50k (calibration of existing sorters)
- **Timeline:** 1-2 years
- **Economic viability:** Mixed flexibles (high gate fees)

Scenario 2:
Dedicated sorting line

- **Market share:** 8-10%
- **Additional MRF investment:** £150k-£500k (new installations)
- **Timeline:** 3-5 years
- **Economic viability:** Medium value (requires market acceptance and scaling)

Scenario 3:
Premium material value

- **Market share:** 5-8%
- **Additional MRF investment:** £150k-£300k (adjustments to existing lines)
- **Timeline:** 2-4 years
- **Economic viability:** Medium/high value (requires market acceptance and scaling)

7.0 Conclusions

- The RAM is currently insufficient in categorising bio-based materials, with numerous gaps within the criteria. It would be assumed that the criteria will be developed to close many of the gaps, limiting opportunities for bio-based materials.
- Trials and testing have shown that bio-based materials are unlikely to contaminate existing streams due to the strong infrared signatures of the materials (tested by RECOUP, TOMRA, Pellenc ST and Cyclos).
- Limitations within the take-back collection protocol mean that most schemes will not provide sufficient evidence for favourable RAM ratings, meaning that all flexibles may be graded as RED under the RAM unless changes are made in future versions[16].
- High gate fees and limited recycling infrastructure mean that it is not economically attractive for MRF operators to sort flexibles and trade for recycling, the most likely route is energy recovery.
- Due to limited infrastructure, some councils have hinted that they will not introduce kerbside flexible collections on time in 2027. Currently there is no incentive for them to do so and no penalty for non-compliance.
- Many MRFs were designed to sort materials being sold 15-20 years ago. The lead time from inception to commissioning of a MRF can be between 5-8 years, meaning sites in development now, may not be designed with flexibles in mind.
- MRF design in the UK favours disc screens and equipment with rotating shafts which are clogged by loose flexibles. This means that investment between £2 million and £4 million could be required just to removed bagged flexibles from the front end of the site as a mixed stream.

Image: Sherbourne Recycling's Mechanical AI Arm

7.1 Recommendations

1 Collaboration

The recycling infrastructure currently in place can be considered legacy infrastructure. In comparison to many industries, the recycling industry is still relatively young, it could be said when you look at the age of recycling compared to other industries, it is still in its toddler phase. In the early 2000's only around 58% of homes had access to some form of kerbside recycling. The first recycling schemes collected mainly paper and card, with metals, glass and later plastic bottles following.

In 1990, collaboration between organisations involved in the production and sale of plastic bottles led to the creation of RECOUP as a project to promote and facilitate plastic bottle recycling. The RECOUP project sponsored councils by providing collection equipment to councils to run take back schemes. RECOUP also facilitated the logistics for plastic bottles from collectors to reprocessors developing over 80 sorting facilities at a cost of over half a million pounds[17].

The BBIA represents UK companies producing and using bio-based, compostable and biodegradable materials, advocating for their growth and development through collaboration.

Drawing from the work of RECOUP in the 1990's and with their support the BBIA could spearhead similar momentum for bio-based materials. Teaming with RECOUP's experience and expertise in developing collection systems and infrastructure combined with the BBIA's knowledge of the bio-based reprocessors and compliance, the establishment of a bio-based initiative to fund bring-bank or kerbside collections promoting commercial viability and prove scalability of bio-based recycling in the UK.

2 Potential Opportunities

- **Redundant lines:** Historically MRFs have claimed that to start sorting new materials, they would need to switch out an existing collection stream. The implementation of DRS may lead to some MRFs collecting mixed plastics as their sole plastics stream, leading to one or two redundant sorting lines. These could be retrofitted and repurposed with sponsorship from the biobased industry to sort biobased materials.
- **Old Paper:** Paper collections have changed in recent years with a reduction in sales of newspapers and an increase in brown packaging led by online sales from companies like Amazon. This has led to some sites making changes to paper sorting, also leading to redundant lines. Such lines may be suitable for the capture of biobased materials including flexibles as a stream. Such collections could be

piloted and sponsored by the bio-based industry.

