



CENTRE FOR CIRCULAR BIOECONOMY

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Going from a fossil based economy to a circular and biobased economy holds significant societal and industrial potentials. In a biobased economy fossil raw materials are replaced with renewable plant- and marine-based biomasses, and energy consumption is based on renewable sources, including sustainable biomasses and organic waste. The potentials include e.g. the production of new high-value products based on an innovative utilization of side streams and by-products as a means to avoid waste. At the same time, more resource-efficient production systems in agriculture and marine farming will ensure compliance with the EU Water Framework Directive as well as the climate policy. However, the transition to a biobased economy requires the development of biorefineries able to utilize the new biomass types for the production of high-value products.

Aarhus University, Science and Technology, has established Centre for Circular Bioeconomy (CBIO) to carry out world-class research and develop bio-economic production systems and recycling concepts; e.g. biorefining methods and high-value products based on green crops, marine biomasses as well as residual and by-products from the agricultural and food sectors.

CBIO activities include research within the entire production chain ranging from cultivating and procuring biomasses, logistics, management, refining, product development and tests, recycling, impact on nature and environment as well as research in relation to society and economy. In addition, more basic research activities are carried out, e.g. in relation to the understanding of biomass conversion at molecular level, supported by advanced chemical analyses.

Product examples comprise high-quality feed protein and other types of feed, biobased fibres for composite materials and chemical components such as bioplastic polymers. Furthermore, the extraction and production of ingredients and components for the food and pharmaceutical industries hold significant potentials.

The chain of research areas

CBIO will gather excellent research along the entire production chain for biological raw materials and products in order to allow the accomplishment of complete analyses and holistic research. The scientific areas are:

Society, sustainability and economy

Professor Mette Termansen, Department of Environmental Science

This research area takes a systemic approach to understand transition towards a circular bioeconomy. The area brings together competences to connect production, distribution, consumption and recycling of bio-resources. In particular, focus will be on regulative, social and economic barriers and enablers to support and initiate a more sustainable and resource efficient production. We will develop methodologies to evaluate economic, environmental and climate consequences of alternative future resource management strategies and policy developments.

Utilization of biomass for food, ingredients and high-value products

Associate Professor Trine Dalsgaard, Department of Food Science

This area will develop and optimize techniques and technologies for the extraction of high-value products for foods and ingredients. Primary focus is develop strategies to avoid enzymatic browning and extraction and characterization of white protein, secondary metabolites, active compounds, prebiotics and natural colours. The area also comprises strategic efforts within the optimization of process parameters in relation to protein-chemical changes, functional properties, sensory preferences and bioavailability.

Production and management of agricultural biomass

Senior Researcher Uffe Jørgensen, Department of Agroecology

This research area focuses on the improvement of plants and crops, innovative cultivation systems and recycling technologies as well as the application of such in sustainable biomass production. The aim is an improved utilization of natural production conditions in order to ensure an optimum resource utilization and minimum losses to the environment. Additional focus will be on the improving biodiversity in both intensive and in more extensive production systems in partly intensive and partly extensive production systems.



Feeds, by-products and feed ingredients

Senior Researcher Søren Krogh Jensen, Department of Animal Science

Research focuses on soluble protein, fiber, fiber associated protein and other products extracted from biomass and how these can be optimally used as feed for both monogastrics and ruminants. We will examine how different animal groups utilize the products most optimally, and how protein and other parts may be used as raw materials in the feed industry. We will further examine how to develop a concept for cooperation between pig/poultry and cattle farmers in order to ensure optimal utilization of green biomasses.

Production of marine biomass

Senior Researcher Annette Bruhn, Department of Bioscience

The primary research areas within marine biomass are 1) Cultivation and harvest of macroalgae (innovative cultivation technology, life cycle control, selective breeding, optimizing biomass yield and quality, nutrient absorption). 2) Environment and climate impact of marine biomass production (macroalgae and mussels) (life cycle analyses, organic modelling, marine area management). Focus will be on the analysis and mapping of biomass production potentials and environmental impacts of large-scale cultivation in marine areas with different oceanography and nutrient loads. This includes impacts on biodiversity and area efficiency of recovery of nutrient emissions from agricultural and marine farming.

Biorefining, conversion and recycling

Head of Section Lars Ottosen, Department of Engineering

This area carries out research in the development of biorefining technologies with a view to increasing the value of biomass streams. Focus will be on applying the newest research results in new technologies and – at the same time – develop pilot scale refining plants in order to ensure that operation results are readily scalable to an industrial level. The plants developed will be implemented into refinery plans, thus ensuring a maximum value increment in relation to produced biomasses and side streams as well as ensuring concerted planning in entire systems in order to finish the value chain.

Biobased materials and bio-oils

Associate Professor Marianne Glasius, Department of Chemistry

This area carries out research in biomass conversion a molecular level via hydrothermal and catalytic processes. The purpose is to develop new materials, molecular "building blocks" for the chemical industry and fuels based on bio-based compounds. The research focuses on the optimization and molecular understanding in relation to conversion of a wide range of biomasses with a view to identifying and evaluating the most suitable ones. An important research area is catalytic upgrading of raw bio-oil to a high-quality fuel.

Facilities

Aarhus University has established a series of unique technology platforms and research facilities, and now – within the framework of CBIO – we will interconnect these to constitute entire chains and invite other interested parties to participate in research and development. The facilities include cultivation and harvest areas for macro algae production, a platform for sustainable intensification of biomass production, a protein platform to optimize extraction methods for protein and active compounds as well as analytical platforms and plants for hydrothermal liquefaction of wet biomasses and for biogas research.

Cooperation with the industry

The Centre aims to strengthen the cooperation with national and international companies and organizations within biobased economy. Generally, all activities should contribute to the establishment of new companies and business areas within biobased economy, e.g. production and marketing of new Danish protein for both animal feed and food production.

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