Biofuels through Electrochemical transformation of intermediate BIO-liquids

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Brief Description of the deliverable content and purpose

This report gives and overview of EBIO's second workshop at EUBCE 31st edition. Four presentations were made by four different European funded projects, under the title 'Electrochemical conversions from biobased compounds. In each of the presentations an overview of the project was provided and a summary of the technology and any relevant results. The workshop was concluded with a panel discussion. The EBIO thematic session was organized in conjunction with the wider full day ETIP bioenergy platform event, which start at 11am and finished at 18:00, and included four thematic sessions, a panel discussion and a European Commission address.

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1 Introduction

The European Biomass Conference & Exhibition (EUBCE, www.eubce.com) combines one of the world's leading R&D conferences with an international exhibition, and represents the leading platform for the collection, exchange and dissemination of scientific know-how in the field of biomass.

The 31st edition of the European Biomass Conference and Exhibition (EUBCE), organized by ETA-Florence, was held in at the Congress Center in Bologna, Italy from 5th – 8th June 2023. During the conference the EBIO project had a visibility point, presented different abstracts, and held a workshop on 6th June, with the title 'Electrochemical conversions from biobased compounds.

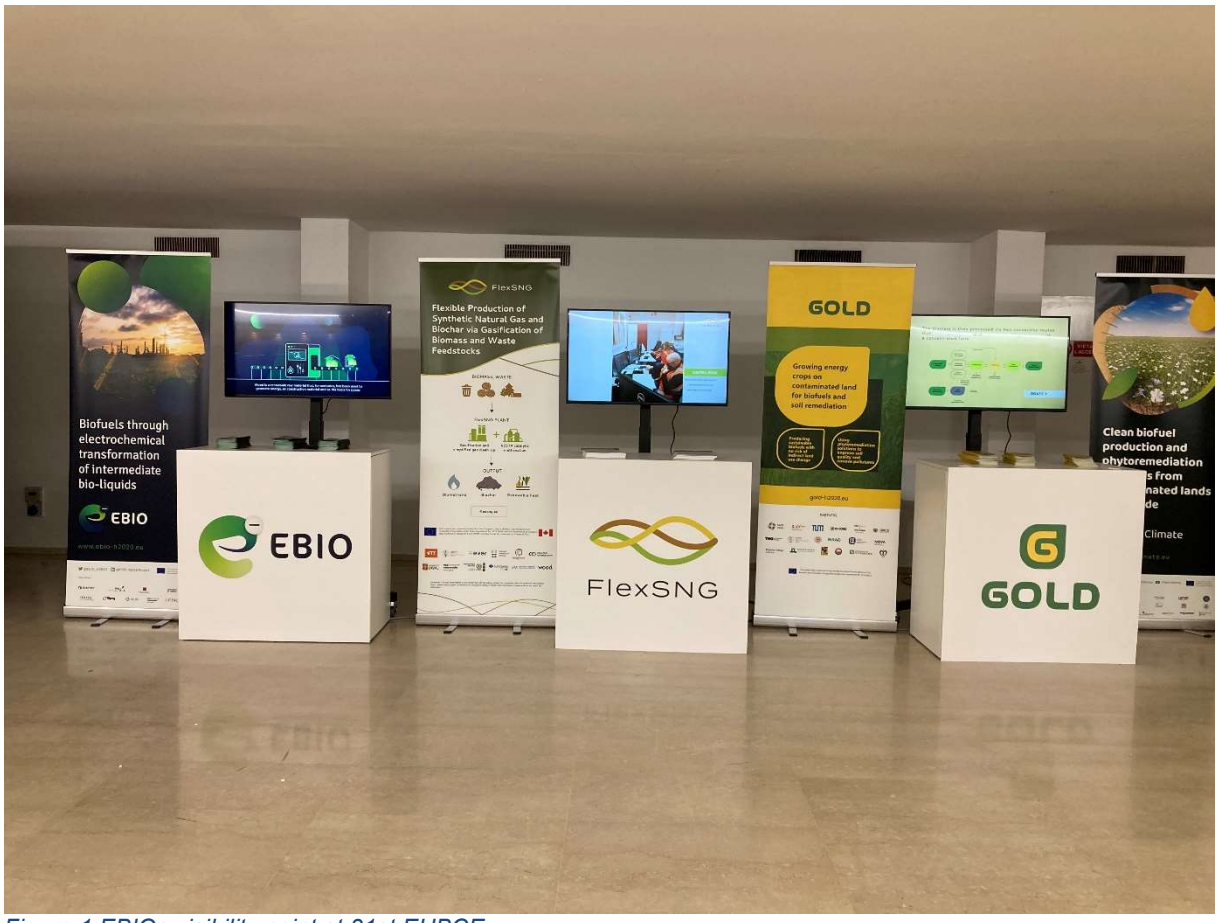

Figure 1 EBIOs visibility point at 31st EUBCE

This report will summarize the event preparation, execution, and conclusions of the EUBCE 2023 workshop.

2 Preparation

The aim of the workshop was to engage with and enable other similar EU funded projects to present their findings together, under the title 'Electrochemical conversions from biobased compounds'. Hosted by EBIO H2020 Project, the session included presentations from 4 European projects that are researching different electrochemical conversion methods. Each project gave an overview of the project including technologies, high level review of results, and lessons learnt.

Workshop organization:

The EBIO thematic session was organized in conjunction with the wider full day ETIP bioenergy platform event, for which ETA-Florence is also included as the communications and dissemination WP Leader. Therefore, the process started with an internal meeting to set the agenda for the day and

