

The Story of Danish Biosolutions

Why Biosolutions

The era of biosolutions is upon us. Through the utilization of fermentation and other biological processes, biosolutions provide a new approach that causes us to rethink how we produce and manufacture products in a variety of sectors including agriculture, food, energy, construction, textile, transportation, water, and waste management. The world stands on the forefront of a new age, where tiny but mighty enzymes, functional proteins and microbes are some of the key drivers of innovation which has the potential to help solving some of humanity's most pressing challenges. This transformation seeks to harness the power of biology, introducing innovative methods that serve as an option next to chemical and mechanical approaches. These refined processes maximise the value of our limited resources and have the potential to advance more sustainable solutions. The biosolutions currently at hand have the potential to cut 4,300 million tonnes of CO2 by 2030, equivalent to 8% of today's global emissions¹. This demonstrates the immense capacity of nature's own toolbox to tackle the globe's climate and environmental challenges. Both the EU and Denmark are decarbonising its economies, with biosolutions paving the way for new products and services that reduce our climate footprint.

Why Denmark

The Danish biosolutions sector excels in developing new technologies and scaling them to commercial use. Building on a longstanding tradition, Danish research institutes and businesses have developed and applied biosolutions. This legacy ensures that advanced technologies like fermentation and biorefining are deeply integrated into the Danish industrial ecosystem, supported by a strong research community that holds extensive expertise and produces the necessary breakthroughs to drive the industry forward. This intersectoral linkage has led to increasing competitiveness and strong public-private partnerships and making Denmark a European centre of excellence. This progression highlights the innovative solutions of Danish companies alongside the Danish government's consistent strategic emphasis on the sector.

In scaling biosolutions globally, collaboration between governments, industries, academia, and civil society continues to be of critical importance. In Denmark, the notion of collaboration goes back to the co-operative movement in the 1800s when farmers united to develop and grow their sector. Today, close tie-ups between businesses, knowledge institutions, and the government mean that Denmark has a highly developed ecosystem for startups, students, researchers, and big businesses. Interdependent and well-organized, they exchange knowledge and talents, thus accelerating development.

The future of biosolutions is global and green

With continued investments, research and collaboration, biosolutions can support the transition of the existing economy into a more bio-based and sustainable one. Danish companies have already demonstrated this potential through proven and resource-efficient solutions that are applicable in a wide range of sectors. **[Insert cases of choice]**. biosolutions are already making a visible impact on people's lives every day, yet there is still much more potential to be unlocked. Denmark is well on the way, continually welcoming new ideas, talents and companies from around the world to excel in the sector and foster global cooperation.

¹ [the-potentials-of-biosolutions_final_20sep2022.pdf \(allianceforbiosolutions.dk\)](#)

Tagline

Danish businesses are cutting-edge when it comes to biosolutions. As a well-established research-based industry with a strong international engagement, the Danish biosolutions cluster provides a breadth of ways to initiate and accelerate the green transition across industries.

Industrial Biosolutions

When combining biology with technology, the possibilities of biosolutions ignite. By cunningly using nature's own toolbox and applying it in scale, Danish companies are leading the way in advancing sustainable biotechnical solutions that contribute immensely to combatting climate change as well as safeguarding biodiversity in industrial productions. Through the implementation of biobased products and innovation, biosolutions are already now revolutionising sectors across industries, while still holding the potential for much more.

If 10 per cent of the world's animal protein was replaced with alternative proteins, this would free up 900,000 km² of agricultural land which could be restored to help preserve biodiversity or serve as carbon sequestration through afforestation².

In essence, Danish companies excel in harnessing the catalytic actions of yeast, bacterial-, algae- and cell-cultures, proteins, and enzymes to produce groundbreaking products for everyday life. While fermentation is an old technology used to safely preserve food, new biotechnical solutions developed in advanced laboratories enable the production of commodities traditionally associated with the mechanical and chemical industries, such as cement, plastics, and more narrowly products like laundry detergent. By 2030, biosolutions have the potential to abate 460 million tons of CO₂e in the conventional plastic industry³.

Although the global industry is only in the spur beginning of integrating biosolutions, Danish companies already now have a lot to showcase. For example, Novonosis enabled biosolutions to achieve an annual reduction of around 90 million tons of CO₂e in 2019⁴

Following this section, you will find three Danish cases of new innovative biosolutions from Novonosis, Biomason, and Pond. These cases elucidate the strongholds of biosolutions, and points to the future, where biosolutions have the potential to redefine our industrial solutions.

^{2,3,4} [the-potentials-of-biosolutions_final_20sep2022.pdf \(allianceforbiosolutions.dk\)](#)

Cases

Novozymes

Long-lasting clothes for a long-lasting climate

PROBLEM:

The very short life of our wardrobe

The fashion industry is responsible for 10% of the world's CO₂ emissions. In the tiny country of Denmark alone, 677 tonnes of textiles get destroyed every year.

