BIOVOX

MedEco

Recycling Factsheet

Ready for the circular economy!

Through measures such as the **Packaging and Packaging Waste Regulation**, the EU is encouraging all industries to move towards a circular economy. Recycling plays a key role in this.

All BIOVOX MedEco types are fully recyclable - of course also with existing technologies. In addition, particularly efficient chemical monomer recycling now makes it possible to safely use recycled materials in medical technology and pharmaceutical packaging!

Short on time? Here's the key information at a glance:

#In a Nutshell

- ✓ All BIOVOX MedEco types are **mechanically recyclable**
- ✓ Our PLA-based MedEco types can be efficiently recycled through **monomer recycling**, returning as medically safe recyclates for use in device and primary packaging production.
- ✓ Recycling can significantly **reduce CO_2 emissions** compared to virgin material.
- ✓ **Avoiding risks:** MedEco plastics meet all currently foreseeable recycling regulations – including those for which there are still transition periods for healthcare products.

RECYCLING MYTHS →

Recycling myths

There are many myths and misconceptions around recycling - what's true?
And what assumptions are outdated? Our sustainability expert Carmen clarifies!

Myth #1: „PLA disrupts recycling flows"

Carmen: „This is a common misconception: PLA can be easily and reliably detected and separated with the sorting technologies in use today. Traces of other polymers can be found in any recycling fraction, and PLA is no more critical than other polymers."

Myth #2: „PLA can't be recycled."

Carmen: „PLA is easily recyclable - even with established processes. For the post-consumer waste stream, the quantities are currently small, which is why the recycling is not yet industrially implemented. This will change as PLA usage increases for purely economic reasons. Post-industrial PLA is already mechanically recycled today. And, thanks to bio-based raw materials, PLA closes the CO_2 cycle even with incineration."

Myth #3: „Chemical recycling means pyrolysis and that's not sustainable."

Carmen: „Yes, pyrolysis is energy-intensive and therefore not a panacea. However, chemical recycling also includes particularly energy-efficient monomer recycling technologies, e.g. by hydrolysis, which produces recycles that are equivalent to virgin materials and therefore ideally suited for sensitive applications in medicine."

Myth #4: „You can't recycle bio-based plastics"

Carmen: „That's not true, bio-based plastics are great for recycling. It's the chemical structure alone that matters, not the origin of the raw material. Whether a plastic comes from fossil or plant-based sources doesn't affect its recyclability."

Recommended links

PLA in the waste stream, Frauenhofer
Recycling Technologies for Plastics, Frauenhofer
EOL options for bioplastic products, European Bioplastics
Mapping of Advanced Plastic Waste Recycling Technologies [...], Renewable Carbon Initiative

More myths?

Our sustainability expert Carmen Rommel is happy to answer your questions: be-green@biovox.systems

RECYCLING PROCESSES (1/2) →

A closed loop for MedTech

Closed-loop recycling is also possible for medical applications. Quality and traceability can be ensured by choosing the right **recycling process**.

Closed-Loop Recycling

For a closed cycle, material is repeatedly recycled back into the value stream. This recycling can happen at different stages of the value chain.

