

URBIOFIN

THE PROJECT

Demonstration of an integrated innovative biorefinery for the transformation of Municipal Solid Waste into new Biobased products.

Each person in Europe generates an average of 500 kg of municipal solid waste (MSW) per year. Around 50 percent of this is organic waste, made up of carbohydrates, proteins and lipids, all of which represent useful raw materials for creating valuable products. However, until today this potential has not been fully exploited. Therefore, the URBIOFIN project will demonstrate the techno-economic and environmental viability of converting the organic fraction of MSW into chemical building blocks, biopolymers and additives.

OUR ACHIEVEMENTS SO FAR

The 4th general meeting was hosted by the project partner AINIA the 19th and 20th of June 2019 in Valencia (Spain) to discuss the achievements of the last project year. During these two days the URBIOFIN working groups presented their latest results, exchanged knowledge and discussed ongoing and upcoming activities to properly prepare the next 6 months period.



URBIOFIN project partners attending the 4th General Meeting at AINIA, Spain

The achievements per Work Package are briefly described below:

WP1 - PRELIMINARY ACTIONS FOR THE URBAN BIOREFINERY DESIGN

The URBIOFIN feedstock - the organic fraction of the municipal solid waste (OFMSW) - is a complex stream with variable composition. URBIOFIN aims to convert all components of OFMSW into a wide range of products. To successfully enter the targeted markets, feedstock requirements and final product requirements had to be analyzed regarding performance, yields and costs. This information is vital to define and improve the underlying biorefinery model and processes, and ultimately ensure the success of the project.

As a result, specific proposals have been compiled and its findings will be applied during the engineering design and demonstration activities of the project. The results will not only improve the operational performance and reduce costs of the involved processes, but they will also have an impact in the design and necessary investment costs in a future scale-up of the proposed biorefinery.

This work package is now finished, and the foreseen objectives have been achieved. WP1 will serve 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

The PERSEO Biorefinery semi-industrial plant was redesigned and partially adapted (e.g. new equipment installation, piping, pneumatics, electrical and process modifications, among others) to meet the conditions and parameters defined in WP1 and in the process improvements defined in WP2, in order to be able to achieve the objectives and yields defined for the bioethanol process optimization for this project.



IMECAL started preliminary demonstration activities for the production of bioethanol

In April 2019, IMECAL started preliminary demonstration activities for the production of bioethanol from OFMSW. Bioethanol will be used as chemical building block for the production of bio-ethylene. The state-of-the-art bio-ethylene module will only produce ethene and water as waste products, reducing final costs. CSIC visited IMECAL demonstration plant to discuss details and necessities for the construction of the final bio-ethylene module, which will be coupled to IMECAL's bio-ethanol plant. The bio-ethylene module construction is scheduled for the beginning of 2020.

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

PHA are thermoplastic polyesters, which are very similar to the petroleum-based polypropylene (PP). After months of intensive construction works, the installation of the 2-phase anaerobic demo-scale plant is almost finalized. The digester, conveyor belts and screws are already installed; the gas holder, feeding and dewatering systems are ready. The final installation of piping, pneumatics and electrical connections will be completed within this month in addition to the supervisory control and data acquisition system (SCADA). Once the system is completed, the operation of the hydrolytic and methanogenic digesters will begin to provide their products to the downstream processes.

The VFA stream will be used for producing scl-PHA and mcl-PHA. Regarding mcl-PHA production, samples of VFA were delivered to WUR for elongation tests. Homogeneous products were obtained in all experiments with all conditions.

First experiments of VFA elongation indicate the feasibility of the process. Several extraction processes were analyzed and the optimal one will be selected to be developed at demo-scale.

Regarding scl-PHA production, advanced lab-scale processes developed by AINIA led to technology transfer to Clamber facilities. In the following months AINIA is testing different enrichments and accumulation experiments to reduce operational costs to be later applied by Clamber. Also, the sterile storage unit has already been finished by Clamber, so as it is ready to be used at demo-scale. The scl- and mcl-PHA extraction process unit is also prepared to obtain the final products.



URBIOFIN project partners visiting AINIAs experimental facilities

WP4 - BIOGAS BIOCONVERSION TO BIOMETHANE AND ADDED VALUE PRODUCTS

The photobioreactor (microalgae pond) will be installed at URBASER's facilities. The produced biomethane needs to comply with regulations; therefore, the installation of a separate unit to control hydraulic and solids retention times is necessary.

