FACTSHEET

Bio-based Products

– Examples, Facts and the Role of Concise Labelling and Certification

3co-project.eu

What are bio-based products (BBPs)?

Bio-based products (BBPs) are becoming increasingly popular as consumers become more aware of the environmental impact of industrial production processes. Additionally, consumers are increasingly concerned about the climate-damaging effects of releasing carbon dioxide (CO_2) into the atmosphere due to the tapping of fossil resources for material and product production. BBPs are often more sustainable than conventional fossil-based products[1] since they help reduce the reliance on fossil carbon and support the transition to a circular economy.

Still, BBPs face several myths and misconceptions that can confuse consumers and hinder sustainable purchasing decisions. One instrument to support consumer choices is trustworthy labelling and certification based on reliable sustainability claims. By providing clear and concise information on a products sustainability performance, product-labels can successfully counteract greenwashing and increase consumer trust. Currently, the EU strives to standardise labelling and certification as there is a significant need to educate consumers and certification bodies, and inform brands and producers on this topic.

This factsheet provides a comprehensive overview of the characteristics of BBPs and critically examines prevalent misconceptions. It also offers evidence-based insights into the environmental benefits of and facts on BBPs.

Info

Bio-based

According to the official European standard, bio-based means “derived from biomass”. This refers to the source of carbon in a product which originates from biological instead of fossil carbon sources such as crude oil, coal or gas. BBPs can be made entirely or partially from biomass, which originates from plants, marine and freshwater organisms or animals.

Examples for BBPs

BBPs offer a wide range of applications, from packaging materials and clothing to household cleaning products or personal care items. Of course, consumers are familiar with bio-based solutions like log cabins and wooden furniture, cotton or linen textiles, paper and fries forks made from wood, or leather from animal skins and drinking straws from – well – straw.
However, supermarket-shelves hold plenty of lesser-known products of biological origin that cannot be recognised at first glance, e.g. bio-based plastics. The following overview introduces a variety of currently available and future bio-based consumer products:

Textiles

- Textiles, yarn and fibres, e.g. from milk, wood cellulose, hemp, leaves, algae, fungi or plant roots
- Artificial leather from plants, fungi and fruit residues (e.g. apple or pineapple peels)
- Textile dyes from agricultural residues

Beauty Care and Cleaning

- Ingredients in cleaning products such as natural enzymes used as dishwasher detergent
- Ingredients in cosmetics, e.g. plant-based oils or bio-based exfoliates
- Nature-identical fragrances and flavours such as raspberry flavour derived from microbial fermentation

Household Goods

- Bottles and cosmetics packaging made from the sugar-based bioplastic PEF, an alternative to PET
- (Toilet) paper from grass, fruit residues, hemp or other alternative fibres
- Vinyl records from sugar cane
- Wound bandages derived from sheep wool
- Glues made from feathers
- Mattress foam derived from sustainable crops like corn, soybeans, sunflower seeds, or castor beans
- Fibre-based lids for single-serve coffee capsules
- Plant pots from bio-composites based on, e.g. hemp, grass, or water hyacinths

Housing

- Bio-based insulation materials such as granulated cork, mats made from hemp, fleeces made from sheep's wool
- Tiles grown with the help of bacteria
- Wall finishing material crafted from corn waste
- Construction materials made from hemp, timber, straw, or reed

Toys

- Toys made from bio-composites and bioplastics, e.g. from sugar cane

Info

BBPs and Mitigation of Climate Change

Fossil-based products are based on finite, below-ground resources such as crude oil, coal and gas, whereas BBPs are made from renewable biological resources like plants, organic waste and algae. The extraction of fossil resources, the manufacture of materials and the incineration of a product at the end of its life increase CO_2 emissions in the atmosphere and therefore contribute to climate change.

BBPs on the other hand are an efficient solution to counteract global warming as bio-based materials emit fewer greenhouse gases over their life cycle than their fossil counterparts[1].

Plants bind atmospheric CO_2 in their tissue, which is then used as a biological carbon source for BBPs. When a BBP is disposed of, in some cases the material can be recycled and used for new materials, or the carbon is released as CO_2 to the atmosphere by burning the BBP. In this way, a sustainable and circular EU bioeconomy is supported.

If atmospheric CO_2 is used for the production of durable products such as building materials, the BBP can even become a way to store carbon for decades, or even centuries if well maintained.

Facts about BBPs

The Sustainability of BBPs

Compared to fossil-based products, bio-based solutions may offer sustainability benefits, e.g. by reducing dependence on fossil carbon and lowering greenhouse gas emissions per product. To ensure consumer trust, it is essential that life cycle assessments and sustainability certifications are carried out to prove sustainability and eco-friendliness of BBPs. Respective labels should be trustworthy and concise so that consumers receive clear messages and comprehensible information to be able to distinguish between greenwashing and true sustainability and eco-friendliness[2].

BBPs Become More Available and Prices are Decreasing

The availability of bio-based products is increasing as technology improves and market demand grows. Furthermore, although bio-based products have historically been more expensive due to production costs, technological advancements and economies of scale are improving cost competitiveness. As demand and production capacity increase, prices are expected to continue decreasing, and some products are already price-competitive with fossil-based solutions. Nowadays, many store chains offer bio-based products as standard solutions for all consumers. Just have a look around and keep an eye out for ecolabels!