designate time slots for each of the thematic sessions (project workshops) under the title 'emerging technologies and their contribution to SET Plan Action 8' (four in total). For the EBIO session specifically, three or four online meetings were held first of all with the project work package leaders and then only with those relevant to the session, as it was concluded in the first meeting that not all project team members would be required for the presentation. During these meetings and through project connections several other EU funded projects were selected and invited to present as part of this workshop.

After the agenda, timings, the appropriate speakers, and arrangements for the day. The following agenda was designated for this EBIO session:

13.45 Electrochemical conversions from biobased compounds

Hosted by EBIO H2020 Project, this session will include presentations from 4 European projects that are researching different electrochemical conversion methods.

Each project will give an overview of the project including technologies, high level review of results, and lessons learnt.

Presenter: Roman Tschentscher, SINTEF

13:50 EBIO - Biofuels Through Electrochemical Transformation Of Intermediate Bio-Liquids.

This presentation will give an overview of the project and its research objective: to use electrosynthesis to convert two low-valued and readily available bioliquids – fast pyrolysis and black liquor – into green fuels and biochemicals. Presenter: Guido Mul, TWENTE

14:05 Liberate

Design of an electrochemical plant to demonstrate the commercial opportunities of converting low-cost lignin feedstock in high value bio sustainable chemicals. Presenter: Bernd Wittgens, SINTEF

14:15 PERFORM

European technology to catalyse electrification of chemical industry: provides solutions for the need for the electrification of the chemical industry and will establish a flexible Power-Platform pilot plant Presenter: Riccardo Zaffaroni, TNO

14:30 ABC Salt

Advanced Biomass Catalytic Conversion to Middle Distillates in Molten Salts. Presenter: Balaji Sridharan, RUG

14:40 Session wrap up. Presenter: Roman Tschentscher, SINTEF

The overall day concluded with a panel discussion, under the title 'Common ground and contribution of EU projects to the revamping of the SET Plan Action 8', with Dina Bacovsky, BEST, as the chairperson, and a representative from each of the thematic sessions during the day, Roman Tschentscher, SINTEF, was the representative from the EBIO session.

Workshop promotion:

Workshop promotions included posts on the project website, the LinkedIn page, and through the EUBCE communication channels (website, programme, and emails).

