Biobased plastics

Advancing sustainability and reducing carbon emissions with biobased plastics

Introducing Sustain solutions

Introduction

Plastics play a crucial role in laboratory and biomanufacturing processes. Their unique properties not only enhance the efficiency and reliability of experimental procedures but also contribute to the scalability and cost-effectiveness of scientific research and biomanufacturing operations. At Thermo Fisher Scientific, we also understand the environmental impact of plastics, including their significant carbon footprint.

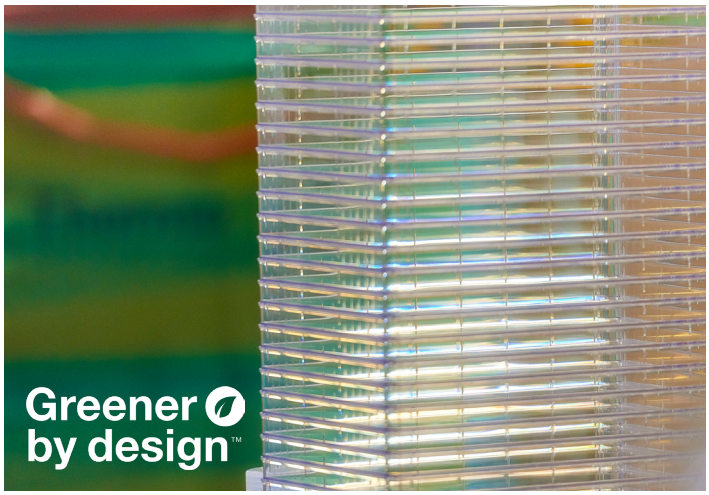
Our Sustain™ solutions represent a breakthrough in plastic-related product offerings. These products are manufactured from plastic resins derived from biobased feedstocks, rather than fossil fuel-based feedstocks, significantly reducing the product's carbon emissions footprint without sacrificing quality or performance. Sustain solutions do not require revalidation or retesting as the product is chemically and molecularly identical to the existing fossil fuel-based version. This is achieved using the mass balance approach, which helps ensure traceability through the supply chain. Our Sustain solutions come with documented carbon claims to support your climate targets.

This technical note provides an overview of our approach to incorporating biobased plastics and highlights the benefits in laboratory and biomanufacturing settings.

Reducing the carbon footprint of plastics

There are various approaches to reducing the carbon footprint of plastic products, such as minimizing the amount of plastic used, increasing recycled content, or sourcing plastic resin from electrified facilities. Using biobased feedstocks, also referred to as bio-circular feedstocks, is an impactful and complementary strategy to reducing environmental impacts. Common biobased feedstocks include used cooking oil and agricultural residues.

Biobased feedstocks are biological in origin and grown using photosynthesis, a natural form of carbon capture. The amount of carbon sequestered by biobased feedstocks is referred to as "biogenic removal," which often exceeds the carbon emissions footprint of the raw materials and manufacturing of the resulting plastic polymer.



Our approach to biobased plastic products

Our Greener by design™ program centers on maintaining product performance and quality while also delivering a lower environmental footprint. Transitioning from fossil fuel-based feedstocks to biobased feedstocks allows us to achieve both priorities. While alternatives such as mechanically or chemically recycled content offer circularity benefits, they may come with a higher carbon emissions footprint and are not necessarily identical to the virgin fossil fuel-based equivalents. Biobased feedstocks are also currently used for a wide variety of standard plastics such as polyethylene terephthalate (PET), polypropylene (PP), polyethylene (PE), and polystyrene (PS).

Biobased plastics is a generic term that can include plastics made from biomass from renewable resources and may be biodegradable or compostable, and/or produced through biological processes. Thermo Fisher's biobased plastic products are made from renewable resources and are not biodegradable to help ensure they are molecularly identical to their fossil fuel-based equivalents.

It is important to evaluate the sourcing practices of biobased feedstocks to avoid negative agricultural impacts and competition with food production. Thermo Fisher sources second-generation feedstocks for our biobased Sustain solutions. First-generation feedstocks are derived from food crops like corn or sugarcane, which can create competition with food production and raise concerns about food security, land use, water consumption, and fertilizer application. In contrast, second-generation feedstocks are sourced from non-food biomass such as agricultural residues, paper industry waste, used cooking oil or forestry waste. This approach minimizes or eliminates competition with food supplies.

The mass balance approach to product manufacturing

We use biobased materials supported by the mass balance approach for traceability in the production of our Sustain solutions. This helps ensure our biobased plastics deliver the same performance and quality as their fossil fuel-based counterparts. Our feedstock chain-of-custody is documented across the entire value chain and certified by the globally recognized International Sustainability and Carbon Certification (ISCC) system.

As illustrated in Figure 1, the mass balance approach is a fundamental concept that allows for the mixing of different feedstocks in the production of plastic resin, while accurately tracking the origin, flow through the supply chain, and quantity of the different materials. By utilizing this approach, it becomes possible to generate accurate claims for the final plastic product and associate the resulting reduction of carbon emissions.

There are several advantages to the mass balance approach compared to alternative approaches for incorporating biobased resins in plastic products. These alternatives include *physical segregation*, which requires separate manufacturing production lines and storage facilities for biobased and conventional resins, and *controlled blending*, which combines different types of resins or materials in precise proportions to achieve specific properties in the final product during the manufacturing process.

