

BioCatPolymers PROJECT

BioCatPolymers is a 3-year European project funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 760802.

The main objective of BioCatPolymers is to demonstrate a cost-effective, sustainable and efficient cascade technological route for the conversion of low-value, low-quality residual biomass to bio-polymers with equal or better performance than their fossil-based counterparts.

The BioCatPolymers consortium comprises 7 legal entities within four EU Member States (Greece, Germany, Sweden, Netherlands) and one Associated Member State (Switzerland). The project is coordinated by the Centre for Research & Technology Hellas (Greece).

BioCatPolymers 5th EXECUTIVE BOARD MEETING & 1st REVIEW MEETING IN BRUSSELS

The 5th official BioCatPolymers meeting was combined with the First Review Meeting on July 1-2, 2019, in Brussels.

At the Governing Board meeting, on July 1, 2019, the activities, tasks and deliverables were summarized and the next steps for the implementation of the active work packages (WP) and next milestones of the project, were discussed and decided. The current financial status of the project was presented and the preparation and submission of the periodic report was also discussed.

The First Midterm Review meeting took place on July 2, 2019 with the participation of representatives from all 7 partners and at the presence of the EC project officer, Dr Angel Fuentes-Mateos and the scientific expert and monitor, Dr Daniela Monti.



The review meeting started with an overview of the project by the coordinator, followed by presentations of the activities, results and progress in each work package by each WP leader, and closed with the recommendations of the project officer and the positive remarks of the reviewer.

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BioCatPolymers ACHIEVEMENTS of the 2nd year

PRETREATMENT



- ✓ Selection of 3 biomasses (Spruce, Birch, Wheat straw) and pre-treatment in accordance with CelluApp® technology
- ✓ Investigation of phosphate removal methods from hydrolysate
- ✓ Enzymatic hydrolysis tests on 100 lt scale with the three selected biomasses
- ✓ 1st Demo Activity: Pre-treatment of birch in SEKAB to produce adequate amount of hydrolysates for 300 lt fermentation

FERMENTATION TO MVL



- ✓ A new 2nd generation MVL production strain (with no phosphate limitations) was engineered by Visolis with MVL productivity from hydrolysate similar to that from pure sugars
- ✓ Bioreactor process conditions (media, T, Ph, DO, Feeding rates) and feedstocks were optimized using real cellulosic hydrolysate
- ✓ Achieved MVL production of > 0.3 g/g sugar at 2 lt bioreactors
- ✓ Achieved fermentation titer of ~ 50 g/L using dilute hydrolysates from birch wood.

THERMOCHEMICAL CONVERSION OF MVL TO ISOPRENE



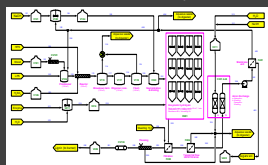
- ✓ SiO₂-rich amorphous materials were identified as promising for the efficient decarboxylation of MVL to isoprene
- ✓ Mapping of operating conditions showed that mild temperatures (225 – 250 °C) and atmospheric pressure maximize isoprene production
- ✓ At these conditions, complete MVL conversion was attained
- ✓ The maximum isoprene yield achieved was ~ 65 % of the theoretical maximum

HYDROGENOLYSIS REACTION OF aMVL TO 3MPD



- ✓ Cu-based catalyst proved to be extremely efficient in the hydrogenolysis of aMVL to 3-methyl-1,5-pentenediol (3MPD)
- ✓ Complete aMVL conversion and very high 3MPD selectivity was achieved, using real MVL and aMVL fermentation-derived feedstocks
- ✓ Catalyst stability was investigated with positive results

CONCEPTUAL DESIGN, TECHNO-ECONOMICS, LCA



Interim reports on:

- i. conceptual process design for the production of monomers from biomass
- ii. economic and social evaluation of the production of monomers from biomass
- iii. environmental Life Cycle Assessment of the production of monomers from biomass

BioCatPolymers ACHIEVEMENTS of the 2nd year

RISK ANALYSIS, BUSINESS & COMMERCIALIZATION PLAN	<ul style="list-style-type: none"> ✓ Final risk analysis and management plan ✓ Interim commercialization plan
PROMOTIONAL ACTIVITIES/ DISSEMINATION	<ul style="list-style-type: none"> ✓ Presentations at 7 national/international conferences ✓ Organization of BioCatPolymers technical workshop in Delft, Netherlands ✓ Production of BioCatPolymers project video ✓ 2nd Annual Newsletter
MANAGEMENT & COORDINATION	<ul style="list-style-type: none"> ✓ Submission of periodic report ✓ Submission of 18 deliverables and 7 milestones

1st BioCatPolymers WORKSHOP

The workshop *“Efficient and Sustainable Production of High Added Value Bio-Chemicals via Biotechnological and Chemocatalytic Routes”* was successfully held on May 15, 2019, at the BPF facilities, in Delft, Netherlands.