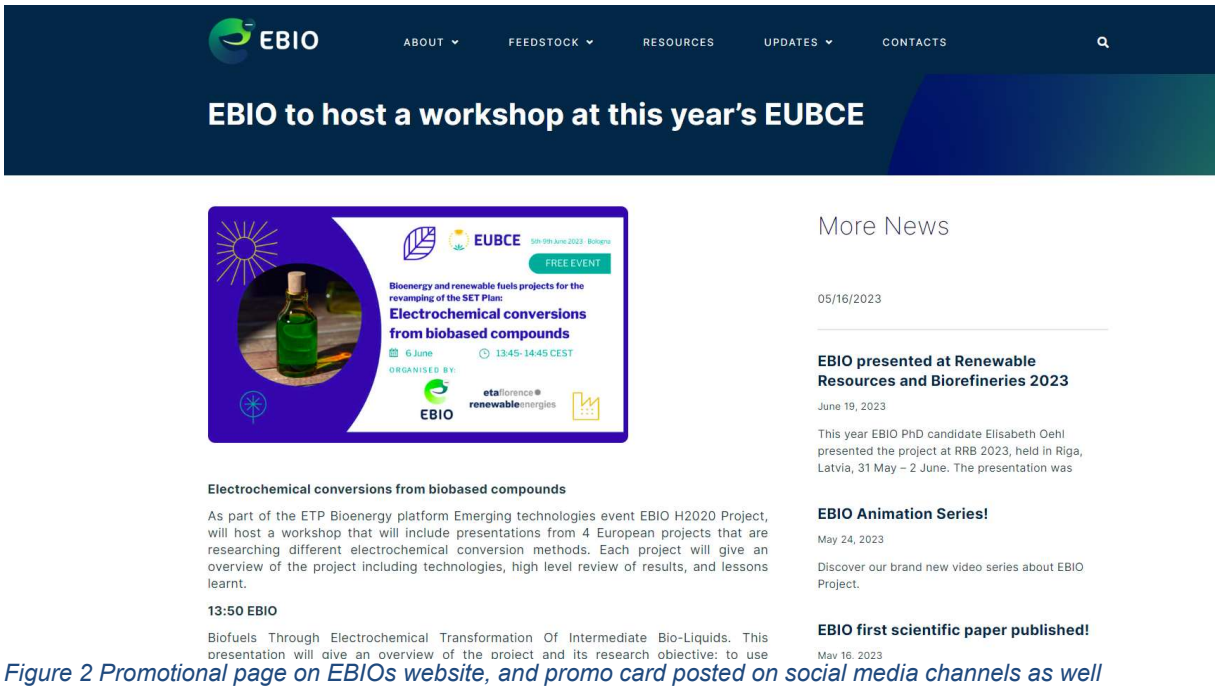

Figure 2 Promotional page on EBIOs website, and promo card posted on social media channels as well

3 Workshop Summary

On Tuesday 6 June 2023, at EUBCE 31st Edition, a one-day event was held under the umbrella of the ETIP bioenergy platform titled: 'Bioenergy and renewable fuels projects for the revamping of the SET Plan'. This event was subdivided into four topical sessions, one session titled: Electrochemical conversions from biobased compounds, the EBIO hosted session.

The session started with an introduction from Roman Tschentscher in which he introduced the concept of the topical session and an introduction to the other projects that would be presenting.

Figure 3 Introduction slides from Roman Tschentscher

Then we heard from Guido Mul, University of Twente, who presented about the current research focus of the EBIO project which is acid decarboxylation reactions. He presented about the type of electrodes that are most appropriate and specifically about the Boron Doped Diamond (BDD) Electrode that is part of the EBIO research, and the mechanism of Acetic Acid decomposition using this type of electrode.

