Competence centre for biorefining research (BIORAF)

BIORAF project (TE01020080), supported by the TACR, employs the techniques of green chemistry for biomass utilization to the high added-value products and energy sources. By refining, it is possible to obtain food supplements, fodders and fertilizers, new-generation biofuels and energy from the biomass of microbial, plant or animal origin. Biorefining is a unique way of new sustainable substitution of fossil fuels minimizing the adverse effect on environment while exploiting the whole volume of biomass.

Joint organizations:

- Institute of Chemical Process Fundamentals
- Institute of Chemical Technology, Prague
- Institute of Botany of the CAS
- Rabbit Trhový Štěpánov, a.s.
- Agra Group, a.s.
- Briklis, spol. s r.o.
- EcoFuel Laboratories, spol. s r.o.

BIORAF
Centrum kompetence pro výzkum biorafinací

Director of the Centre and project manager: Ing. Petr Kaštánek, Ph.D.

Scientific director of the Centre: Ing. Olga Šolcová, CSc., DSc.

Technological director of the Centre: Prof. Ing. Jiří Hanika, DrSc.

Project web pages (http://bioraf.icpf.cas.cz/) provide up-to-date information about projects results, milestones and events.

Biorefinery research centre of competence

(O. Šolcová, solcova@icpf.cas.cz)

In a relatively short period of time, the project established interdisciplinary research centre which resulted in applications in livestock breeding, cultivation and plant protection, food supplements and health care. The companies involved in the project not only supply so far unused waste materials, but already implement and benefit from the project results; new design of bioreactors and knowledge on algae cultivation find use in novel poultry feeding, plant extracts and waxes are tested for cosmetics production and as a repellent for protection of forests, new species of microalgae extremely rich in omega-3 fatty acids are being licensed for production of pharmaceuticals and food supplements, new process equipment are manufactured etc.

Selection of unicellular algae strains capable of growth on the raw glycerol belongs to the project results as well cultivation of microorganisms for the production of biomass rich in Docosahexaenoic acid applicable as food additives, photobioreactor for cultivation of microalgae, and the novel verified technology Inulin from the tuber of Jerusalem artichoke - certification of crop cultivation in which framework the agent for plant protection against insects was developed. In the framework of processing technology of waste feathers the pressure hydrolysis of chicken cartilage and feathers protein wastes, which is focused on the production of valuable amino acids mixtures with nutraceutical importance, was developed. Moreover, variety of prototypes suitable for mixing, disintegration, drying, pelleting,

briquetting, packing, storage or transport were developed as the side products and some of them were also produce for sale. Majority of products is focused on private customers from the Czech Republic and also abroad. In the first part of the Project majority of technologies was suggested and developed on laboratory level and only some technologies and products were scaled up. Nowadays, a scale up of all products and technologies is planned

Project brought awareness into society about the biorefinery area as new scientific direction, that in Czech Republic was virtually absent before creation of BIORAF, but has big perspective for development of small and medium size companies. BIORAF published through Academia publishing house a free book on this subject to educate public and scientific community.

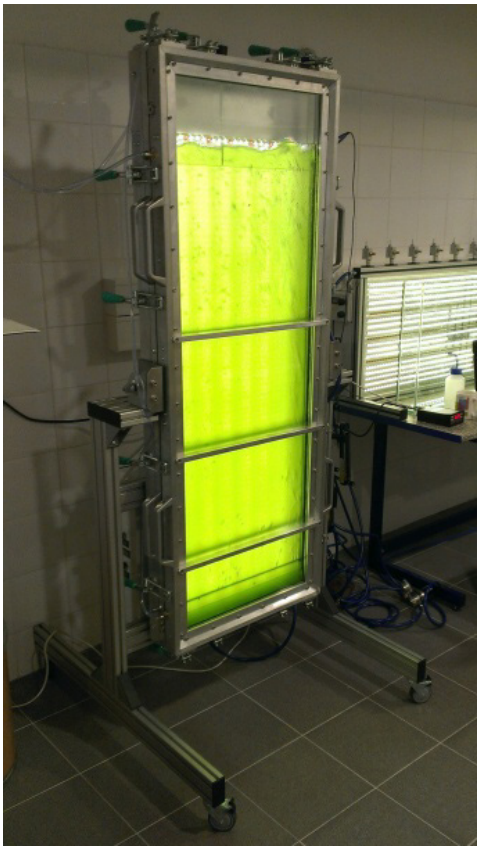

Photo-bio-reactor

Feathers as reusable materials

Method for processing algae and cyanobacteria

(J. Sobek, V. Veselý, sobek@icpf.cas.cz, vesely@icpf.cas.cz)

The method for processing algae and blue-green algae to obtain oil by breakage of their cell wall with the use of microwave radiation has been applied. Water suspension of algae was first adjusted by the addition of a hydrophobic sorbent in an amount ranging from 0.5 to 5 % by weight and so adjusted suspension was heated at a pressure in the range of about 200 to about 2000 kPa by the action of microwave radiation to a temperature in the range of 105 to 190 °C for a period of 1 to 5 minutes. Subsequently, the suspension was led to expand and after cooling down and separation of disintegrated algae, the sorbent with sorbed oil was separated from the water layer wherein the sorbed oil was then isolated by extracting agent. [Ref. 1]

Sedimentation of algae

Method and device for hydrolysis of inulin solution

(J. Sobek, V. Veselý, sobek@icpf.cas.cz, vesely@icpf.cas.cz)

Inulin represents a mixture of polysaccharide molecules with the general formula GF_{n-1}, where G is glucose, F is fructosyl, and *n* is degree of polymerization (polycondensation). It was obtained from Jerusalem artichoke from underground part.

Method of hydrolysis of inulin from natural juice was based on membrane electrodialysis device, in which the anode compartment was fed a solution of natural juices containing inulin. This solution was treated together with mineral salts from a previous separation of juice. In the cathode compartment provided a hydrolyzate formed in the anode compartment. [Ref. 2]

Root of topinambour and process of drying

Publications

Patents

[1] Sobek J., Hájek M., Veselý V., Punčochář M., Církva V.: Způsob zpracování řas a sinic. The Processing of Algae for Obtaining Oil Resulting. *Pat. No. 304392*/PV 2013-323. Applied: 13.04.30, Patented: 14.02.26.

[2] Punčochář M., Sobek J., Veselý V.: Způsob hydrolýzy inulinového roztoku a zařízení k provádění způsobu. Inulin Solution Hydrolysis Process and Apparatus for Carrying Out the Method. *Pat. No. 304803*/PV 2013-799. Applied: 13.10.18, Patented: 14.09.18.