- **Infrastructure Investment:** The FlexCollect project predicted that gate fees of £650-£1,000 could be common due to the complexity of collecting and sorting flexibles. With limited known commitment in infrastructure development for the sorting and recycling of flexibles, there is an opportunity to drive the development of infrastructure in the UK to include biobased materials and reduce gate fees by turning residual materials into valuable recyclables.
  - Sorting of the waste fraction: PE and PP materials are currently the only flexibles considered target materials. Bio-based collectors could purchase the remaining waste fraction and sort bio-based materials, driving rebates and interest in moving harder to recycle laminates and multi-material films to bio-based materials.
  - Development of flexibles sorting: Purpose built sorting facilities for mixed flexibles could benefit from the rebates from sales of PE or PP materials, subsidising the sorting of bio-based materials from the remaining stream.
- **Case Studies and Surveys:** RECOUP created the Household Plastics Collection Survey highlighting the development of plastics recycling infrastructure year on year in the UK.

A bio-based survey, or set of case studies could promote the development and investment in infrastructure to support the improvement of sorting facilities to promote capture of bio-based and other hard to recycle items including small items (considered problematic and RED in the RAM).

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9.0 Glossary

AI Sorting/SamurAI/Recycleye: Robotic arms fitted with cameras that use artificial intelligence to recognise and sort different types of packaging on a moving conveyor belt; like a very fast, smart mechanical picker.

Amber Rating: A mid-level recyclability score under the UK's EPR rules. It means the packaging has some recyclability challenges. Producers pay a moderate fee. Better than Red, worse than Green.

Ballistic Separator: A machine that bounces waste items off a vibrating, angled surface. Flat 2D items (like film and paper) are carried upwards, while 3D items (like bottles) tumble downwards; allowing the two to be separated automatically.

BBIA: Biobased and Biodegradable Industries Association; the trade body representing UK companies that make or use materials derived from plants or biological sources rather than fossil fuels.

Biobased Material: A material made from natural, biological sources such as plants, wood, or agricultural crops, rather than from oil or gas. Woodly® is bio-based because it comes from wood pulp.

Biogenic Carbon: Carbon that was originally absorbed from the air by plants or trees as they grew. When bio-based materials are burned or decay, this carbon is released back into the atmosphere; meaning it does not add new carbon to the air the way burning fossil fuels does.

Bioplastic: A plastic-like material made from biological sources rather than petroleum. Some bioplastics are designed to biodegrade; others (like Woodly®) are designed to be durable and mechanically recyclable.

Carbon Black Masterbatch: A black dye or colouring agent used in some plastics that makes NIR sorting impossible, because it absorbs infrared light. Packaging containing it is automatically given a Red rating.

Cellulose: The natural fibre that gives plants and trees their structure. It is the world's most abundant natural polymer. Woodly's resin is made from wood cellulose that has been chemically processed.

CMR Chemicals: Chemicals classified as Carcinogenic, Mutagenic, or Reprotoxic; meaning they can cause cancer, damage DNA, or harm reproduction. Woodly states its materials are free from these.

Comingled / Co-mingled Collection: When different types of recycling (e.g. bottles, cans, paper, and plastic bags) are all collected together in one bin or bag, rather than being sorted separately by the householder.

DRS (Deposit Return Scheme): A system where consumers pay a small deposit on drinks bottles or cans at the point of purchase and get it back when they return the empty container to a collection point. Expected to launch in England.

EPR / pEPR: Extended Producer Responsibility for Packaging. A legal system (in force since January 2025) where businesses that put packaging on the UK market must pay for its collection and recycling. The fees vary depending on how recyclable the packaging is.

EUDR Compliant: Compliant with the EU Deforestation Regulation; meaning the wood used in Woodly's products can be traced back to forests that were not illegally or unsustainably cleared.

Extrusion / Injection Moulding / Blow Moulding: Manufacturing processes for shaping plastics. Extrusion pushes molten material through a mould to make films or sheets. Injection moulding injects it into a shaped cavity to make rigid items. Blow moulding inflates it like a balloon to make hollow items like bottles.

Flexibles / Flexible Packaging: Packaging that changes shape when squeezed or filled; such as plastic bags, crisp packets, bread bags, and cling film. These are much harder to recycle than rigid plastic containers.

FSC Compliant: Certified by the Forest Stewardship Council, an independent organisation that certifies that wood products come from responsibly managed forests.

Gate Fee: The charge a recycling or waste facility makes to accept a tonne of material. High gate fees make recycling expensive; low fees make it attractive. Flexible plastics currently attract gate fees of £650-£1,000 per tonne, making incineration (around £120/tonne) far cheaper.

Green Rating: The best recyclability score under the UK's EPR rules. Packaging with a Green rating is widely collected, sorted, and recycled, and attracts the lowest producer fees.

HDPE: High-Density Polyethylene; a common rigid plastic used for milk bottles, shampoo bottles, and similar containers. It is widely recycled and commands good rebates (up to £500-600/tonne).