UVa provided AINIA with microalgae for preliminary hydrolysis assays to optimize the procedure and evaluate amino acid concentration. The start-up of the high rate algal pond is expected for November 2019.

The operation of two bio trickling filters for siloxane removal has been analyzed. In the coming months, the microbial communities from siloxane removal systems will be studied and lab-scale BTF for siloxanes removal will be optimized.

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

AINIA has identified the specific packaging characteristics for plastic bags and cosmetic packaging and preliminary tests will start in the following months.

BPe, together with CAJAMAR Research Foundation (Agricultural experimental station), defined the protocol for the field trials for the agricultural applications of this project, e.g. biodegradable mulch films. The same applies for the validation trials of solid and liquid fertilisers.

The first proof of concept study on the PHA composition, processing and thermomechanical properties was performed. Extracted PHA was initially blended into a commercial PLA at lab scale to assess its properties, but larger extruders are needed.

Regarding bio-ethylene, validation trials will be done after starting the pilot plant, which is scheduled for the beginning of 2020.

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

Modelling and integrated process flow diagrams have been carried out.

Material balances and equipment lists are ongoing and will feed valuable data to the smartsheet used for the techno-economic assessment evaluation.

Updates of LCA activities (LCA, LCC & S-LCA) have been done.

Summary of the identified legislations were selected according to the obtained bioproducts:

- 1st bioproduct – Ethylene with focus on safety requirement and hazard in handling this chemical. No difference with ethylene from other sources.
- 2nd bioproduct – PHAs based bioplastic for cosmetic packaging and waste bags (very specific regulations). Reduced plastics and increased bioplastics production; overall market growth.
- 3rd bioproduct – PHAs based bioplastic agriculture film.

- 4th bioproduct – Bio-based fertilizer with focus on Product Functional Categories (PFC's), Component Material Categories (CMC's) and Fertilizers Products Regulation (FPR).

WP7 - COMMUNICATION, DISSEMINATION AND EXPLOITATION ACTIVITIES

The URBIOFIN representatives attended several events during the past months. For example: project partner NATRUE presented the URBIOFIN project at the "Natural and Organic Products Europe", in London. IMECAL introduced the URBIOFIN project at the "Urban Waste Management and Circular Economy: Challenges and Initiatives Conference (ECOMONDO 2018)" in Rimini, Italy. Furthermore, URBIOFIN representatives from BCM presented the project at "The 8th International Bioeconomy Conference and "BIOPOLYMER 2019" in Halle (Saale), Germany. URBASER attended "WASTE-TO-RESOURCE - 8th International Symposium MBT, MRF & Recycling" in Hanover. Moreover, URBIOFIN representatives from URBASER, UVA and AINIA have been to the 16th IWA World Congress on Anaerobic Digestion in Delft where they showcased the scope and the status of the project among others.

During the past months, BCM has done many communication activities besides the announcements of conferences and workshops. Further on, events and news have been published regularly on our website and the Twitter and LinkedIn social media account. Followers are able to follow the URBIOFIN accounts to receive the latest news regarding the URBIOFIN project.

A Project Newsroom has been implemented in the URBIOFIN website, to monitor the URBIOFIN partners respective their field of research/market.

WP8 – PROJECT MANAGEMENT

We are very pleased to welcome ICP-CSIC from Spain as our new partner as substitute of GI Dynamics, for the development of the bio-ethylene module in WP2.

Last month, URBIOFIN submitted the first interim report of the project. The next General Meeting will be hosted by URBASER in Zaragoza on the 26th-27th November 2019.

PUBLICATIONS

Waste Biorefinery

V. Pérez, M. Latorre-Sánchez, C. Coll Lozano, et al
Elsevier, 2018

DOI: <https://doi.org/10.1016/C2016-0-02259-3>

MEET URBIOFIN

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

BBI JU Stakeholder Forum 2019 on 4 December 2019,
Brussels | Belgium,

<https://stakeholderforum.bbi.europa.eu/bbi2019>

InterPack 2020 on 7 – 13 May 2020,
Dusseldorf | Germany,

<https://www.interpack.de/>

Please feel free to contact the coordinator for more information: caterina@imecal.com

@URBIOFIN | URBIOFIN Project

www.urbiofin.eu | imecal@imecal.com

PROJECT PARTNERS

