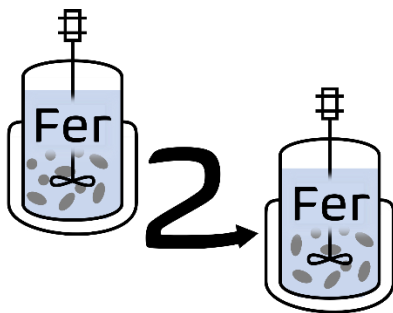


SUSTAINABLE VALORISATION OF FERMENTATION WASTE BY MICROBIAL METABOLIC MODELING AND EXTENSION OF FERMENTATION CASCADES

ANNUAL REPORT ON DISSEMINATION,
COMMUNICATON, MOBILITY AND TRAINING
ACTIVITIES, AND PROGRESS AND RISK MONITORING:
2021



*Prepared within the project “Sustainable valorisation of fermentation waste by microbial metabolic modeling and extension of fermentation cascades (Fer2Fer)”
(No. 1.1.1.2/VIAA/4/20/610)*

30.03.2021

The report is prepared within the project's work package no. 4.

The scientific objective of the project is to provide methodology leading towards an optimal, circular and efficient flow of Fermentation Waste (FerW) and side-streams from one fermentation process to others. This methodology would encompass an integrated FerW valorisation system where the contents of feedstock, its bioconversion efficiency, and the related environmental and economic effects are considered.

Results of the project: Four activities are planned in the project:

1. Evaluation of FerW streams,
2. Preparation of stoichiometric models for FerW fermentation,
3. Development and ranking of valorisation designs (VD),
4. Knowledge transfer, mobility and training.

The project will develop an innovative methodology for FerW valorisation. In addition (1) 2 scientific articles will be published in journals indexed in Scopus and Web of Science databases with a citation index of 50% of the industry average; (2) results will be presented at 2 international scientific conferences; and (3) the young researcher (postdoctoral student) will develop her competence in research, study, international mobility and networking activities for a total of at least 2 months, as well as develop her transferable skills.

Information about the project: Bioeconomy is a fast-growing field generating a range of bio-based products from biological feedstocks. A key enabler for bioeconomy is industrial fermentation (IF), which can be broadly defined as any process where microorganisms are used to transform biomass into useful products. These fermentation processes themselves create a diverse range of side-streams and waste, that could be valorised through anaerobic digestion, co-production of other products (e.g., biofuel and animal feed) or be used as feedstocks for subsequent fermentation cascades. This project will focus on methodology supporting decisions and evaluation of contents of various FerW as well as assessing the economic opportunities and constraints for further use of these FerW. Thus, the project focuses on sustainable growth of bioeconomy, paving way for predictive models to aid the design of more integrated bioconversion processes and biorefineries.

As a result of the project, the postdoctoral researcher will significantly improve her scientific, managerial and communication skills, which will help her achieve the status of an independent, mature researcher. The project will promote the development and implementation of the smart specialization strategy area "Knowledge-intensive bioeconomy" through more efficient use of resources (eco-innovative products, new technologies), innovation capacity building, knowledge base and human resources development (knowledge-intensive bioeconomy), innovation systems (eco-innovative products) and overcoming social, environmental, climate and energy challenges.

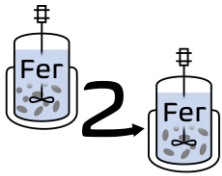
Project period: 01.03.2021 – 30.06.2023. (28 month)

Project costs: 104 071.24 EUR (98 867.67 EUR from EU as ERDF funding; 5 203.57 EUR – the share of the University of Latvia)

Source of funding: European Regional Development Fund Specific Objective 1.1.1 "Improve research and innovation capacity and the ability of Latvian research institutions to attract external funding, by investing in human capital and infrastructure" 1.1.1.2. measure "Post-doctoral Research Aid".

Project application selection round No.4.

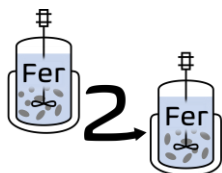
Project Leader: Researcher, Anna Stikane, PhD, anna.stikane@lu.lv



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microbial metabolic modeling and extension of
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DISSEMINATION, EXPLOITATION AND COMMUNICATION ACTIVITIES

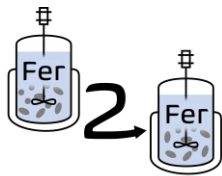
The project was started on 1st of March, 2021 during the global Covid-19 pandemic, which has influenced the dissemination and communication activities.

