Bio-based packaging

Heading towards greater sustainability

Sustainability affects everyone – consumers and manufacturers, retailers and packaging suppliers. Especially packaging manufacturers from the plastics industry are required to take action. The plastics industry is being fiercely criticized – unjustly to a certain extent, since more and more manufacturers are focusing on sustainable packaging solutions made from renewable raw materials, which can very well consist of plastic. Bio-based packaging in particular has the potential to pave the way to more sustainable packaging step by step.

A wide variety of terms such as bioplastics, biopolymers, bio-based and biodegradable plastics are used in the discussion about sustainable plastics. Some of these materials have existed for well over 100 years: celluloid, for example, was already produced from cellulose in 1855 and is regarded as one of the first plastics ever. In fact, fossil, non-renewable raw materials such as oil or natural gas did not enter the packaging industry until the late 1940s. Today, efforts to produce plastics completely or at least partially from renewable resources are again increasing.

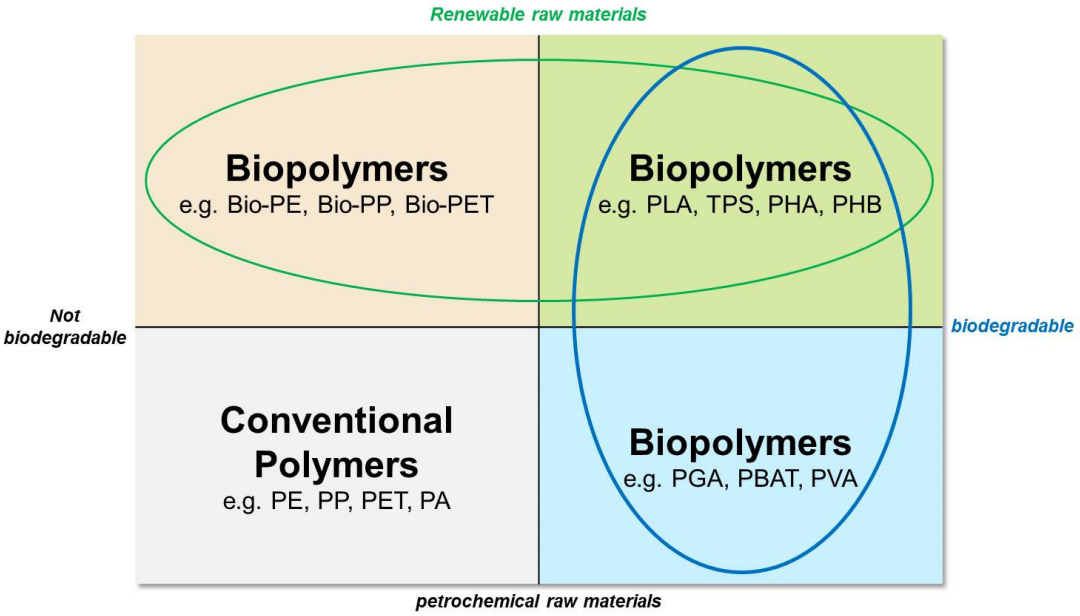


Fig. 1: Bioplastics at a glance (graph based on european-bioplastics.org)

Shedding light on the definition jungle

The most important distinguishing features are the origin and properties of the plastics. The raw materials used are either petroleum-based or made from renewable resources. Furthermore, the durability of the plastics plays an important role: they are biodegradable or not, as shown in figure 1.

Biopolymers (or bioplastics) is the general, chemical term for bioplastics. In principle, it comprises three categories: degradable petroleum-based biopolymers, degradable and predominantly bio-based, and non-degradable bio-based biopolymers. Hence, bioplastics are bio-based, biodegradable or both at the same time. It is important to distinguish between these two circumstances:

- **Bio-based plastics** partly consist of the same chemical base as traditional fossil plastics but are produced to a large extent or even completely from renewable raw materials. Examples are Bio-PE or Bio-PET. They are chemically identical to the petroleum-based variants. The term bio-based therefore says something about the origin of the material from which the plastics are made. This does not necessarily mean that the plastics are also biodegradable.

