

# Industrial Biotechnology

Saxony-Anhalt is a development centre for industrial biotechnology in the fields of:

- > **Basic Chemicals**
- > **Biopharmaceuticals**
- > **Bioplastics**

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## Basic Chemicals

About seven billion euros in turnover are generated annually here at one of the world's most attractive locations for the chemical industry. We are the East German federal state with the largest density of employees in the chemical industry, who in turn show a unique sales productivity. Research additionally accelerates the growth processes. For instance, scientists at the Fraunhofer centre in Leuna are working on replacing oil and natural gas with biomass as a raw material for the chemical industry.

## Scale-up and Contract Manufacturing

EW Biotech GmbH, a subsidiary of EW Nutrition GmbH, operates a multi-purpose biotech plant in Leuna, Germany. In addition to scale-up and contract manufacturing, the facility will enable expanded research and development activities in the field of bio-based chemicals, feed and food additives. EW Biotech and its experienced staff in the field of biotechnology and fermentation are thus creating the conditions to enable customers and partners to make the leap from the laboratory to industrial scale.

### Scents & Fragrances

### Audis e-fuels

### Lignin



Global Bioenergies GmbH is a subsidiary company of the French start-up Global Bioenergies SA. The company has developed a process which enables the direct production of isobutene through the fermentative metabolisation of sugar-based raw materials.

“We may be a small company, but we want to be a catalyst between biotechnology and the chemical industry,” says Ales Bulc, Managing Director of Global Bioenergies. “We are breaking new ground with this innovative fermentation process and we want to further develop the process to market maturity.”

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Isobutene is a volatile gas which is currently extracted from fossil sources such as oil. As an important derivative molecule, it represents one of the foundations of the petrochemical industry, from which many more economically-significant chemical products are manufactured. The process for the fermentative production of isobutene from sugar-based raw materials, developed and patented by Global Bioenergies, offers itself as an alternative to those processes which are based on fossil fuels. For this to occur, optimised micro-organisms which are able to metabolise sources of sugar from the first and second generations and to directly produce isobutene in the form of gas were developed in the laboratory specifically for this purpose.

## Innovative Process for the Fermentative Manufacture of Isobutene

The innovative fermentation process was initially tested and further improved in the laboratory and, subsequently, on a pilot scale before being transferred over into demonstration plant-scale production. The aim of this plant is to demonstrate a robust, reproducible and economic operation of the process.

When it came to building this demonstration plant, the choice landed upon the Leuna industrial park, based on its very well built-up and already-existent infrastructure, and based on the technical know-how available at the location. With finalisation and start-up completed, the plant is now in stable process operation using first generation resources. Currently, the plant is being adapted to allow for the use of second generation resources.

However, the final step towards shorter and more efficient carbon cycles with higher sustainability is in the use of third material generations such as CO<sub>2</sub> emissions from industrial fumes (CO<sub>2</sub>, CO, syngas). As a company which was already been occupying itself with processes which use third generation resources from an early stage, Global Bioenergies took over a small Dutch company in 2017, which it is using to forge ahead with the development of this technology.

## Partners and Collaborations in all Branches of Industry

Biomass is increasingly being viewed as an alternative raw material for fossil oil, which represents a finite resource. In order to reduce the problems of climate change and to strengthen an independence of the European nations from fossil energy resources, research in the field of the use of renewable resources is an essential part of bioeconomy. To this end, Global Bioenergies is working together with industrial partners who are promoting this research, as well as putting it into practice. For example, in the field of raw materials supply, it has a collaboration with one of France's largest sugar producers. It is currently also in talks with the German industry and, of course, the Saxony-Anhalt location, as Germany's biggest sugar factories are based here.

In the field of the fuel industry, Global Bioenergies is working together with Audi, who have already successfully tested a new type of fuel mixture in their vehicles. To this end, isobutene was processed into isooctane and other components. This can be added to traditional fuels to a level of up to 30% and, in doing so, achieves a reduction in the fossil CO<sub>2</sub> emissions of up to 70%, improved performance, and reduced particle emissions. And all this without having to undertake any adjustments to the existing engine!

What's more, isobutene can be used in other branches of the economy and industry to reduce the use of oil: as aviation fuel, plastic, rubber, dye, lubricant and in cosmetics.

A current key topic is the field of renewable fuels which can be produced from renewable raw materials. The isobutene process developed by Global Bioenergies, and its resulting derived products, can be used to make a contribution towards environmentally-friendly fuels here too.

Through the European Renewable Energy Directive (RED), EU member states are obligated to reach the target of a 10% use of renewable fuels by 2020. A part of this must come from second generation biomass. Today, Global Bioenergies has already made it possible to replace this part and, thus, to reduce carbon dioxide emissions. In doing so, Global Bioenergies is one of the few companies worldwide, and the only one in Europe, which is developing and using the fermentation process to transform renewable raw materials into hydrocarbons.

