Julabo
THE TEMPERATURE CONTROL COMPANY

TECHNICAL REPORT

BIO-BASED PLASTICS – REDUCED ENVIRONMENTAL FOOTPRINT FOR THE FOOD INDUSTRY

The food industry is looking for and researching sustainable packaging alternatives that ensure the safety of food and ideally even extend its shelf life. Bio-based plastics are one such way to protect the environment while reducing food waste. Consumer interest in sustainable alternatives to fossil-based plastics is also steadily growing. There is a realistic opportunity for food and beverage manufacturers to reduce their environmental footprint.

There are already countless examples of bio-based plastics that can help the food industry achieve ambitious, environmentally important goals: packaging for chocolate bars made from potato starch, recyclable drink bottles partly made from plant-based raw materials, bags and containers for fruit, vegetables, meat, eggs, and dairy products, or sustainable packaging for coffee pads. This also applies to other consumables such as cups, straws, and bowls. In addition to the savings in carbon dioxide and petroleum, these materials usually biodegrade more easily.

DEFINITION: BIO-BASED PLASTICS

But what exactly are bio-based plastics? These are materials obtained from renewable or regenerative biological sources. The underlying biomass is derived, for example, from vegetable oils, corn starch, or pea starch.

"Biodegradable" means materials that can be broken down into their components by means of microorganisms. Plastics that can be composted, for example, belong to a subcategory of these materials that can be biodegraded within a certain period of time and under certain conditions. In the food industry, all these materials are naturally subject to specific legal regulations to ensure consumer safety.

However, it is important to differentiate between bio-based plastics and bioplastics. Bioplastic is either bio-based or biodegradable, or both. Bio-based plastics, on the other hand, are materials made from biomass.

PRECISE TEMPERATURE CONDITIONS FOR HIGH-QUALITY RESULTS

To convert the underlying biomass into bioproducts or bio-based plastics, several different process steps are required. These include hydrolysis, i.e. the breaking down of chemical bonds, and fermentation. In these processes, ideal environmental and therefore temperature conditions often play a crucial role in achieving high-quality results. For example, in the hydrolysis of sucrose, it is necessary to maintain a specified constant temperature over a certain period of time. With the corresponding temperature control systems, temperatures can not only be monitored during these processes, but also precisely controlled and maintained. With temperature control technology tailored to the relevant application and the associated automation, processes can be designed much more efficiently.

EXAMPLES OF BIO-BASED PLASTICS

The first bioplastics came from agricultural sources. Soy proteins, starch, cellulose, and sugarcane can be used to produce biomass, which in turn can be used to produce polymers. This is how, for example, polylactic acid (PLA) is produced, which often forms the basis for bio-based plastics for food packaging. This lactic acid is produced by fermentation of waste such as sugar beet or sugarcane. Although production is not necessarily economical, it has barrier properties comparable to those of conventional fossil fuel-based plastics.

Another example of a bio-based plastic is lignin. The organic polymer can enhance the barrier properties of plastic products to protect contents against, for example, UV rays. The material is also easily biodegradable and is ideal for the production of bags and packaging films. Bio-polyethylene terephthalate (Bio-PET) has the same molecular structure as the equivalent based on fossil sources, but plants and biomass are used for its manufacture. This material uses less carbon and is easier to recycle due to its renewable components.

These are some of the many options. Industry and research are also looking for further innovation opportunities. Plastics produced by microbial fermentation belong to the first generation. A new generation made from by-products of food, wood, and sawdust is entering the market. Various areas of research are also focusing on the potential of algae. With the help of targeted genetic modifications, new algae strains are intended to help optimize the properties of poly-based plastics.

CONCLUSION

Food manufacturers looking to reduce their ecological footprint have found a viable alternative in biodegradable and recyclable bio-based plastics. These are often similar in their properties to fossil fuel-based plastics and can even be improved in terms of food shelf life. However, they do not require petroleum and are easier to break down or reuse.

As with all industrial biotechnological processes, the right conditions must be established for the corresponding conversion of renewable raw materials. Precise temperature control using temperature control systems can make a crucial contribution to product or research success.

We support you with technology tailored towards your specific bioreactor or fermenter needs. With the right modular extras, there are essentially no limits to the customization options and successful bio-based plastic production.

Please contact us if you have any questions or would like a more in-depth consultation.