- **Biodegradable plastics**, on the other hand, have the properties of biodegradability. Biodegradation takes place in a chemical process in which microorganisms present in the environment convert the plastic into natural substances such as water, carbon dioxide, salts and biomass. Biodegradable plastics can be either petroleum-based or bio-based.

In order to avoid misunderstandings, it is therefore recommended to speak of bio-based plastics rather than bioplastics when referring to plastics that are produced to a significant extent or completely from renewable raw materials. The newer bio-based plastics can be divided into those based on chemically innovative polymers such as polylactides (PLA) or polyhydroxyalkanoates (PHA) and so-called drop-ins, i.e. known polymers where fossil raw materials have been completely or partially replaced by renewable raw materials (e.g. bio-PE) in the production process.

Production and eco-balance

The most important raw material source for bio-based plastics is plant biomass, e.g. cellulose and lignin from wood; starch from corn, wheat and potatoes; sugar from sugar beet or sugar cane; oils from rape, sunflowers and soya or from exotic oil plants such as oil and coconut palms, which are converted into “green” ethanol.

Fig. 2: The life cycle of bio-based polyethylene (© Sanner GmbH)

The bio-based plastics available on the market now cover a broad and technically demanding range of applications. In some areas, petrochemical plastics can easily be replaced by bio-based plastics. This is particularly true for those bio-based plastics whose chemical structure is identical to the one of conventional petroleum-based plastics, such as Bio-PE and Bio-PET. Moreover, Bio-PE can be modified so that it has comparable properties to PP.

Bio-based plastics conserve fossil resources and thus contribute to future security of supply. At the current stage of development, they contribute to climate protection by generating a reduced ecological footprint, i.e. lower CO_2 emissions, compared to petroleum-based plastics. During the growth phase, plants (e.g. sugar cane) absorb CO_2, which is stored by the further processing into ethanol and polyethylene.

Areas of application

The areas of application of bio-based plastics are manifold: from bottles and disposable tableware, toys and car parts to flowerpots and coffee capsules, bio-based plastics are advancing into all areas of life. Of course, this also applies to films and packaging solutions. However, the requirements for product protection are particularly important for drugs and food packaging. How high must the oxygen barrier be? How much moisture protection is necessary? What is the shelf life of a product that is packaged with bio-based plastics?

An example: Sanner BioBase®

With Sanner BioBase®, Sanner has now introduced the first bio-based packaging made of renewable raw materials for effervescent tablets to the market, thus breaking new ground in the development of sustainable packaging solutions.

The Sanner BioBase® packaging mainly consist of renewable raw materials. They are produced according to the “good agricultural practice”, which is ensured by the “Suppliers Code of Conduct”. The raw material suppliers commit themselves to good business practice, amongst others regarding the incineration of sugar cane, respect for biodiversity, ecological practices, human rights and working conditions.

The effervescent tablet packaging consists of 90 percent renewable raw materials and is recyclable. The properties of the entire packaging are comparable to those of conventional effervescent tablet packaging – and are sometimes even better as far as the water vapor barrier is concerned. The shelf life of the tablets can be extended thanks to higher H_2O barrier properties. In terms of handling, Sanner BioBase® offers consumers a high-quality look and feel. The tablet tube can be printed or provided with an IML label.

The eco-balance of the new Sanner BioBase® effervescent tablet packaging was assessed by a recognized independent company[1]. The properties of a tube with a diameter of 27 mm and a capacity of approx. 15-20 effervescent tablets was compared to a petroleum-based counterpart. The methodological basis is the “Product Life Cycle Accounting and Reporting Standard” of the Greenhouse Gas Protocol. The procedure in accordance with this international standard ensures the plausibility, precision, and credibility of the balancing.