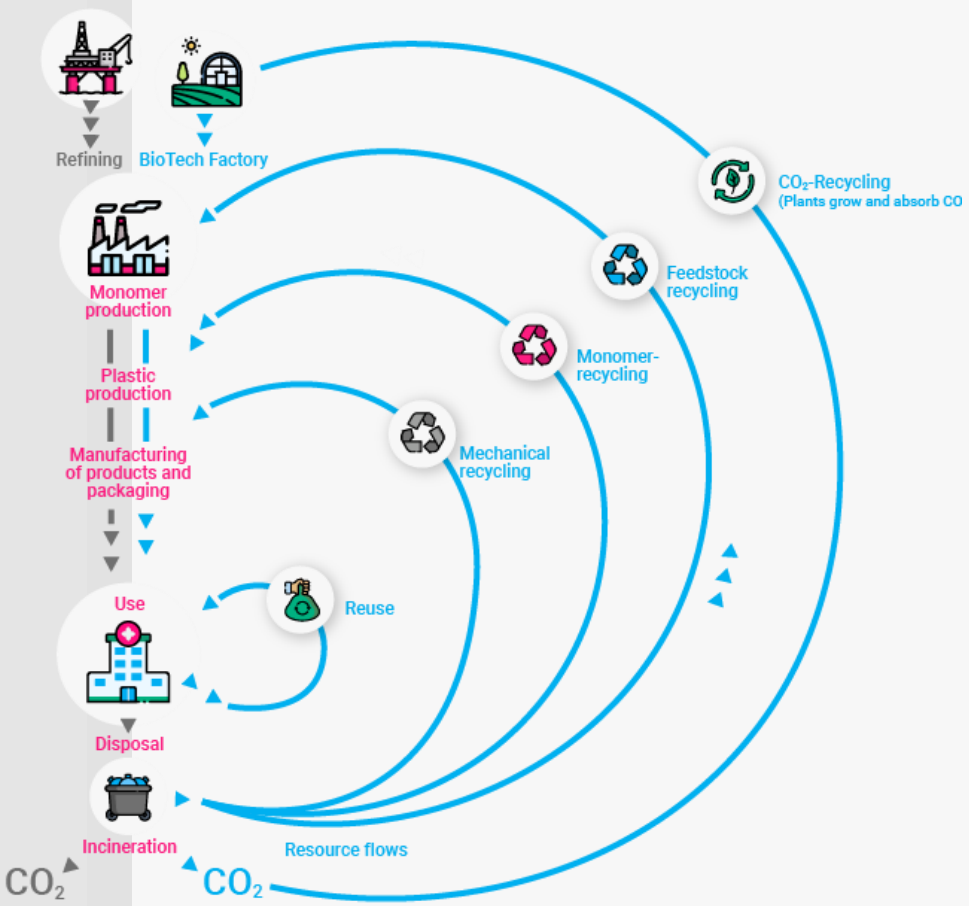
Precise sorting is essential for most recycling technologies: both polyolefins such as bio-PE and polyesters such as PLA can be sorted quickly and cost-efficiently using optical methods.

Contaminated waste can also be sorted safely and precisely after decontamination.*

The sorted plastic fractions can then be processed in mechanical or chemical recycling processes.

*see, e.g. the decontamination plant at REMONDIS Medison. The technological foundations for recycling medical plastic waste already exist.

Circular Economy
Future



Status Quo
Linear Economy

RECYCLING PROCESSES (2/2)

Mechanical or Chemical Recycling?

Mechanical recycling of medical devices (PCR) usually leads to downcycling. Chemical recycling, on the other hand, enables the preservation of medical quality.

Mechanical recycling requires very little energy. The generated recyclates can be used well in applications that place lower demands on the purity of the materials used. Traceability and high purity are currently not possible on a large scale.

Chemical recycling breaks down the polymer chains. Depending on the process, this is done in a very targeted and energy-efficient way, or by sheer chemical force in the form of heat. The products replace virgin feedstock in polymer production. Specifically relevant are:

Monomer recycling

With monomer recycling, e.g. by hydrolysis, polyesters such as our MedEco ICB and XCB are recycled in a very energy-efficient manner. In hydrolysis, the polymers are cleaved into their building blocks using solvents (in our case water) and catalysts. High monomer yields of 90-95% can be achieved while low process temperatures keep energy consumption low. With monomer recycling processes, demanding applications can be serviced regularly with biologically safe recycling and at the same time a lot of CO_2e can be saved.

Feedstock recycling

For polyolefins, only the more energy-intensive feedstock recycling, is possible. The process used is pyrolysis where the polymers are broken down into smaller hydrocarbon fragments at high temperatures (300 – 800 °C) in an inert atmosphere. The products are a so-called pyrolysis oil (used as naphta-substitute), gas mixture and solids. The carbon footprint of the resulting recyclate is, depending on the accounting method, roughly equivalent to that of virgin materials. The yield reaches about 50%. It is particularly suitable for improving the quality of degraded residual material streams.

COMING SOON: How much CO_2e can be saved by recycling?

Recycling saves CO_2 – but how much exactly? We're looking at the potential savings and calculating the impact recycling has on the carbon footprint. The results will be out soon –get in touch now to be informed and don't miss out!

RECYCLING PROCESSES FOR MEDECO →

Which recycling processes are suitable for MedEco?

Different types of plastics are suitable for different recycling technologies: polyesters, such as PLA, are ideal for closed material cycles and chemical recycling, while polyolefins, such as bio-PE, are preferred in markets with high material uptake. Occasional pyrolysis can be used to refresh the material stream.

When choosing the appropriate recycling process, not only the types of plastics but also their specific formulation play a decisive role: chemical properties, additives and fillers influence suitability and efficiency.