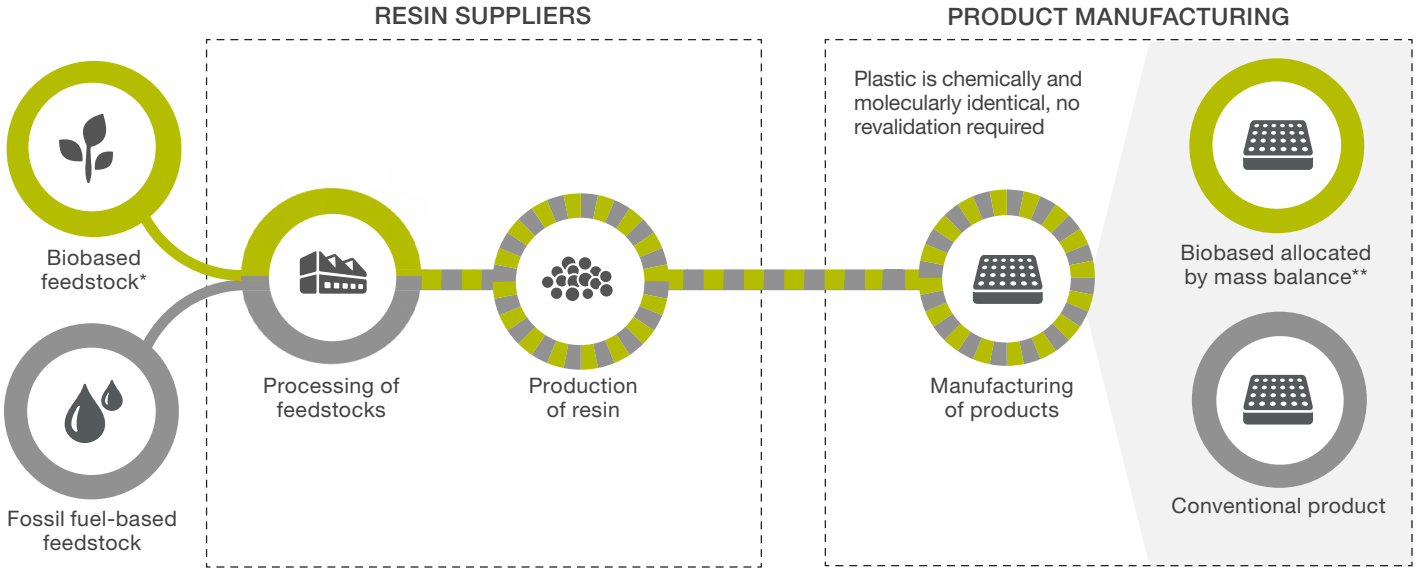
Advantages of the mass balance approach:

- **More scalable:** To support the transition away from fossil fuels, biobased feedstocks will need to be scaled significantly. Mass balance enables growth to keep up with supply and demand using existing infrastructure.
- **More flexibility:** For some products, the proportion of biobased and fossil fuel-based feedstocks can be adjusted to fit customer needs, allowing you to find the right balance between cost and reducing environmental impact
- **More cost-efficient:** By avoiding the need to build separate production lines and storage facilities for biobased and fossil fuel-based resins, companies can reduce expenses and operational costs. This efficiency accelerates the adoption of biobased feedstocks.
- **Same quality and performance:** No change to product specifications, eliminating the need for product revalidation.

Although the mass balance approach may result in products containing an unknown physical percentage of biobased feedstock, it provides a robust chain-of-custody methodology for traceability.

Overall, the mass balance approach offers a practical and scalable solution for incorporating biobased resins in plastic products, balancing the need for sustainability with the realities of industrial manufacturing.

Figure 1. By implementing a mass balance chain-of-custody approach, companies can track different feedstocks across the supply chain from source to the final product manufacturing. The ISCC PLUS certification enables accounting to match the input amount of biobased feedstocks with the outputs, such as final products and waste.



* Second-generation feedstock, which refers to crops, plants, or wastes not suitable for human or animal consumption

** Biobased feedstock allocated to selected products; ISCC PLUS certification allows users to substantiate sustainability claims

ISCC PLUS certification

ISCC PLUS certification is a comprehensive scheme under the International Sustainability and Carbon Certification (ISCC) system that covers the sustainability and traceability of biobased products. It sets standards and provides certification for various sectors, including agriculture, food, feed, chemicals, and biofuels. The ISCC aims to promote sustainable production and trade while addressing environmental and social aspects.

The ISCC PLUS system certifies the chain of custody and helps ensure traceability throughout the entire supply chain, from agriculture to the finished product, through independent third-party audits. It encompasses products made from waste, residues, and recycled materials, providing assurance that certified products meet stringent sustainability criteria.

Thermo Fisher utilizes the ISCC PLUS system to help ensure robust chain-of-custody tracking of biobased material from supplier to the final product. Our manufacturing sites are independently audited and ISCC PLUS certified for each of the biobased materials used.

Learn more about ISCC and ISCC PLUS

ISCC
International Sustainability & Carbon Certification

Summary

Thermo Fisher's Sustain solutions offer the same quality and performance as fossil fuel-based plastics but with a lower carbon emissions footprint. By integrating biobased and fossil fuel-based resins at the monomer level and using the mass balance approach, we maintain high performance while reducing reliance on fossil fuels. This method supports investment in renewable feedstocks and ensures scalable use for a sustainable future in plastic manufacturing.

Choosing Sustain solutions allows researchers to achieve accurate, reproducible results while contributing to a greener future and demonstrating a commitment to responsible sourcing of laboratory plastics.

Furthermore, the mass balance approach supports the transition to a circular economy. By integrating biobased resins from second-generation feedstocks into existing production processes, it encourages the gradual replacement of fossil-based materials with renewable alternatives, promoting sustainability and reducing the environmental footprint of plastic products.

Learn more at **thermofisher.com/lowcarbonplastics**