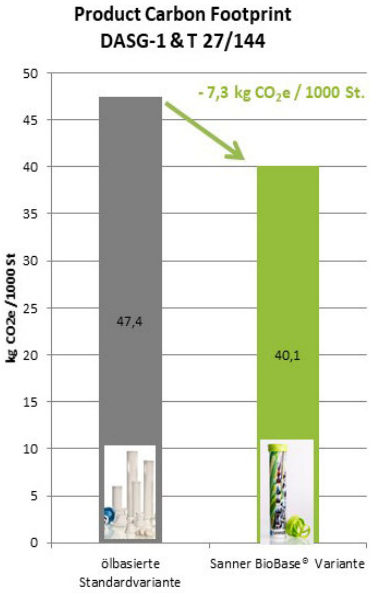
The present product carbon footprint was determined according to the “Cradle to Gate” approach (from material procurement to the factory gate) and comprises the life cycle phases of material procurement, pre-processing of the material, and production of the packaging. The use and disposal phase of the packaging was not considered, as this is not within the company's sphere of influence.

The emission sources taken into account therefore include:

- Material procurement and pre-processing
    - Raw materials used for tubes and closures
    - Transport of the above-mentioned raw materials from the supplier to the production plant
- Energy consumption during production
    - Raw materials used for packing the tubes and closures

[1] CO2OL – ForestFinest Consulting GmbH, Bonn

Compared to conventional plastics, the Sanner BioBase® effervescent tablet packaging achieves a reduction in emissions (in kg CO_2 equivalent, CO_2e) of around 15 percent.



This corresponds to approx. 7.3 tons of CO_2e per million tubes. This in turn corresponds approx. to the CO_2e emissions of four mid-range cars per year or the average CO_2e emissions of one person per year.

Present challenges

Bioplastics account for only one percent of the amount of plastics produced annually. However, demand is growing, and new biopolymers are being developed or existing ones optimized. In a market survey carried out in cooperation with the nova-Institute, European Bioplastics assumes that the worldwide production of bioplastics will increase from 2.11 million tons in 2019 to approx. 2.43 million tons in 2024. Bio-based plastics will account for almost half of this amount.

The development of bio-based plastics is a very dynamic process, which currently holds a huge potential for optimization. The production costs are still considerably higher than those of conventional plastics. The processing of all materials has not yet been finally defined. The challenge is to further develop the production, processing and marketing structures along the entire value chain to ensure a balance between economic efficiency and security of supply, while taking sustainability aspects into account.

Outlook

Society, economy and politics determine which plastics and products made from them will be marketed in the future. The higher the appreciation of climate-friendly and environmentally compatible products, the more important and larger the role of bio-based plastics will be. Functionalities such as barrier properties, gloss, transparency, mechanics or processing will play an important role. Technical optimizations will be particularly effective when larger quantities of bio-based plastics gradually come onto the market.

However, there are far more criteria to consider when talking about sustainable packaging: how do we want to recycle in the future? How can we avoid weight and unnecessary packaging without compromising product protection? How can new concepts be integrated into the three pillars of sustainable action (ecological, social and economic)? Technical revolutions do not happen overnight. Accordingly, not every product and packaging has to be made of bioplastics right away. It is much more important to take the first steps and start with the right products. The new Sanner BioBase® packaging shows how this can be done.

Let’s take the next steps together!

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About Sanner

Based in Bensheim, Germany, Sanner GmbH was founded in 1894 and is now in its fourth generation as a family-owned enterprise. Sanner develops and produces high-quality plastic packaging and components for pharmaceutical, medtech, diagnostics and healthcare products. As the world's leading manufacturer of desiccant closures and effervescent packaging, Sanner produces four billion plastic parts each year for standard and customized packaging solutions. With 550 employees in Germany, China, Indonesia, India, Hungary, France and the U.S., the company generated annual sales of approx. 85 million euros in 2019.

For further information, please visit www.sanner-group.com.