The following table shows the recyclability of our MedEco types:

#In a Nutshell

- ✓ The higher the chemical stability of the plastic, the more energy intensive the chemical recycling
- ✓ The fewer additives and fillers, the easier the recycling

	Sortability	Mechanical recycling	Chemical recycling		
		Suitability	Suitability	Energy efficiency	Process & Features
PLA based MedEco grades					
MedEco ICB	✓ Swim/Sink procedure Near-infrared spectroscopy	Very good	Very good	Very good	**Monomer recycling / hydrolysis** Through catalytic depolymerization, the PLA is broken down into lactic acid with low energy consumption while a high yield is achieved. The resulting recyclates have a significantly reduced carbon footprint compared to virgin material - a great savings opportunity for medical materials.
MedEco ICB C1		Very good	Very good	Very good	
MedEco XCB		Very good	Very good	Very good	
MedEco IGH		Good*	Good*	Very good	
MedEco XGB		Good*	Good*	Very good	
Bio-PE based MedEco grades					
MedEco IPI	✓ Swim/Sink procedure Near-infrared spectroscopy	Very good	Possible	Only partially useful	**Feedstock recycling / Pyrolysis** Pyrolysis produces naphtha substitute, which can be returned to plastic production. The yield is significantly lower than in monomer recycling, and the energy use is equal to or moderately lower than virgin plastic. Suitable for refreshing degraded recycling streams.
MedEco XPI		Very good	Possible	Only partially useful	

* As MedEco IGH and XGB contain mineral fillers, they cannot be used to produce transparent recyclates, which can limit their use. In chemical recycling, the mineral filler is removed, which reduces the yield of the recycled polymer somewhat.

LEARN MORE ABOUT MEDECO →

MedEco can do more than recycle

What makes BIOVOX bioplastics future-proof?

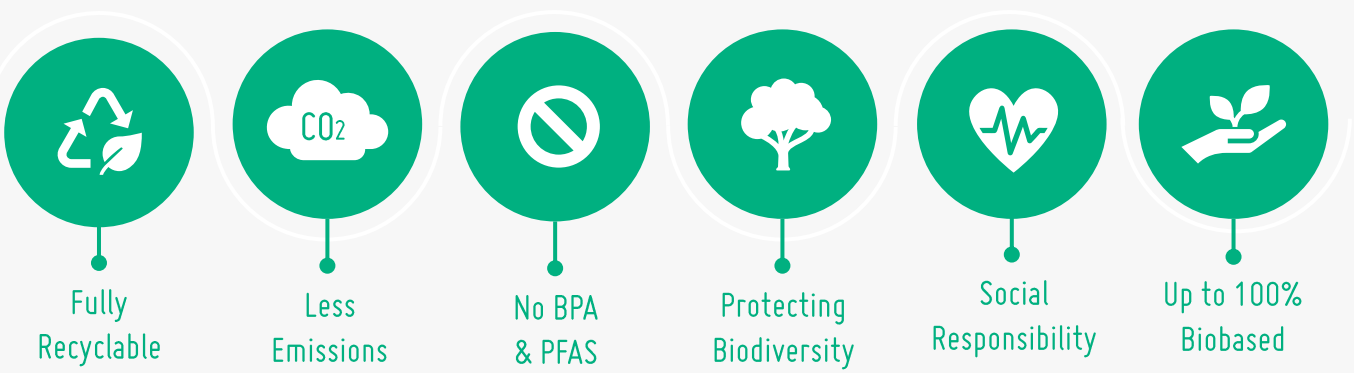
In addition to being fully recyclable, there are other features that make BIOVOX MedEco plastics future-proof: BIOVOX MedEco bioplastics are up to 100% **bio-based**, **fully recyclable** and save **up to 85% CO_2e** compared to conventional medical plastics. At the end of their life cycle, our plastics do not release any fossil carbon into the atmosphere - because at some point, even after many recycling cycles, they are often incinerated. Along the supply chain, we also pay attention to protecting **biodiversity** and **rainforests** and live up to our **social responsibility**. MedEco is also free from substances of concern, such as **PFAS** or **BPA**, and thus not affected by potential bans.

„Regulatory requirements such as bans on critical substances, tightened recycling guidelines or carbon regulations are changing the market. MedEco helps to minimize potential risks early, reduce reliance on fossil fuels, and gain a competitive advantage with innovative solutions."

Carmen Rommel, BIOVOX

#In a Nutshell: MedEco was made with the future in mind!

