

# URBIOFIN

NEWSLETTER NO. 5

## THE PROJECT

*Demonstration of an integrated innovative biorefinery for the transformation of municipal solid waste (MSW) into new biobased products.*

Each person in Europe generates an average of 500 kg of MSW per year. Around 50% of this waste is composed of organic matter, made up of carbohydrates, proteins and lipids, all of which represent useful raw materials to synthesize value added products. However, to date this potential has not been fully exploited. Therefore, the URBIOFIN project aims to demonstrate the techno-economic and environmental viability of converting the organic fraction of MSW into bio-based chemicals such as building blocks, biopolymers and additives.

## OUR ACHIEVEMENTS SO FAR

The 5<sup>th</sup> General Meeting was hosted by the project partner URBASER on November 26<sup>th</sup> and 27<sup>th</sup> in Zaragoza (Spain) to discuss the accomplishments of the last project months. During these two days the URBIOFIN working group visited URBASER facilities, presented the latest results, exchanged knowledge, and discussed ongoing and upcoming activities to properly prepare the next 6 months period. Lastly, the first URBIOFIN review meeting, which was held at the BBI-JU offices on December 5<sup>th</sup>, was also prepared.



*URBIOFIN project partners visiting the anaerobic digestion demo plant at URBASER during the 5<sup>th</sup> General Meeting in Zaragoza, Spain*

The achievements per Work Package are briefly described below:

## WP1 - PRELIMINARY ACTIONS FOR THE URBAN BIOREFINERY DESIGN

This work package is finished, and the set objectives have been achieved: evaluation of the composition variability of feedstock, design of a versatile biorefinery model, definition of bioproducts requirements to facilitate market access, preliminary design and LCA of the biorefinery. With the accession of CSIC, the balances and models have been updated to include new processes for the new bioethylene technology. WP1 serves as a basis for the other WPs of the project.

## WP2 - CONVERSION OF OFMSW TO BIOETHANOL AS BUILDING BLOCK FOR THE PRODUCTION OF BIO-ETHYLENE

Tests to optimize the enzymatic hydrolysis process leading to bioethanol production are in progress. The project partners CIEMAT, NOVOZYMES and IMECAL led the development of optimized enzymatic cocktails. Enzymatic hydrolysis process reached up high yields for selective organic fraction of municipal solid waste (OFMSW). Varying steps in the process procedure indicate that there is even further scope for improvement although the economic feasibility of this process needs to be evaluated.

The implementation of new CSIC's bio-ethylene module at IMECAL is currently in the tendering process and its installation is expected in the following months. Furthermore, advances on the bio-ethylene catalyst development and characterization have resulted in new insights.

At IMECAL, first demonstration activities were conducted and the development of the required advanced sensors. These newly installed sensors will be tested and improved in the following months, providing an updated and refined version soon.

## WP3 - CONVERSION OF OFMSW TO VFAS (VOLATILE FATTY ACIDS) FOR THE PRODUCTION OF PHAS

The construction of the 2-phase anaerobic digestion demo-scale plant is finalised, and first tests were conducted. For example, tests on the enrichment of polyhydroxyalkanoates (PHAs)-producing mixed cultures, water-based PHA extraction, and of volatile fatty acids (VFAs) elongation using OFMSW-digestate or synthetic VFA<sub>6</sub> were performed. The results are as follows:

- Mixed microbial cultures devoted to scl-PHAs production exhibited robustness upon removal of nutrient salts in culture media provided with digestate at AINIA.
- Water-based extraction yielded moderate purification levels and solvent-based extraction is being evaluated to obtain high purity mcl-PHA.
- WUR is combining fatty acids (FAs) elongation and mcl-PHA production in one fermentation process to reduce processing time and steps. This will likely

increase the efficiency of the overall process due to a reduction of product loss associated with each processing step. Specifically, the FAs elongation process and mcl-PHAs.

- Production will be combined in one fermentation process.

To find the best PHA extraction method, tests will be conducted in cooperation with CLAMBER and NATUREPLAST in the next months. The final method will be implemented at CLAMBER demonstration plant. Since fermenters and other equipment have been procured in the past month, scale up at CLAMBER's plant is expected soon.

#### WP4 - BIOGAS BIOCONVERSION TO BIOMETHANE AND ADDED VALUE PRODUCTS

In the last months, UVa has been working in the detailed engineering of all systems and evaluating the overall operational costs of the plants. Advancements in the hydrolysis tests with algae have been made at AINIA, including optimizing enzyme/substrate ratios and solid contents of the raw material to meet the objectives, without compromising the quality of the bioproducts. The removal of siloxane has been tested by using single and double stage biotrickling filters (BTF) at UVa. Results show that 85% of siloxane was removed when using a two phase BTF compared to only 20% removal with an aqueous phase BTF.

The algal pond demo plant at URBASER facilities will be operational in March 2020 and final isolation tests are to be done in the coming weeks.



*Algal pond demo plant at URBASER facilities in Zaragoza, Spain*

#### WP5 - FINAL APPLICATIONS AND INDUSTRIAL VALIDATION OF THE BIOBASED PRODUCTS DEVELOPED

The fruit ripening trials will be carried out on the next citric campaign, when the bio-ethylene module is operational.