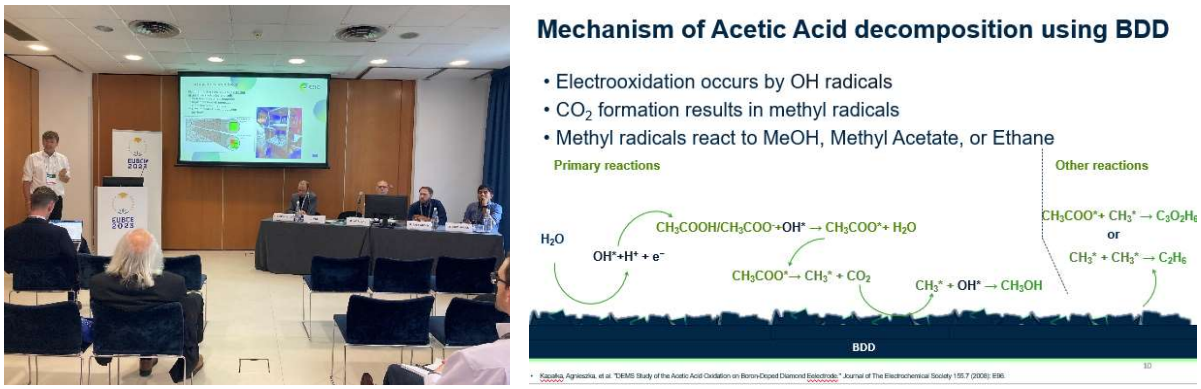

Figure 4 Guido Mul presenting the EBIO project

The next project to be presented was Liberate by Bernd Wittgens, SINTEF. This project presentation focused on lignin biorefinery approach using electrochemical flow, and an overview of the project that finished shortly before the EUBCE (Duration: 54 months (from 01/10/2018 to 31/03/2023).

The main objective of LIBERATE was to deliver a pilot scale electrochemical plant to demonstrate the commercial opportunities of converting low-cost lignin feedstock in high value bio-sustainable chemicals.

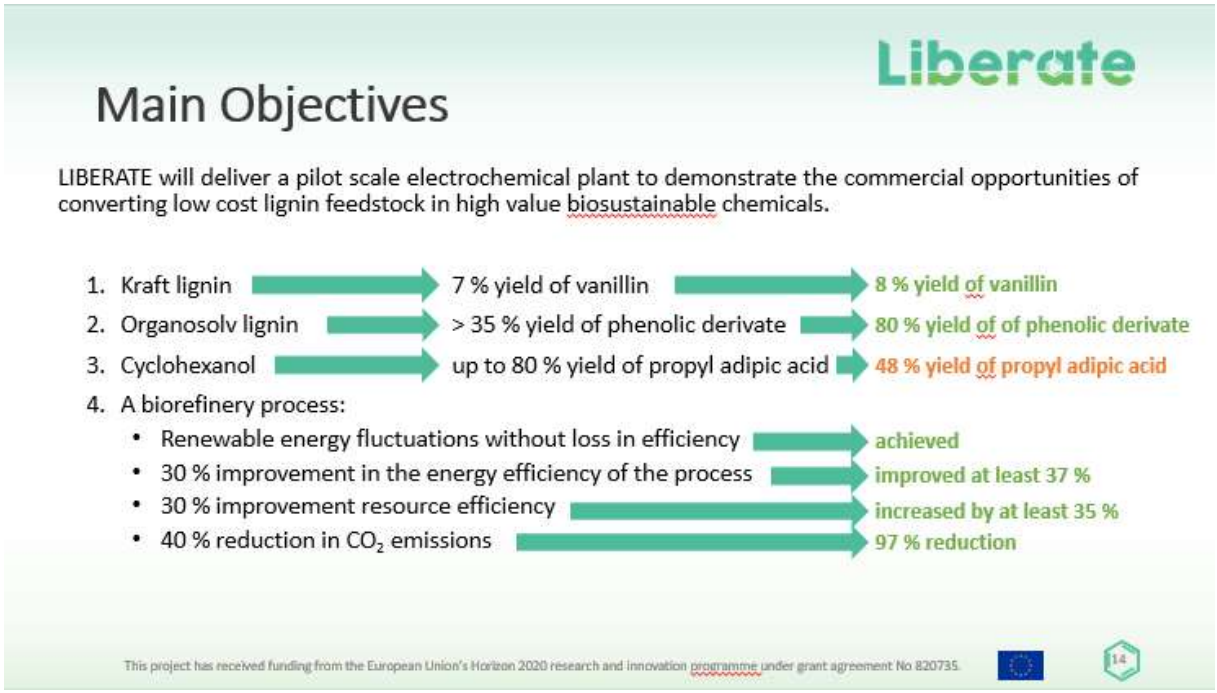

Figure 5 Presentation slide for project Liberate showing a summary of the project results

The third presentation was given by Riccardo Zaffaroni, TNO, about PERFORM, PowER platFORM. The presentation started with the project outline; Four year IA (Innovation Action) project budget € 8.7 M€, started 1 January 2019, + extension, new end of project: December 2023, with the goal to develop solutions for the electrification of the chemical industry- Electrochemical production methods for value-added components, and more efficient and sustainable production –Paired electrolysis.

