RRB 2023
RENEWABLE RESOURCES & BIOREFINERIES

19th International Conference on Renewable Resources and Biorefineries

Green gold – Forests for the future

31 May - 2 June 2023 • Riga, Latvia

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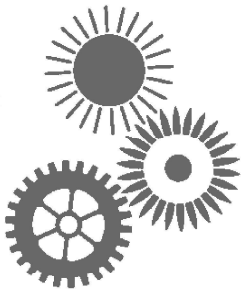
Final Programme & Abstract Book

LATVIAN STATE INSTITUTE OF WOOD CHEMISTRY

RRB 2023

RENEWABLE RESOURCES & BIOREFINERIES



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MEDICONGRESS
Noorwegenstraat 49, B-9940 Evergem
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For each of these products/fractions we need to identify the most suitable markets, competitiveness, economical - and environmental sustainability. These results will guide us for setting up a first stage biorefinery producing a few of these products and move towards the final stage where most of the value is extracted. Based on these results we can assess how seaweed farming could be sustainable in the Baltic sea, opening up a new sector of activity for these rural areas.

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EFFICIENT CONVERSION OF AGRICULTURAL AND FOREST RESIDUES INTO BIOETHANOL: BIOFLEXPOR AS FLEXIBLE TECHNOLOGY TOWARDS SUGAR-BASED BIOREFINERIES

Susana Marques[1], S.M. Paixão[1], L. Alves[1], M. Gomes[1], A. Eusébio[1], T. Lopes[1], L. Coelho[2], E. Diebold[2], F. Girio[1]

[1]Laboratório Nacional de Energia e Geologia I.P., Unidade de Bioenergia e Biorrefinarias, Lisboa; [2]STEX, Aveiro, Portugal

susana.marques@lneg.pt

Lignocellulosic ethanol is in the upfront of advanced biofuels to be commercialized worldwide. However, the commercial deployment of 2G ethanol is dependent of high biomass availability and cost-effective supply. In Europe, some agricultural residues are presently underused and constitute attractive renewable resources. In addition, residual forest biomass, non-seasonably available at low cost, might be complementarily used as raw material boosting the economy of biorefineries.

In this context, the present work deals with the development of an innovative and sustainable technological strategy to produce advanced bioethanol using agricultural and forestry residual biomass. The bioprocess involves enzymatic hydrolysis of major lignocellulose polysaccharides (cellulose and xylan) with commercial enzymes and fermentation of the resulting sugars. A pre-treatment step should firstly be accomplished so as to make cellulose more amenable to hydrolytic enzymes, and the prototype is based on a proprietary non-catalysed steam explosion technology, i.e. without the addition of acids and using only high-pressure steam, called FLEXBIO™, which was initially developed in Brazil by the company STEX and since 2019 in partnership with LNEG.

The proposed technology has been successfully demonstrated in a relevant environment (TRL 5) for the efficient conversion of corn stover, olive tree pruning and eucalyptus-based forest residual biomass, yielding close to 150 L of ethanol per metric tonne (dry basis) of biomass, corresponding to an overall yield close to 75% of maximal theoretical yield for glucan conversion. Both enzymatic hydrolysis and fermentation steps have achieved yields superior to 85% of the maximal theoretical conversion, and the optimization of process configuration, targeting the best integration with pre-treatment, is now under progress and higher yields will be expected. Given the higher xylan content of corn stover, both cellulose and xylan fractions are pursued. In addition, the upgrading potential of all wastewater streams will also be assessed, by studying the feasibility of its combined use to increase the ethanol yield as alternative to its use for biogas production through anaerobic digestion, with the goal to reach near-zero waste.

The present study reveals the industrial potential of this flexible technology that might be applied to implement distinct small-scale sugar-based biorefineries by converting several lignocellulosic raw materials into distinct marketable biofuels/biomaterials, promoting the circular bioeconomy.

The present work was carried out in frame of the Project BIOFLEXPOR POCI-01-0247-FEDER-047982, supported by Operational Programme for Competitiveness and Internationalization (COMPETE2020) and by Lisbon Portugal Operational Programme (Lisboa 2020), under the Portugal 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

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NOVEL APPLICATION OF TORREFACTION AS AN ALTERNATIVE PRETREATMENT FOR LIGNOCELLULOSE-BASED RHAMNOLIPID PRODUCTION

Anjana Hari, T.R.K.C. Doddapaneni, T. Kikas

Biosystems Engineering, Institute of Forestry and Engineering, Estonian University of Life Sciences, Tartu, Estonia

anjana.hari@emu.ee

Estonia is a resource-rich economy with an established timber industry. However, it generates a large amount of waste in the form of offcuts, shavings, and wood chips, which are primarily used for heat generation, at a substantial environmental cost. Finding alternative applications for these wood wastes is necessary for the long-term sustainability of the industry. However, the recalcitrance of lignocellulose, a complex polymer of hemicellulose, cellulose, and lignin present in wood, is one of the major factors hindering its potential as a biorefinery substrate. This recalcitrance can be overcome by pretreatments such as torrefaction, i.e., heating the biomass at a temperature of 200°C–300°C for 1h or longer, at atmospheric pressure, in an oxygen-deficient environment, liberating fermentable sugars resulting from the complete breakdown of hemicellulose and partial breakdown of cellulose. Herein, we demonstrate for the first time the use of torrefied biomass as a viable alternative substrate for the production of rhamnolipid biosurfactant using simultaneous saccharification and fermentation. Aspen wood chips were torrefied at four different temperatures (225°C, 250°C, 275°C, and 300°C) at a residence time of 1 h in a batch torrefaction rector, and torrefied biomass was characterized via proximate and ultimate analyses. Subsequently, it was used for fermentation experiments with *Burkholderia thailandensis* E264. To evaluate its potential as a carbon and/or energy source for biosurfactant production, two types of media formulations were used: plain deionized water and conventional nutrient broth, with torrefied biomass supplementation at 2.5% and 5%. Interestingly,