UpWaste

SUSTAINABLE UP-CYCLING OF AGRICULTURAL RESIDUES: MODULAR CASCADING WASTE CONVERSION SYSTEM

3° Call:	2019
Project period:	04/2020 – 03/2023
Topic:	Sustainable intensification of food and non-food biomass production and transformation systems, including biorefinery concepts
Keywords:	Insects, microalgae, food waste, LCA, modular technology
Coordinator:	Dr. Sergiy Smetana - DIL Deutsches Institut für Lebensmitteltechnik e.V. (DIL e.V.), Germany Email: s.smetana@dil-ev.de
Project partners:	Leen Van Campenhout (KU Leuven, Belgium); Daniel Pleissner (Leuphana Universität Lüneburg, Germany); Sabine Van Miert (Thomas More University, Belgium); Janusz Golaszewski (university of warmia and mazury in olsztyn, Poland); Agris Pentjuss (Latvia University of Life Sciences and Technologies, Latvia).
Total funding:	1.397.000 €
Website:	projects.au.dk/faccesurplus/research-projects-3rd-call/upwaste/

FACCE SURPLUS
SUSTAINABLE AND RESILIENT AGRICULTURE FOR FOOD AND NON-FOOD SYSTEMS

UpWaste

BACKGROUND

The UpWaste project tackles the interconnected challenges of agriculture as well as the sustainable intensification of the agricultural sector, efficient use of resources and lower GHG emissions by developing a flexible and modular system for the conversion of agricultural residues into heterotrophic microalgal (Galdieria sulphuraria) and insect (Hermetia illucens) biomass.

OBJECTIVE

The goal of the UpWaste project is to create a modular cascading biorefinery system for the upcycling of agricultural residues, to obtain higher-value products of defined composition. An industrial blueprint for such a system will be created based on metabolic modelling and experiments at lab and pilot industrial scale. These will be carried out with the heterotrophic microalga Galdiera sulphuraria and insect larvae of the black soldier fly (Hermetia illucens), since both organisms have been found to have great potential in the safe utilisation of challenging waste streams as well as promising characteristics for the extraction of valuable compounds. Based on the system design, economic and life cycle assessment (LCA) will be carried out to determine the economic feasibility as well as sustainability of such a system.

METHODOLOGY

A range of different waste streams, like for instance manure, straw, hull and other plant parts as well as food waste will be transformable into high-quality biomass in the UpWaste system. High quality lipids, hydrocarbons and proteins can subsequently be used for the production of fine chemicals such as polymers or dyes, energy sources as well as feed or high value food nutritives.

Metabolic modelling is ongoing to find out the optimal substrate for and possible uses of the algae and insects. This approach relies on computer driven mathematical analysis of genetics and feeding behavior, giving insights into optimization potentials. In order to gain useful data for this model and hints as to practicable design of the process, a range of experiments are currently being carried out by different project partners.

Different substrates have been tested for hydrolysis and subsequent cultivation of the red alga G. sulphuraria; straw, potato pulp and biogas digestate were hydrolysed and characterized, and the alga has been cultivated on digestate and also food waste hydrolysate. Various factors for suitability of different side-streams in insect rearing, such as insect growth and biological safety as well as legal obstacles have been assessed. So far, fruit puree, apple pulp, grain middlings, beer draff and feather meal have been identified as suitable.

RESULTS

One joint scientific article with different project partners has been published and three additional ones proposed. Other accomplishments include the development of first schematics and inventory models of the proposed modular processes, which will serve as a basis for sustainability and environmental life cycle analyses

Ultimately, the developed system will create market opportunities for sustainable and economic production and processing of food and non-food materials whilst at the same time reducing pollution and resource use by closing loops in the circular bio-economy. This additional raw material source will increase the utilization of current agricultural production and take some strain off natural resources and agricultural production capacities.