- Pilot Perform Platform delivered and commissioned –May 2023- to demonstrate electrochemical conversion on kg/day production scale in Maleic and valeric acids.
- Flexible electrochemical reactor stack with various electrode testing possibilities.
- Integrated DSP has been developed (electrodialysis, nanofiltration, extraction & distillation, crystallization, …).

- Potentially positive business case for maleic and valeric acid; Final TEA after process demonstration at kg/day scale.
- Pending; productivity at kg/day scale, showcase of integrated DSP, product assessment and testing from industry.

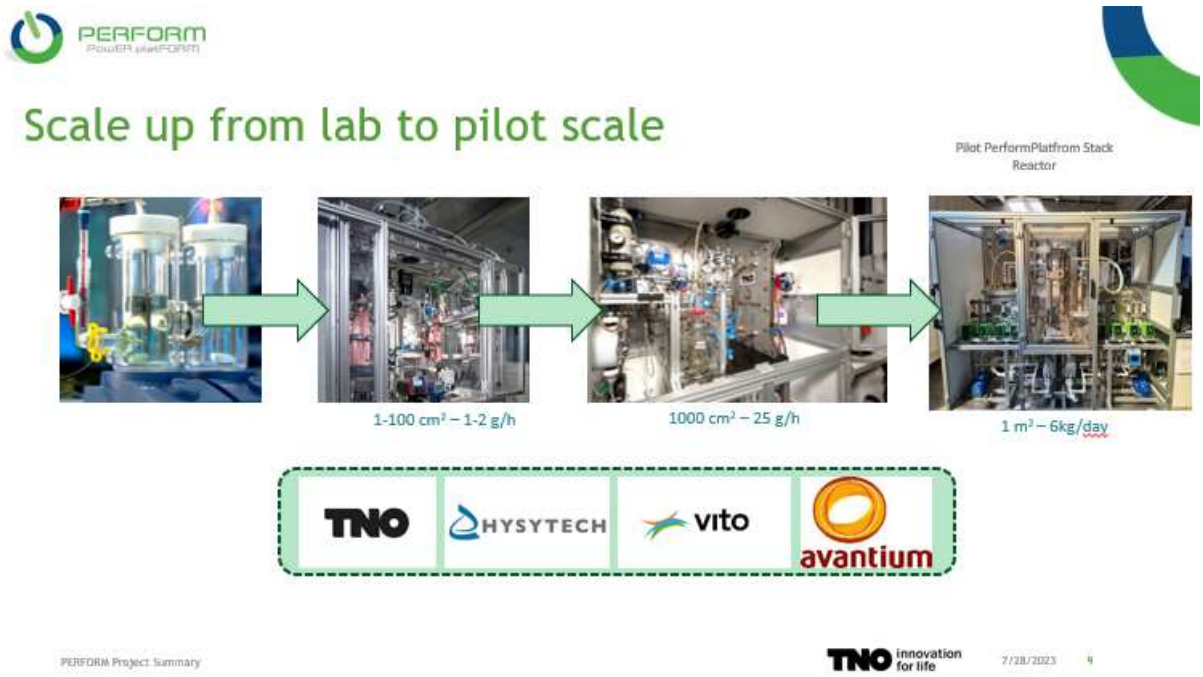

Figure 6 Perform: Power Platform presentation slide.

The final project presentation came from the project ABC-Salt (Advanced Biomass Catalytic Conversion to Middle Distillates in Molten Salts), that focused on the conversion of lignin to biofuels with high carbon yields. The presentation was given by Balaji Sridharan, University of Groningen, and began with an overview of the project; A four-year project funded by EU Horizon 2020 (completed September 2022) to demonstrate a novel route to produce sustainable liquid biofuels at laboratory scale from various lignocellulosic waste streams.

The conclusions of the project included:

Catalytic activity of molten salts

- Pinewood: Selective conversion to furfural and acetic acid. Catalytic conversions allow efficient upgrading to a hydrocarbon rich fuel
- Lignin: able to depolymerize lignin effectively leading to very carbon yields.

ABC – Salt process for sustainable biofuels : Results exceeded anticipated targets

- Overall liquid hydrocarbon yield increased from 24 C% to over ~80 C% by the end of the project
- Demonstrated in a continuous scale over a period of almost 100 hours
- High carbon yields for both the hydropyrolysis step and the downstream upgrading steps.
- Molten salts are key.