Hyperspectral / MACH Hyspec: An advanced version of NIR scanning that captures a much wider range of light wavelengths, allowing it to detect subtle differences between materials, including some multi-layer plastics, that standard NIR would miss.

Kerbside Collection: The collection of recyclables directly from households, usually by a local council vehicle picking up from the pavement or doorstep. Only about 16% of UK councils currently collect flexible plastics this way.

MRF (Material Recovery Facility): A large sorting facility where mixed recyclables collected from households are automatically sorted into different material streams (e.g. paper, glass, rigid plastic, metals) before being sent on for reprocessing. There are approximately 99 in the UK.

NIR (Near-Infrared) Sorting: The main technology used to identify plastics at recycling facilities. A scanner shines infrared light onto packaging; different materials absorb and reflect it in unique ways, creating a fingerprint that the machine uses to identify and sort them. Current systems are calibrated primarily for fossil-fuel-derived plastics like PET, HDPE, and PP.

PackUK: The organisation appointed by the UK government to administer the Extended Producer Responsibility (EPR) scheme for packaging.

PE (Polyethylene): A very common plastic used in carrier bags, bin liners, and flexible film packaging. It comes in different densities: LDPE (low-density, soft and flexible) and HDPE (high-density, rigid). The most sought-after flexible for recyclers.

PET: Polyethylene Terephthalate; a clear, lightweight plastic commonly used for water and fizzy drink bottles. It is one of the most widely and efficiently recycled plastics, attracting rebates of around £200/tonne.
PFAS: Per- and polyfluoroalkyl substances; a group of man-made chemicals sometimes used in packaging for water or grease resistance. They are very persistent in the environment and have been linked to health concerns. Woodly states its materials are PFAS-free.

Polyolefin (PO): A family of common plastics made from oil or gas, including PE (polyethylene) and PP (polypropylene). Current UK recycling rules and infrastructure are heavily focused on sorting and reprocessing polyolefins. Woodly® is not a polyolefin.

PP (Polypropylene): A common plastic used in yoghurt pots, margarine tubs, bottle caps, and some films. Widely collected and sorted, though less valuable than PET or HDPE.

PRF (Plastics Recovery Facility): A specialist facility that receives bales of sorted plastic from MRFs and carries out further, more detailed sorting to produce cleaner material suitable for reprocessing. There are 7 operational PRFs for rigid plastics in the UK.

PRN / PERN: Packaging Recovery Note / Packaging Export Recovery Note. Documents issued by accredited reprocessors or exporters to prove that a tonne of packaging has been recycled. Used as part of the EPR compliance system.

RAM (Recyclability Assessment Methodology): The UK government's scoring system (managed by Defra and PackUK) that rates packaging from Red (hard to recycle) through Amber to Green (widely recyclable). These scores determine how much producers pay under EPR. RAM v1.1 was updated in April 2025; bioplastics are not expected to be formally reviewed until 2029.

Red Rating: The worst recyclability score under the UK's EPR rules. Packaging rated Red is considered hard or impractical to recycle and attracts the highest producer fees (up to £545/tonne for flexible plastics).

Reprocessing / Reprocessor: The step after sorting, where plastic is shredded, washed, and melted down to produce recycled pellets or flakes that can be used to make new products. A reprocessor is a company that carries out this step.

Scope 3 Emissions: Greenhouse gas emissions that occur in a company's value chain but are not directly produced by the company itself; for example, emissions from producing the raw materials it buys, or from customers disposing of its products. Many large businesses are now tracking and trying to reduce Scope 3 emissions.

Simpler Recycling: A UK government policy requiring all local authorities in England to collect a consistent set of materials for recycling. From March 2026, this covers dry mixed recycling. From March 2027, it extends to flexible plastics from all households.

Take-Back Scheme: A voluntary or retailer-run scheme where consumers return used packaging to a collection point (e.g. in a supermarket) rather than putting it in their kerbside bin. Under current rules, take-back schemes can at best achieve an Amber RAM rating for flexible plastics.

Trommel: A large rotating drum with holes of different sizes used at MRFs to sort waste by size. Small items fall through early; larger items travel further along. Broken glass and small hard-to-recycle items typically fall through the smallest holes**.**

Wind Sifter / Air Separator: A machine that blows a controlled stream of air across a conveyor of waste. Lightweight items like plastic films are blown into a separate stream, while heavier items fall through. Used to separate flexible plastics from heavier materials.

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