Two scientific articles have been envisaged to report the results of the project. During the first year of the project, the first article has been prepared and submitted for review to the journal [New Biotechnology](#) (ISSN 1871-6784, IF=5.079). The manuscript looks at the resource potential of spent microbial biomass (SMB) as an organic, potentially valuable and increasingly available side stream of biotechnological production processes in the bioeconomy. The reviewers' comments have been received and are currently being addressed to prepare the manuscript for a resubmission.

The communication activities of the project include (1) participation in the international conference "Metabolic Pathway Analysis: The Frontiers" organised by University of Tennessee, with a poster presentation "Exploring Valorisation of Fermentation By-Products Through Metabolic Modelling", and (2) a participation with a talk on fermentation waste as part of a national event on what to do with biowaste and industrial side-streams (in Latvian "Kas vienam lieks, otram – prieks! Bet ko darīt ar ražošanas blakus produktiem un bioatkritumiem?") run as part of the [Vidzeme Innovation Week](#).

A [dedicated section](#) has been developed at the website of the University of Latvia, that informs visitors about the project's aims, tasks and progress, while also providing links to all results published as an outcome of the project (information is provided in Latvian). Also, the website of the Computational Systems Biology Group holds a [section](#) dedicated to the project (information is provided in English). In addition, a project has been developed at ResearchGate, where periodic updates of the project's progress are published.

At the beginning of the project, an information plate (A3 size) about the project and funding provider was placed in the premises of the University of Latvia – the House of Nature. The plate will be maintained for the whole project, thus informing employees and visitors of the House of Nature and acknowledging the funder of the research project.



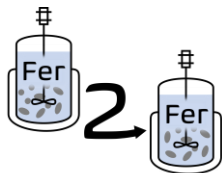
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MOBILITY AND TRAINING ACTIVITIES

The project was started on March 1, 2021 with a mobility visit to Teesside University (United Kingdom), where the post-doctoral researcher was able to meet academics and knowledge exchange professionals working within bioeconomy – from such areas as metabolic modelling, bioprocess engineering, bioindustries and biotechnology. The visit allowed to network and learn about several academic networks such as Biomass and Biorefinery Network, Environmental Biotechnology Network and High Value Biorenewables.

The post-doctoral researcher attended a virtual training course Introduction to Python for Biologists run from 29th of November to 3rd of December, 2021 by a non-profit organisation “Transmitting science”. The course allowed the post-doctoral researcher to learn the basics and main elements of Python programming for data analysis and to learn to apply obtained knowledge in the post-doc research project, as well as gaining knowledge of language-agnostic principles of programming, such as automation with loops and encapsulation with functions, that will serve as best practices for the scientific computing required for the post-doctoral research in fields of metabolic modelling. Thus, the course increased the professional knowledge and skills of post-doctoral researcher.

The post-doctoral researcher has participated in the training sessions on stoichiometric metabolic modelling provided by the Computational Systems Biology Group, University of Latvia. Also, various national and international level webinars have been attended to learn about a range of topics, including scientific, industrial, motivational, and personal development topics. No certificates of attendance have been received, yet the post-doctoral researcher has used the vast opportunities provided by organizers of virtual events available during the pandemics.



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PROGRESS AND RISK MONITORING

The project was started during the global pandemics, thus challenging implementation of the project according to the work plan and timely delivery of the envisaged results. Nevertheless, the work package #1 has been completed with a manuscript on the resource potential of fermentation waste being submitted and under a review for publication to the [New Biotechnology](#) (ISSN 1871-6784, IF=5.079).

In addition, the work to the other work packages (#2 and #3) have been started. To perform these work packages the post-doctoral researcher is undergoing a steep learning curve for using metabolic modelling tools (such as coding for COBRA Matlab and COBRApy packages). In order to, facilitate this the post-graduate researcher is undergoing additional knowledge exchange and training for metabolic modelling by attending public events such as Biomodelling Spring and internally by colleagues from the Computational Systems Biology Group, University of Latvia. The post-doctoral researcher is confident that the scientific progress will be achieved in time.

Due to the travel restrictions caused by the global Covid-19 pandemic, a higher emphasis has been on attending virtual events (virtual conferences, webinars and virtual training courses). Despite this a mobility visit has been achieved and implemented to visit academics at the Teesside University. With the improving situation of the pandemic and travel restriction more presentations and attendance to in-person conferences and mobility is planned this year. These include conference on BioTechPro in April, Society of Applied Microbiology annual conference that was moved from 31st of March 2022 to June 2022, as well as mobility visit to University of Nottingham.

In conclusion, risk and progress monitoring has been performed on a regular basis to assess the progress of the project, correspondence with the project's timeline and evaluate the possible risks in coming phases of the project. The needed mitigation and contingency plans have been initiated and implemented by rescheduling some of the planned activities and deliverables.