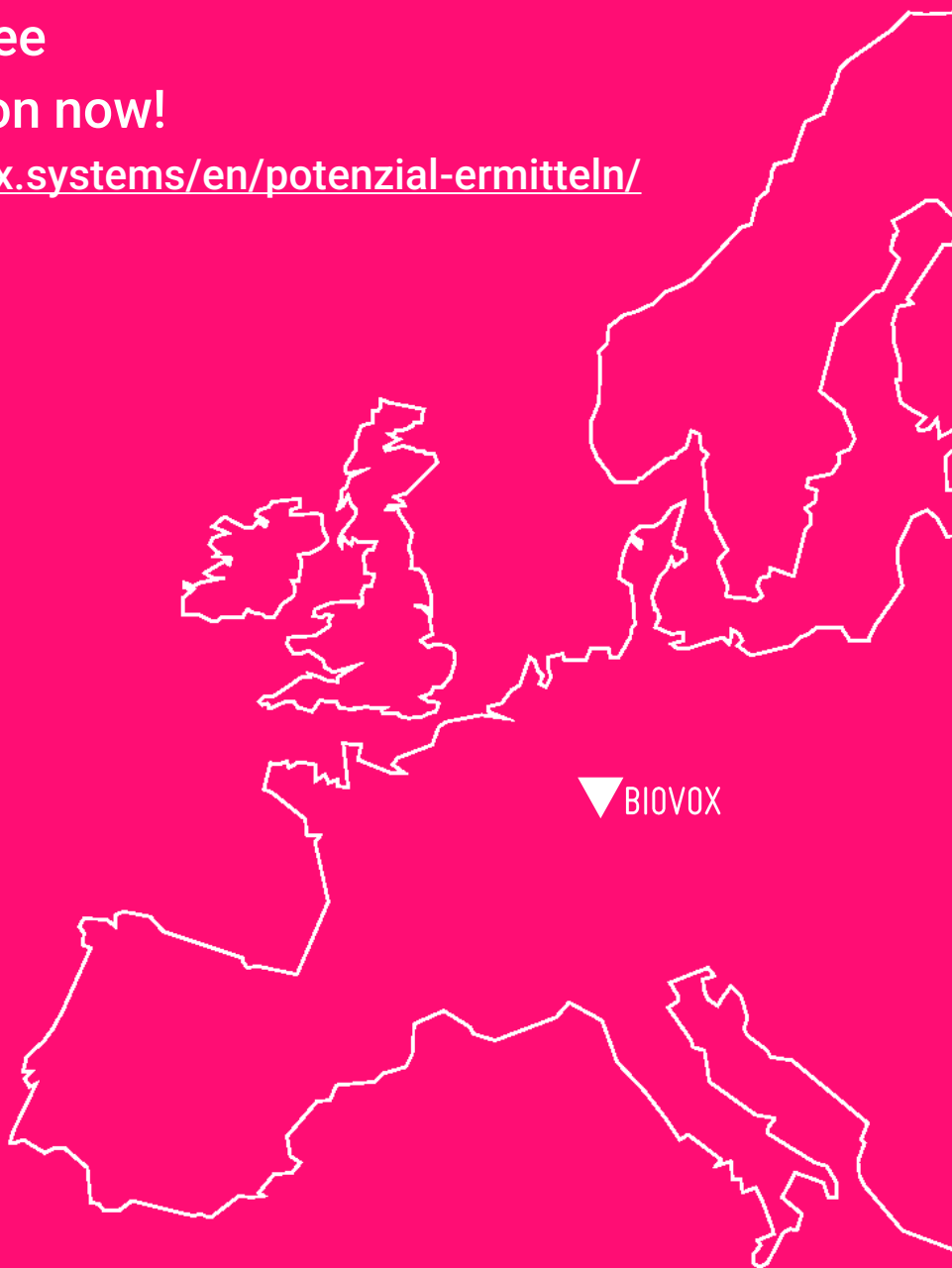
- ✓ Fully **recyclable, also in a closed-loop**
- ✓ Suitable for **circular economy**
- ✓ **Free from substances of concern** such as PFAS and BPA
- ✓ **Lower carbon footprint** than fossil plastics with similar properties
- ✓ **Rainforest** protection, **biodiversity** & **human rights** along the supply chain
- ✓ No competition for **food production**



>> Read more in our Sustainability-Factsheet

Get your free Consultation now!

>>www.biovox.systems/en/potenzial-ermitteln/



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