bioethanol®

URBAN BIOREFINERY: SECOND GENERATION BIOETHANOL, BIOPRODUCTS AND BIOENERGY FROM ORGANIC MUNICIPAL SOLID WASTE

WATER CYCLE MANAGEMENT AND MUNICIPAL BIOWASTE EXPLOITATION IN THE CONTEXT OF CIRCULAR ECONOMY: FROM CONCEPT TO STANDARD PRACTICE

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INDUSTRIAS MECÁNICAS ALCUDIA S.A.

Metal mechanical company founded in 1979.
 Located in L'Alcúdia (Valencia – Spain)
 High technological capacity. Experience in petrochemical and refinery sectors.
 25.000 m2 of facilities. 180 employees.







About 100 Mt of municipal <u>biowaste</u> is generated every year in Europe.

Only about a third (30 Mt) of this was separately collected and composted and/or digested (European Compost Network (ECN))

New Waste legislation (22 may 2018)

Mandatory separate collection of bio-Waste: 31/12/2023
 Maximum 10% landfill of MSW 2035.

COM (2015) 614 Circular economy. From residue to resource.



Biotechnological process: Transform the organic fraction of municipal waste into advanced bioethanol, bioproducts and bioenergy.









Patented biotechnology to transform the Organic fraction of Municipal Solid Waste into secondgeneration Bioethanol bioproducts and bioenergy.





Collaboration with different Universities, Private companies, European Associations, Municipalities and Public Authorities









PERSEO Bioethanol®: Urban Biorefinery









Bioethanol market:

- ✓ Biofuel: 90% of total biofuels. In Europe 13 billon € in 2030
- Chemical Building block: Bioethanol is considered as one of the "top 10" potential biobased raw materials for the chemical industry. (US Energy Department)







IMECAL biorefinery Projects

2017-2021



2017-2020



2017-2020



Demonstration of an integrated innovative biorefinery for the transformation of Municipal Solid Waste (MSW) into new BioBased products. (GA No. 745785)

Chemical building blocks from versatile MSW biorefinery. (GA No. 745828)

Valorization of urban wastes to new generation of bioethanol (EXP-00098459 / SERA-20171009)



Este proyecto ha recibido financiación del programa ERA-NET CO-FUND BESTF3 con cofinanciación de CDTI y MINECO en España y DECC en Reino Unido así como del Programa Marco de Investigación e Innovación, H2020, de la Unión Europea.





Horizon 2020 European Union Funding for Research & Innovation





The URB SFIN consortium

Demonstration of an integrated innovative biorefinery for the transformation of Municipal Solid Waste (MSW) into new BioBased products. (GA No. 745785)

Demo Project Budget: 15 M€ Duration: 4 years project (6/2017 – 5/2021)







NEW MODEL OF OFMSW TREATMENT Biorefinery Multiple bioproducts Higher value

Landfill Composting Anaerobic Digestion







VALUE



Biorefinery concept













URBIOFIN: Demonstration sites







CLAMBER Pilot Plant















Horizon 2020 European Union Funding for Research & Innovation

Market of bioproducts

- **Bioethanol**:
- ✓ Biofuel: 90% of total biofuels. Market Forescast in Europe: 13 billon
 € in 2030
- Chemical Building block: Bioethanol is considered as one of the "top 10" potential biobased raw materials for the chemical industry. (US Energy Department)



> Bioethylene:

 ✓ Global bioethylene market size was over USD 160 billion in 2015 and is foreseen to exceed USD 235 billion valuation by 2024











Market of bioproducts

> Bioplastics:

Biodegradable bioplastics 2014 vs. 2019

- ✓ Biodegradable bioplastics market is expected to double between 2014 and 2019.
- ✓ In the case of PHA market it is expected a growth from 32 to 104 Mton, mainly related to flexible or rigid packaging and agriculture purposes.
- Biofertilizers
- ✓ Global bio-based fertilizers market is expected to reach USD 1.9 Billion by 2020 at a CAGR of 14.0% from 2015 to 2020





Source: European Bioplastics, Institute for Bioplastics and Biocomposites, nova-Institute (2015). More information: www.bio-based.eu/markets and www.downloads.ifbb-hannover.de

*Others include zinc, boron, and sulfur-solubilizing biofertilizers E – Estimated; P - Projected Source: Expert Interviews and MarketsandMarkets Analysis











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BID-BASED Bio-based Industries Consortium



Horizon 2020 European Union Funding for Research & Innovation



Chemical building blocks from versatile MSW biorefinery



PERCAL Chemical building blocks from versatile MSW biorefinery

PERCAL will exploit **OFMSW** as feedstock to develop **intermediate chemical products** at high yield and low impurity level with huge industrial interest.

- **Bioethanol** (current PERSEO Bioethanol[®] technology) as chemical building block.
- *Lactic acid (LA)* to produce:
 - o Eco-friendly ethyl lactate solvents by reactive distillation from lactic acid & bioethanol.
 - o Hot-melt adhesives in combination with maleic anhydride by reactive extrusion.
- Succinic acid (SA) as an intermediate building block to produce polyols for the polyurethane industry.
- *Biosurfactants* by chemical modification of proteins and lipids from the remaining fraction of MSW fermentations.





PERCAL Chemical building blocks from versatile MSW biorefinery

Overall concept



PERCAL Chemical building blocks from versatile MSW biorefinery Main results so far

- ✓ A list of specific <u>requirements for PERCAL's intermediate and final products</u> was defined.
- <u>Pre-treatment and enzymatic hydrolysis processes were optimized.</u>
- <u>LA and SA selected strains</u> have been used to perform small scale fermentations and identify the best strains.
 LA fermentations have shown promising results with high conversion yields.
- ✓ <u>Fermentation residues</u> were analyzed showing similar composition, rich in lipids and proteins, which <u>will be</u> <u>used for the synthesis of biosurfactants.</u>
- First tests to optimize the synthesis of final products ethyl lactate, LA based hot melts adhesives and polyester polyols have been performed.
- ✓ <u>The study of the adaptability and monitoring of a versatile biorefinery</u> to obtain three chemical intermediates (ethanol, lactic acid and succinic acid) has been started.





PERCAL Chemical building blocks from versatile MSW biorefinery





VALORIZATION OF URBAN WASTES TO NEW GENERATION OF BIOETHANOL (WASTE2BIO)





WASTE2BIO PROJECT

The <u>main objective</u> of the WASTE2BIO project is to validate and demonstrate a global process for the production of bioethanol as liquid biofuel and biogas from the remaining recoverable organic fraction from MSW in order to enhance the valorization of residues, reducing energy costs and impacts from waste management and contribute to an improved balance of GHG emissions from biofuels and to the achievement of the EU's objectives.





WASTE2BIO PROJECT Main results so far

- ✓ OFMSW pretreatment improved.
- ✓ PERSEO Biothanol[®] process optimized
- ✓ AD tests show similar/better biogas yields than fresh OFMSW.





WASTE2BIO PROJECT

Validation and Demonstration of the Integrated Process



PERSEO Bioethanol® plant







Benefits of an urban biorefinery:



Higher annual benefits, when compared to current MSW technologies

Profitability



Improvement of the performance through the use of by-products generated in their own processes -



Evolution towards the path of the bioeconomy defined by the EU.







Reduction of fossil resources dependence in energy and products.

Bioresources



Sustainability

Boost competitiveness, foster sustainable economic growth and generate new jobs

Circular Economy



THANKS!





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