In doing so, notable and successful companies are providing support to the still-young company from Leuna, such as Audi, Repsol, SkyNRG, Butagaz, L'Oreal, Clariant and Arkema. A good collaboration exists with Fraunhofer CBP, also on location. They are operating the existing demonstration plant together, where the initial fuel components are being produced. The first comprehensive production plant, in a joint venture with Cristal Union named IBN-One, is currently being prepared.

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## Gallery Global Bioenergies

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## Biopharmaceuticals

Specialists in red biotechnology, there are many in Saxony-Anhalt - as well as valuable active substances in biotechnology: Who would have thought that the tobacco plant could one day help to cure life-threatening illnesses? And that this discovery would come from Saxony-Anhalt? Just like other biotech innovations.

### New Alzheimer's Drug



The Hidden Champion Heppel Medical Chitosan on the weinberg campus in Halle (Saale) produces high-purity chitosan as a raw material for the pharmaceutical industry worldwide.

### Vaccine Research



### Vaccine Platform



Biodegradable biopolymers as an alternative to oil-based materials are on everyone's lips and are already used in a wide variety of products such as packaging and films. Chitosan, a biopolymer that is still relatively unknown to the public, offers countless areas of application. In the medical field, for example, it improves wound healing as a component of wound dressings and dissolves naturally as suture material at the desired time.



Fluorescent proteins

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## Chitosan - raw material for innovative medical devices

The world market leader for high-quality Chitosan is based in the weinberg campus technology park in Halle (Saale). Heppe Medical Chitosan manufactures chitin, chitosan and chitosan derivatives for customers in the pharmaceutical industry and conducts research into chitosan and its various fields of application.

### Production of chitin and processing into chitosan

Chitin is a plant-based polysaccharide that can be obtained, for example, from the exoskeleton of crab shells, which are produced annually in large quantities as a waste product from crab fishing. The shells are cleaned to remove all foreign substances. Chitosan is obtained by deacetylation of the chitin, from which various chitosan derivatives can be produced by further reaction.

The founder of the company, Katja Richter, already conducted research into chitosan as a drug-delivery system for overcoming the blood-brain barrier during her studies. The biopolymer chitosan can be used as a transport vehicle to bring drugs to their place of action inside the body in a targeted manner and in sufficient concentration. During her research Richter noticed the lack of quality and reproducibility of the Chitosan products available on the market. That is why she founded Heppe Medical Chitosan GmbH more than 13 years ago at weinberg campus near Martin Luther University Halle-Wittenberg. Good support from "Univations" start-up service, the opportunities for cooperation and the advantages of the location's existing, compact structures were decisive factors in its choice of location.

### Worldwide market for the universal product

The main business of Heppe Medical Chitosan is the worldwide supply of the raw material Chitosan to small and medium-sized companies as well as to globally operating corporations: Most customers are located in America, China, Korea and Japan. A special field is the production of chitosan derivatives. On behalf of companies, the HMC team develops chitosans with the desired, special properties. In the laboratories of HMC it is possible to produce under clean room conditions according to GMP ("Good Manufacturing Practice") guidelines. Research is being conducted on fiber materials and chitosan coatings, among other things, which can be used in the medical field. "In what we do and in this breadth we are unique on the world market. We have made it our business to be able to produce very special chitosans, meaning you can buy over one hundred different chitosans from us. Our competitors are able to produce about three to four different chitosans. This makes us really unique," says company founder Katja Richter.

As Chitosan can be used universally, it is interesting for almost every branch of industry. Whether in hairspray, sunscreen or toothpaste - Chitosan is contained in many cosmetic products. In the medical field, dressing and suture materials as well as implant coatings benefit from the bacteriostatic and haemostatic effects of chitosan. Research is also being conducted into chitosan-based "scaffolding" in tissue engineering. But also the textile industry, agriculture and waste water technology use biopolymers. "This is our motivation. Going to a pharmacy and knowing 'Yes, we have our fingers in the pie' and now you can help people with it. Chitosan connects people, markets and ultimately a bleeding wound," Richter explains.

## Gallery Heppe Medical Chitosan

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## Bioplastics

In times of climate change and rising crude oil prices, bio-based plastics are becoming more and more significant. Furthermore, the demand for materials with new properties is high. Biotechnology has great and still untapped potential.

## Aeroplane Cup



3D Printing

## Vinyl Revolution



## Precision Plastic



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## Fact Sheet



HERE Bioeconomy is scaled for markets.  
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## Contact



Nico Horn  
Senior Manager Bioökonomie  
+49 391 568 99 28  
nico.horn@img-sachsen-anhalt.de

## Contact



Mandy Bunge  
Strategisches Standortmarketing  
+49 391 568 99 73  
mandy.bunge@img-sachsen-anhalt.de

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