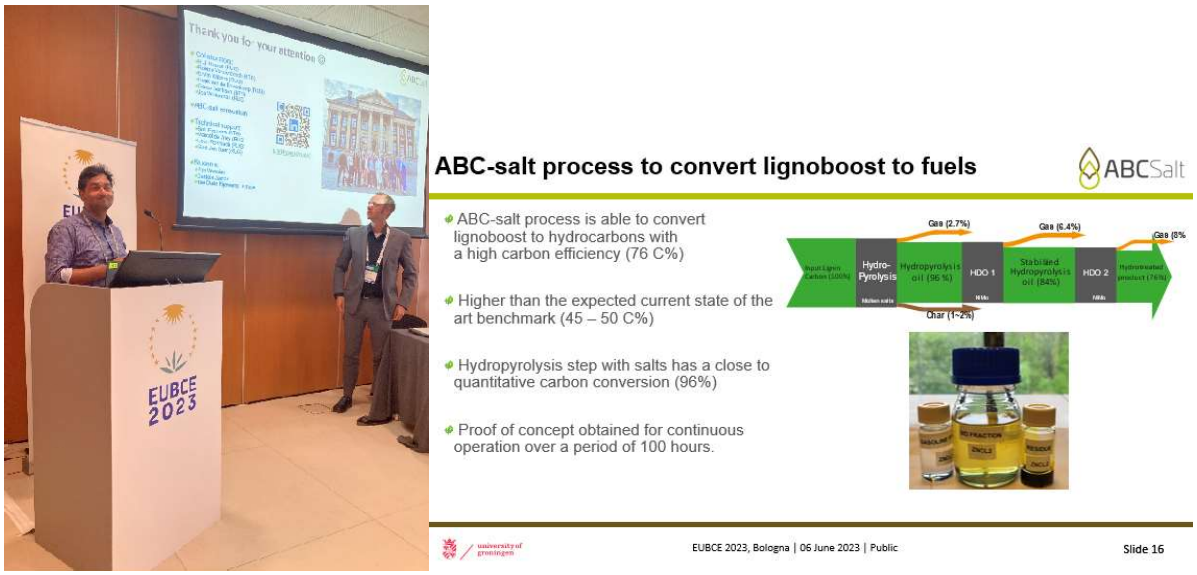

Figure 7 ABC-Salt presentation by Balaji Sridharan, University of Groningen

After the three presentations a panel discussion was conducted by Dina Bacovsky (BEST, Germany), under the title 'Common ground and contribution of EU projects to the revamping of the SET Plan Action 8', with a representative from each of the thematic sessions during the day, as well as two external representatives. George Vourliotakis (Exergia, Greece) was the representative for the GOLD workshop, whilst the other participates included: Roman Tschentscher (SINTEF, Norway), Ilkka Hiltunen (VTT, Finland), Thomas Schleker, (European Commission, DG RTD), and (Luc Pelkmans, IEA Bioenergy). During the panel discussion the following questions were discussed amongst the panel lists:

- What is needed to transfer results from HEU projects into demonstration, scaling up and deployment of the technologies? (from a researcher´s perspective, okay to make technology-specific statements (Roman, Ilkka, George), how does EC RTD support such a transfer (Thomas), best international examples how to stimulate technology development and deployment (Luc))
- Which strategy would support viable technologies in the market in the longer term?
- We can develop technologies through targeted R&D, learn how to operate facilities through demonstrations, and optimize technologies in the scale-up process. Still there are non-technical barriers. Which non-technical barriers have you identified, and how can they be overcome?
- How can we make use of the immense knowledge built through HEU/H2020/FP7 projects? How can projects/research teams/companies benefit from each other, thus stimulating innovation?

Figure 8 Panel discussion

4 Conclusions and Remarks

This workshop was considered a success with between 20 - 80 people in the audience during the whole event. The number fluctuated during the day due to the length and varied nature of the event. It was free to attend and open to all, therefore allowing the audience to come and go as they pleased. For the EBIO workshop it was counted to be between 15 – 25 people continuously in the meeting room, and slightly more for the final panel discussion, with a maximum of 30 - 40 people. The workshop was not filmed but the presentation slides are available in the EUBCE proceedings.