Our overuse of clothes puts an enormous pressure on nature. Today, 60% of microplastics in the seas and oceans come from textiles.

Extending the lifespan of our clothes and buying less, better clothes is one of the biggest differences we as consumers can make to reduce the climate and environmental footprint of the shirts, the jeans, and the shoes we wear.

BIOSOLUTION:

Enzymes remove stains, smell, and damaged fibres

The Danish company Novozymes is a worldleading supplier of enzymes – a biosolution that helps solve the problem of extending the lifespan of our wardrobes.

Enzymes are proteins found everywhere in nature and in all living beings. When one substance needs to be transformed into another, nature uses enzymes to speed up and control the process.

Novozymes has developed enzymes that help speed up the efficiency of the detergents we use to wash our clothes – removing stains, smell, and damaged fibres. Used for decades in households all over the world, the enzymes in our washing detergents also enables us to wash our clothes clean at lower temperatures. This means that less energy is used and thereby greenhouse gas emissions are reduced.

IMPACT:

Without enzymes, laundry detergents would have a higher environmental impact

The use of natural enzymes in laundry detergents helps our clothes look, smell, and feel new for longer – with less use of chemicals.

Without enzymes in detergents, laundry washing in the EU would require 12 million MWh more electricity per year for washing at higher temperatures, emit 3.3 million tons of CO₂ more per year, and require 220,000 tons of additional chemicals per year.

Additionally, the lifetime of clothes would on average decline by 10% in the EU without enzymes, either due to stains, textile damage, or dinginess and dullness of colours and whites. If this is taken into consideration, the presence of enzymes is estimated to save an additional 22 million tons of CO₂ and 4,300 million m³ of water in the EU every year.

Biomason

Growing cement, the same way nature does

PROBLEM:

The world needs cement, but it comes with high CO2 emissions

Cement is used everywhere in concrete production as part of the global construction industry, but the production method is a major climate change culprit.

To make cement, limestone is burned at 1,400 - 1,500 degrees Celsius. To generate this heat large amounts of fossil fuels, need to be burnt, a major contributing factor to the carbon footprint problem of cement. In addition, the associated calcination reactions free up large amount of carbon that get emitted in the atmosphere. Both factors cause the production of cement to be responsible for 8% of the world's CO2 emissions.

After water, concrete is the second most used substance on Earth, and as the demand for cement and concrete continues to grow, so does the need for new technologies that eliminate the climate impact of this construction material.

BIOSOLUTION:

Using bacteria to form clean cement

With inspiration from marine ecosystems, the company Biomason has developed a biological alternative to traditional cement by using microorganisms and natural processes to create more sustainable concrete products.

The production method involves mixing sand, bacteria, and nutrient-rich water. When the mixture ferments, billions of bacteria create crystals of calcium carbonate. The method is inspired by the way coral reefs have been making durable structures for millions of years – also based on calcium carbonate.

The calcium carbonate binds the grains of sand together when reacting with water – just like traditional cement. And the result is high-quality building materials made from biocement.

IMPACT:

Close to zero carbon footprint

The process used by Biomason eliminates the need for fossil fuel-fired furnaces as well as calcination of limestone, which are the largest sources of CO2 emissions in cement production.

This means that biocement has the potential to reduce the carbon footprint of cement to close to zero compared to traditional cement.

Pond

From green grass to green plastic

PROBLEM:

Life with plastic, not fantastic

400 million tonnes of plastic are produced globally – every year. It stays in the environment for ages, threatening wildlife and spreading toxins

Furthermore, the production of plastic today is based on crude oil and responsible for emitting around 2 billion tonnes of greenhouse gas emissions – equivalent to 3.4% of global emissions.

Yet, the demand for plastic is increasing and is estimated to reach around 800 million tonnes by 2050, doubling the negative effects on the planet.

BIOSOLUTION:

From grass juice to biodegradable sportswear

A new technology, developed by the Danish company Pond, holds the potential to revolutionise the plastic industry.

Based on greens like grass, duckweed, and sugar beets, Pond has developed and patented a technology, that first extracts the carbohydrates from the plants and then convert the carbohydrates into a bioplastic through fermentation

With Pond's patented technology, they are able to give the bioplastic a strength and quality that allows it to replace close to all fossil-based plastic that fills our world today.

The use cases are manifold – the polyester in your sportswear, the plastic cover on your phone, and your children's plastic toys, all made from grass juice.

IMPACT:

Carbon capture bioplastic

Because the bioplastic from Pond is based on plants, it is biodegradable, compostable, and can be recycled endlessly – without losing its quality.

But the real potential lies in bioplastic's ability to absorb and deposit CO₂. Based on plants and created by photosynthesis, Pond's bioplastic can absorb and deposit up to 2 kg of CO₂ per kg – also known as Biogen Carbon Capture Storage.