BBPs are Durable and High-performing

The performance and characteristics of BBPs have evolved significantly over the past decade, with many now matching or even exceeding the performance of their fossil-based counterparts. Furthermore, many polymers or chemicals derived from biomass and used for BBPs such as plastic bottles, cleaning agents or dissolvents are chemically identical to those based on fossil carbon. Therefore, BBPs perform as good as conventional products, while often showing clear sustainability benefits.

BBPs do not Consume much Agricultural Land

In fact, currently only 5 % of agricultural biomass world-wide is used for the production of bio-based materials, while 75 % is needed for animal feed, e.g. for the production of dairy and meat[3]. Therefore, eliminating the global overconsumption of meat allows for further increase of the production of BBPs. Regarding food crops, often these are high-performance variants of certain plants, e.g. soy, rice, sugar beet, that are bred for high yields on small areas which prevents excessive land-use for the production of BBPs.

Additionally, the use of marginal land (i.e. land that is currently not used for agricultural or any other purposes) for the production of BBPs has few associated negative environmental and socio-economic impacts[4]. Furthermore, biological waste materials can be tapped as resource reducing the impact on land use and deforestation.

BBPs are well Monitored for Safety

Bio-based products are generally considered safe in terms of health aspects[5], but their safety depends on several factors, including the specific product, its intended use, and how it is processed and handled. Biological feedstock might contain natural toxins, allergens and microbial contaminations depending on their origin. These need to be monitored and – if necessary – excluded before further processing. Similar to fossil products the production process can hold additional risks depending on the application of chemicals. The term „bio-based“ refers to the source of the raw materials, not the absence of chemical use in the process. Nevertheless, regulatory standards and certifications ensure these products meet safety requirements for specific applications, such as food contact, cosmetics, and medical uses. If BBPs are biodegradable or compostable and disposed of properly, pollution of the environment by microplastics can be prevented, benefiting the health of people and nature.

BBPs and Biodegradability

Many consumers assume that bio-based means biodegradable. This does not apply to all bio-based products and should only apply to those for which biodegradation is the best end-of-life solution. In fact, there are both fossil-based and bio-based products that can be biodegradable, since the biodegradability of a product depends on its chemical structure, not solely on its (biological) origin.

There is also a difference between biodegradability and compostability[6]: Biodegradability means that a material can be broken down by microorganisms in various natural environments. Compostability, on the other hand, requires specific conditions – such as heat, humidity, and oxygen – that are typically found in industrial composting facilities. BBPs should therefore carefully be checked for sustainability labels indicating whether the product is biodegradable, compostable or should be disposed of differently. In general, consumers should not throw away products in nature, even if there is a statement of biodegradability as this can cause problems to the local environment.

BBPs do not Compete with Food and Feed

While many bio-based products are derived from food crops, others utilise non-food biomass, biological waste (e.g. used cooking oil) and agricultural and forestry residues[7]. This minimises competition with food production and promotes the use and valorisation of waste materials. Moreover, according to the World Food Programme in 2023, the relevant causes for food insecurity are climate change, conflicts, extreme inequalities in wealth distribution, heavy dependence on food imports from industrial countries, overconsumption of meat, losses along the value chain and the impact of the COVID-19 pandemic, whereas competition between biomass uses is not mentioned. In fact, using food and feed crops for chemicals and materials has the potential to benefit local and global food security and to mitigate climate change.[8]

Conclusions

- Switching to renewable BBPs is a crucial step towards a more sustainable national and international bioeconomy that also is independent from fossil resources from outside the EU.
- By understanding the facts about BBPs, consumers and industries can make informed choices that contribute to environmental sustainability and economic development.
- Concise labelling and certification for BBPs should follow clear guidelines regarding layout and the provision of information. They ensure that consumers are not mis-guided by unsubstantiated green-claims and increase consumer trust.
- Labels and certificates can support consumers in making sustainable purchasing decisions in favour of bio-based solutions.

BBPs in EU-Regulation

The European Union (EU) has implemented several laws, regulations, and directives to promote the use of bio-based products and biological feedstock. These aim to support sustainability, innovation, and economic growth while ensuring safety and environmental protection.

Key frameworks include:

Bioeconomy Strategy

Aims to develop a sustainable and circular bioeconomy in Europe by encouraging the use of bio-based resources, reducing dependency on fossil fuels, and promoting innovation in bio-based products.

Circular Economy Action Plan (European Green Deal)

Emphasises the role of bio-based products in creating a circular economy, focusing on sustainable resource management, waste reduction, and the development of sustainable products and processes.

Common Agricultural Policy (CAP; Regulation (EU) 2021/2115)

Supports sustainable agricultural practices and encourages the use of agricultural residues and other non-food biomass for bio-based products and bioenergy.

Single-Use Plastics Directive (Directive (EU) 2019/904)

Encourages the use of bio-based and biodegradable alternatives to single-use plastics to reduce plastic pollution and promote sustainable products.

The 3-CO Project

The 3-CO project aims to improve the sustainability performance and competitiveness of bio-based systems and focuses on consumer-oriented labelling options for sustainable industrial BBPs. Based on the assessment of ten different bio-based value-chains[9], 3-CO will develop actionable guidelines for label design for label and certification scheme owners that reflect consumers' and other stakeholders' needs.

The project investigates consumer behaviour towards BBPs[10] which serves as a basis for the development of digital solutions to support better-informed decision-making processes of consumers. Also, the objective of 3-CO is to provide best practices in sustainability communication among label and certification schemes[11] as well as policy recommendations on deploying social measures.

By involving consumers and other stakeholders from the bio-based industries, 3-CO makes sure to identify and select relevant certification criteria and that information presented on the labels is not only verified but of value for consumers and the environment.

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