

Joint chemical laboratory for the service of bioeconomy in the Slovak-Hungarian border region

Project number: SKHU/1902/4.1/001

The project is implemented with the support of the European Regional Development Fund (ERDF) and the National Office for Research, Development and Innovation within the framework of the Interreg V-A Slovakia-Hungary Cooperation Programme.

Lead Beneficiary

Slovenská technická univerzita v Bratislave (STU) – Slovak University of Technology in Bratislava
Faculty of Chemical and Food Technology - Department of Organic Technology, Catalysis and Petroleum
Chemistry

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Project partner

Eötvös Loránd Research Network, Research Centre for Natural Sciences

Institute of Materials and Environmental Chemistry (AKI)

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Project duration: 24 months

Start date of project: 1st October 2020

End date of project: original September 30, 2022, extended until November 30, 2022

Budget of the project

EU contribution from ERDF: 338 367,59 EUR

ERDF contribution for STU: 173 958,89 EUR

National contribution for STU: 20 465,75 EUR

Own contribution (DOTCPCH): 10 232,88 EUR

The aim of the project is to improve cooperation between institutions and promote joint cross-border activities to support the regional bioeconomy. Most of the grant will be used by the partners to develop equipment for a joint Slovak-Hungarian laboratory for the development of catalysed chemical processes for biomass utilisation.

Project summary

With ERDF support proposing partner institutions established a joint chemical laboratory in 2012 to study the chemical utilization of waste biomass appearing in the Slovak –Hungarian border region. Ever since partners continued co-operation using their own resources and taking advantage of the joint laboratory. Recently the support gained from the small project fund of the Interreg Programme helped us to focus on the circular economy in the regional agribusiness. The present proposal concerns bioeconomy that involves every cross-border activity where agricultural businesses and related industrial sectors co-operate to process waste and side-product biomaterials into marketable products, such as, energy, fuels, and chemicals. The general objective of the project is to promote spreading of bioeconomic activity by providing chemical information to stakeholders about the kinds of renewable waste and side-product biomaterials in the border region of Slovakia and Hungary. The information includes the structural and chemical properties of the biomaterials and the possible methods of their processing to get products of increased value. Specific objectives of the project is to broaden operational infrastructure of the existing joint laboratory to serve and promote the spread of bioeconomic solutions in the regional agribusiness by providing farmers and other interested local actors with wider chemical laboratory assistance at higher scientific value. Our aim is to maintain our existing partnerships and to establish new relationships with players of the biomass business.

The objectives of the project are in harmony with those of the Bioeconomy Strategy of the EU, the BIOEAST Initiative of the CEE countries, the National Regional Development Strategy of the Slovak Republic, and the National Smart Specialisation Strategy (S3) of Hungary.

The leading partner is the Faculty of Chemical and Food Technology STU in Bratislava. The Accreditation Commission of the Slovak Republic and the independent Slovak Academic Ranking and Rating Agency (ARRA) ranked FCHFT as first among technical universities in Slovakia over 10 years. The leading participant of the project is the Department of Organic Technology, Catalysis and Petroleum Chemistry (DOTCPCH) of the Institute of Organic Chemistry, Catalysis and Petrochemistry of FCHFT. Its research focuses on the conversion of renewable raw materials, especially components of lignocellulose and renewable bio-oil sources also found in SR, into fuel components and on the preparation of chemicals and materials with high added value as components of the circular economy.

The Hungarian partner is the TTK Institute of Materials and Environmental Chemistry (TTK AKI). The active participant of the project is the Renewable Energy Research Group of the TTK AKI, which deals with the possibilities of reducing the harmful environmental effects of human activities and with the conversion of renewable energy and carbon sources into useful energy carriers and chemicals. The project researchers undertook to map the main bio-waste and agricultural by-products in the Slovak-Hungarian border area, collect samples, organize and store them at the Slovak partner by creating a so-called Biobank. DOTCPCH FCHFT STU collects mainly lignocellulosic samples in the Slovak border area and the Hungarian partner collects them mainly in the Hungarian border area.

Both research groups deal with depolymerisation of lignocellulose: the Slovak group mainly uses thermochemical and the Hungarian group hydrolytic processes. The characterisation of biopolymers and their depolymerised derivatives is carried out, in addition to standard analytical methods, using the new modern analytical equipment of the joint laboratory. Both laboratories are engaged in the development of catalytic technologies for the conversion of biomaterials and lignocellulose derivatives into value-added chemical products, fuels or chemical intermediates for further processing. The joint laboratory will provide technical support to entrepreneurs interested in implementing a biomass utilization process.

The equipment purchased with project funds is necessary to achieve the project objectives. In addition to the existing equipment of the joint Slovak-Hungarian laboratory, DOTCPCH FCHFT STU will purchase high-pressure laboratory reactors and laboratory equipment for automatic sample dosing for the Py-GC-MS instrument (pyrolysis microreactor connected to a gas chromatograph with mass spectrometer), which will significantly increase the research capacity of the joint laboratory.

Polymers represent the largest amount of waste and by-products of biomaterials to be recovered. The first step in their chemical processing is depolymerisation. It is known that one of the most important properties of biosolids is the molecular weight distribution of the polymer. The Hungarian part of the joint Slovak-Hungarian laboratory in Budapest (TTK) will acquire an Advanced Polymer Chromatograph (APC gel permeation chromatograph) to determine the molecular weight distribution of biopolymers. The chromatograph can also be used in high-pressure liquid chromatography (HPLC) mode to separate and determine the composition of complex mixtures of bioproducts.

The role of the Hungarian partner is to provide a computer link that will allow researchers to remotely monitor the equipment of the virtual joint laboratory located at the partner institution. The results will be stored in a common electronic database installed in Hungary. The data will be freely accessible to the partners by computer and processed by computer software compatible with the instruments.

The partners wish to benefit from the synergies of their expertise. They plan to cooperate not only for the duration of the project but also in the long term. The research will be closely linked to the training of young researchers and students, will contribute to improving the quality of university education and will provide the basis for new cooperation at inter-national and EU level.

STU



GC-MS with microreactor



High pressure flow reactor



High pressure batch reactor

TTK



UV VIS spectrophotometer

High pressure catalytic reactor



**Automatic apparatus
for adsorption of gases**



**Server for data
exchange**



APC/UHPLC