The workshop included presentations from major industries active in bio-chemicals and related European-funded projects working on innovative bio-catalytic and chemo-catalytic process concepts. The BioCatPolymers workshop brought together representatives of academic/research organizations and industry, to discuss the current and future trends of biochemical technologies and markets.

In terms of impact, the workshop was very successful, with participants coming from 12 different countries, 39% from academia (*DTU, TU Graz, etc.*) and 61% from industry (*EV Biotech B.V., Bio Base Europe Pilot Plant, etc.*).

The dissemination of the BioCatPolymers project was successfully combined with the event. The event closed with a tour at the BPF facilities.



BioCatPolymers VIDEO



The BioCatPolymers video was released in December 2019 in terms of the promotional activities of the project. The video, which is available on the project's website, presents to the public audience the objectives of the BioCatPolymers project and describes in a simple way the innovation of the project and the technology under development for the efficient production of sustainable bio-polymers starting from residual biomass.

BioCatPolymers PUBLICATIONS/PRESENTATIONS of the 2nd year

1. E. Heracleous, E. Pachatouridou, A.A. Lappas, Sustainable and Efficient Bio-Chemical Catalytic Cascade Conversion of Residual Biomass to High Quality Biopolymers, *7th ENMIX Workshop*, Rome, Italy, April 3-4, 2019. 
2. E. Pachatouridou, E. Heracleous, A.A. Lappas, Hybrid bio/ thermochemical catalytic conversion of residual biomass to bio-plastics, *12th National Conference in Chemical Engineering*, Athens, Greece, May 29-31, 2019. 
3. E. Heracleous, E. Pachatouridou, L. Louie, M. Bootwala, D. Dugar, and A.A. Lappas, Hybrid bio/thermochemical catalytic conversion of residual biomass to bio-isoprene via mevalonolactone as platform molecule, *2019 NORTH AMERICAN CATALYSIS SOCIETY MEETING*, Chicago, Illinois, June 23-28, 2019. 
4. E. Heracleous, Catalysis in downstream processing for the cascade production of high added value biochemicals and biofuels, **Keynote lecture**, *14th European Congress on Catalysis, EuropaCat 2019*, Aachen, Germany, 18 – 23 August, 2019. 
5. E. Heracleous, E. Pachatouridou, A.A. Lappas, Sustainable and efficient bio-chemical catalytic cascade conversion of residual biomass to high quality biopolymers, *14th European Congress on Catalysis, EuropaCat 2019*, Aachen, Germany, 18 – 23 August, 2019. 
6. E. Pachatouridou, E. Heracleous, M. Papapetrou., A.A. Lappas, Efficient catalytic conversion of mevalonolactone to isoprene over SiO₂/Al₂O₃ catalysts, *5th International Conference on Catalysis for Renewable Sources: Fuel, Energy, Chemicals*, Crete, Greece, September 2-6, 2019. 
7. H. Vleeming, R. Roelant, H. Keuken, Turning biotechnology development into an industrial application, oral presentation, *The European Summit of Industrial Biotechnology 2019*, Graz, Austria, 18-20 November, 2019. 
8. H. Vleeming, R. Roelant, H. Keuken, Turning biotechnology development into an industrial application, poster presentation, *The European Summit of Industrial Biotechnology 2019*, Graz, Austria, 18-20 November, 2019. 
9. R. Verlinden, The scale-up route for fuels and chemicals from second generation biomass, *The European Summit of Industrial Biotechnology 2019*, Graz, Austria, 18-20 November, 2019. 
10. E. Heracleous, E. Pachatouridou, B. Russell, B. Lee, D. Dugar, A.A.Lappas, A novel hybrid bio-thermochemical route for the production of bio-isoprene via decarboxylation of mevalonolactone (MVL), *28th European Biomass Conference and Exhibition (EUBCE)*, Marseille, France, 27-30 April, 2020, *submitted*. 

BioCatPolymers CONSORTIUM



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CENTRE FOR
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