Compounding tests have started with commercial PHA at AINIA. Once the process with commercial PHA is

optimized, URBIOFIN PHAs will be employed. Moreover, mulch films will be produced in the next 3 months.

BPe is evaluating the bio-based fertilizer produced on-field trials. There can be different options for crop cycles where the fertilizers can be tested depending on the project's fertilizers availability period. BPe has evaluated several crop cycles and selected.

On the other hand, samples of compounded PHAs+PLAs were sent to NATUREPLAST to make blends. In the following months, the PHAs from the project will be further processed.

To mitigate any deviations in the project activities, a new time management tool has been created by all participants, including data about production and testing times, and minimum input requirements. This tool is intended to help and ensure that the project objectives are met.

Final calculations on fertilizer demands are concluded. The company responsible for testing and preparing the final fertilizers will adjust the nutrient content according to the formula prepared by BPe, using recovered minerals (from wastewater).

#### WP6 – INTEGRATION OF THE URBAN BIOREFINERY. ECONOMIC, ENVIRONMENTAL AND REGULATORY ASSESSMENTS

The techno-economic assessment is being evaluated to include updated material balances and equipment and will feed valuable data to the smartsheet used for evaluation. LCA activities (LCA, LCC & S-LCA) have also been updated.

While the identified legislation to the URBIOFIN project were addressed in the previous newsletter, there have been two regulatory updates that affect URBIOFIN, namely the new circular economy package and the "end of waste status" – a tool that all materials need to comply with. In addition, there is also a new standard affecting mulch films. While there are current regulations regarding the standardization of plastics produced from organic waste, no problems are expected regarding the ethylene produced via OFMSW-based bioethanol. However, legislation regarding bioplastics is yet to be fully implemented.

#### WP 7 – COMMUNICATION, DISSEMINATION AND EXPLOITATION ACTIVITIES

The URBIOFIN representatives attended several events during the past months. Project partner BPE presented the project during a round table at the "ECONOMÍA CIRCULAR e INNOVACIÓN en la GESTIÓN DE BIO-RESIDUOS en la UE" in Madrid. CIEMAT held an oral presentation about URBIOFIN at the seminar "INTERNATIONAL BIOECONOMY" in Jaén and

presented the project at “COP25” and “Sustainable Bioeconomy: An overview of future societies” in Madrid. WUR introduced the URBIOFIN project at the “EFFoST - European Federation of Food Science and Technology” in Rotterdam, The Netherlands and at the EFIB Forum of Industrial Biotechnology in Brussels. Furthermore, URBIOFIN representatives from NATRUE presented the project at “Eco Life Scandinavia trade fair” in Malmo, Sweden. UVa was invited to a talk for “New Horizons in Biotechnology 2019” to Trivandrum, India. IMECAL and AINIA attended at the “BBI JU Stakeholder Forum” in Brussels. Lastly, URBIOFIN representatives from IMECAL went to the Closing Meeting of the RES URBIS project in Rome.



Dr. Frits de Wolf from WUR presenting URBIOFIN at EFIB Forum of Industrial Biotechnology in Brussels

The URBIOFIN website has been updated, e.g. posters and presentation from events are now made available.

Also, preparation of the URBIOFIN workshop, to present results, has started. It will take place on 17<sup>th</sup> June 2020 in Halle (Saale) and will be connected with the 9<sup>th</sup> Bioeconomy Conference.

#### WP8 – PROJECT MANAGEMENT

In December 2019, the URBIOFIN Project Consortium met for the 1<sup>st</sup> Review Meeting at the Bio-based Industries Joint Undertaking (BBI JU).

The next General Meeting will be hosted by BCM in Halle (Saale), Germany on 16<sup>th</sup> June 2020 and will be connected to the 9<sup>th</sup> Int. Bioeconomy conference. In the framework of the General Assembly and the Conference, also the first URBIOFIN International workshop will be organised on 17<sup>th</sup> June.

#### PUBLICATIONS

##### *Biobased Products and Industries*

A. D. Moreno, A. Susmozas, J. Miguel Oliva, M. José Negro

Elsevier, 2020

DOI: <https://doi.org/10.1016/B978-0-12-818493-6.00001-4>

#### MEET URBIOFIN

Are you interested to meet our partners? The next international events where to learn more about the project are:

28<sup>th</sup> European Biomass Conference & Exhibition (EUBCE 2020) on 27 – 30 April 2020, Marseille | France, <http://www.eubce.com>

InterPack on 7 – 13 May 2020, Dusseldorf | Germany, <https://www.interpack.de/>

URBIOFIN workshop on 17 June 2020, Halle (Saale) | Germany, <https://www.bioeconomy-conference.de>

9<sup>th</sup> Int. Bioeconomy Conference on 17 – 18 June 2020, Halle (Saale) | Germany, <https://www.bioeconomy-conference.de>

Please feel free to contact the coordinator for more information: [caterina@imecal.com](mailto:caterina@imecal.com)

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#### PROJECT PARTNERS

