Julabo
THE TEMPERATURE CONTROL COMPANY

TECHNICAL REPORT

FROM RENEWABLE ORGANIC RAW MATERIAL TO BIO-BASED CHEMICAL

For some time now, important steps have been taken around the world to move from a fossil fuel-based economy to more sustainable options. More sustainable options consist of bio-based chemicals, which in turn can be obtained from renewable biological resources. Chemicals are already used in many aspects of everyday life, but are set to become an even more important part of the global energy supply in the future.

Bio-based chemical

WHY ARE BIO-BASED CHEMICALS BECOMING INCREASINGLY IMPORTANT?

There are numerous reasons for the growing pressure to move away from fossil fuels. Oil, gas, and coal may reach their production peak in the near future, and as a result, prices will continue to rise. Many countries want to reduce their own dependence on fossil fuels and diversify their energy source portfolio.

In the face of increasingly threatening man-made climate change events, more and more nations are being forced to reduce the amount of greenhouse gasses emitted without directly restricting prosperity and freedoms too much – a goal that is coming within reach with biofuels, for example.

In general, the conversion of these biological resources in the form of waste, residues, by-products, and value-added products such as food, animal feed, and all other bio-based products opens up enormous potential for new, innovation-driven economic growth.

DEFINITION: BIO-BASED CHEMICALS

Bio-based chemicals are derived from renewable or regenerative organic raw materials. These are mostly forestry and agricultural products that can be used outside of food production to manufacture cellulose fibers or cosmetic and cleaning products, for example. The industrial and energy sector should be no exception in the present and future, as alternative energy sources such as biogas or bioethanol can also be obtained from organic raw materials.

The starting products are often oil plants, cereals, or legumes. The particularly valuable or value-adding plant elements include polysaccharides, oils, fats, lignans, phenolic acids, glucosinolates, etc. In order for enzymes or microorganisms to access the components of these bio-raw materials, manufacturers must apply thermal and chemical processing steps.

EXAMPLE: POLYLACTIC ACID

Depending on the structure, properties, and composition of these diverse raw materials, diverse processes are necessary. Raw materials can be waste, wheat straw, textile residues, sugarcane, or residues from sugar production, also known as bagasse (fibrous waste from sugarcane).

However, preparatory processing is necessary to pre-treat the various raw materials. Lignocellulose is broken down into its three main components, lignin, hemicellulose, and cellulose. Sugar can be produced with the subsequent enzymatic hydrolysis of the polysaccharides. Depending on the structure, filtration is sometimes useful or even necessary to separate larger particles. Depending on the composition and properties of the raw material resource, this can occur before or after enzymatic hydrolysis.

The fermenter is usually the centerpiece of an industrial manufacturer's biotechnological range. The chemical industry uses fermentation to produce a multitude of products. The number of chemical building blocks available through fermentation is extremely high and is steadily increasing due to advances and research in biotechnology.

For example, bio-based chemicals are produced in the fermenter or bioreactor from various microbes, cells, and small plants using bacteria and enzymes. To obtain lactic acid, bio-based raw materials such as sugar or starch are converted into lactic acid by fermentation of microorganisms. The starting product must be converted to a clear, colorless polylactic acid (PLA) by fermentation and further purification steps such as filtration and electrodialysis. PLA, in turn, is suitable for the production of bioplastics and ultimately for packaging, garbage bags, diapers, or hygiene products.

Reliable and constant temperature control applications are usually crucial for the successful completion of these processes.

Due to the sensitivity and susceptibility to temperature, the manufacturing process and the corresponding temperature must be continuously monitored and regulated. For this purpose, temperature control systems are used that maintain temperatures at a constant level and can quickly heat and cool to the exact temperature required. Otherwise there is a risk that the polymers will decompose and a high-quality product cannot be guaranteed.

CONCLUSION

The use of organic raw materials is versatile and will be an essential companion for humanity on its journey towards independence from fossil fuels. Whether in the production of synthesis gas or polylactic acid, precise temperature control and monitoring is an important part of any manufacturing process for bio-based chemicals or their extraction from organic raw materials. Polymers, cells, and enzymes are extremely sensitive to temperatures outside a certain tolerance range and must be treated accordingly with the appropriate technical solutions.

We want to be a part of this solution and contribute to progress in this exciting field of research and development. That's why we offer you all the necessary temperature control systems and the right modular accessories to create the ideal environment for a rich bio-based end product. Our own products can be adapted to every individual need and are ultimately simple and intuitive to use.

If you have any further questions or would like an in-depth personal consultation, please do not hesitate to contact us. We would be happy to work with you to develop the perfect solution for your company and all your future projects.