LignoCOST ONLINE workshop 'Current status of lignin valorisation in Europe'

October 12, 2020, organised by RISE / WFBR

Dr. Richard Gosselink, Action chair
Dr. Ted Slaghek, Grant holder manager

Contents

Grant holder Wageningen Food & Biobased Research

Applied research for sustainable innovations

- In-depth knowledge of the entire agri-food chain
- Market oriented R&D approach
- Multi-disciplinary applied R&D project teams; 250 employees
- Up-scaling: from lab to pilot
- Connection with the University of Wageningen

Sustainable Food Chains

Biobased Products

Healthy & Delicious Foods

WAGENINGEN
UNIVERSITY & RESEARCH

Need for pan-Europe network

- Lignin has large potential, is underexploited, but has also large challenges
- Industry is now more convinced of valorisation of side streams (e.g. lignin)
- Last 5 years industrial lignin production increased
- Knowledge is scattered in Europe
- To overcome challenges, hurdles
- Multi-actor network needed to connect whole development-deployment chain
- Development knowledge to built new value chains including industrial valorisation of lignin
- Not only focusing on connecting Academic persons but also on SMEs and industry

Recent developments on lignin

- Suzano/Fibria is running a demoplant Limeira for Kraft lignin production
- Klabin started a pilot plant production of Kraft lignin
- Avantium opened a LC fractionation pilot plant to produce HCl extracted lignin
- Clariant started a precommercial plant on LC ethanol generating a lignin side stream
- The SWEETWOODS project, a BBI Flagship project, is establishing a first-of-a-kind wood fractionation demo plant in Estonia that uses sustainable hardwood biomass as raw input material to produce high quality sugars and lignin
- In the Netherlands several demonstration roads (15) have been paved with up to 50% lignin based bituminous binders
- Trespa/Arpa launched a new production line on board materials in which 50% lignin based PF resins in the core are used. Also UPM, Stora Enso announced these for plywoods.
- New collaborations within the biorefinery / lignin field started: SEKAB + Vertoro, Praj + SEKAB, Fortum + Chempolis, ...

Participants (274) October 2020

- 36 countries
- 4 NNC
  - Ukraine (UA)
  - Lebanon (LB)
  - Georgia (GE)
  - Algeria (DZ)
- 4 IPC accepted
  - Canada (CA) *Dr. Zhirun Yuan, FP Innovations*
  - Colombia (CO) *Prof. Ramon Colmenares, Uni Colombia*
  - South Africa (SA) *Prof. Annegret Stark, Uni SKwazulu-Natal*
  - New Zealand (NZ) *Dr. Daniel van de Pas, Scion*

Austria [AT]
Belgium [BE]
Bosnia and Herzegovina [BA]
Bulgaria [BG]
Croatia [HR]
Cyprus [CY]
Czech Republic [CZ]
Denmark [DK]
Estonia [EE]
Finland [FI]
France [FR]
Germany [DE]
Greece [EL]
Hungary [HU]
Iceland [IS]
Ireland [IE]
Israel [IL]
Italy [IT]
Latvia [LV]
Lithuania [LT]
Netherlands [NL]
Norway [NO]
Poland [PL]
Portugal [PT]
Romania [RO]
Serbia [RS]
Slovakia [SK]
Slovenia [SI]
Spain [ES]
Sweden [SE]
Switzerland [CH]
Turkey [TR]
United Kingdom [UK]
fYR Macedonia [MK]

Objectives

- To establish a whole chain network focusing on sustainable lignin production, conversion and valorisation
- To deliver answers for the main scientific, technical, engineering and market deployment questions on lignin valorisation
- To create a platform for the actors to cooperate and exchange know-how of experienced and young researchers and other (industrial) stakeholders

Objectives

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Secondary objectives

- Develop a web tool-based lignin information portal (**WikiLignin**)
- Develop knowledge on standardisation, regulation (REACH), improvement of lignin's intrinsic properties by innovative processing
- Assess the international state-of-the-art (lignin providers, technologies, stakeholders) as reference to support European lignin-based business development
- Set-up an inventory of industrial market application requirements versus lignin properties
- Assess the performance of lignin conversion processes at relevant technology readiness levels (TRLs)
- Evaluate **technical and sustainability** aspects, market potential and implementation potential, of most promising lignin valorisation routes

Major achievements GP1+GP2

- Participants (272)
  - Increase from 80 till 274 in 2 years (11/2018 – 10/2020)
  - Distribution over 36 European countries, 4 Near Neighbour Countries (NNC), 4 International Partner Countries (IPC)
  - Gender balance: 43% female
  - 21 companies and associations (incl. SMEs)
- 20 STSMs organized
- 2 ITC conference grants granted
- Meetings
  - Kick off Brussels (47 participants)
  - Core group meeting Cordoba: Exchange LigniVAL and LignoCOST (27 participants)
  - Co-located joint WG + MC meeting Wageningen (122 participants)
  - Co-located joint WG + MC meeting Régua (106 participants)
- Dissemination
  - Many joint papers (info on website)
  - Presentations on promotion of lignoCOST
  - Poster LCA, lecture @ NWBC 2020
  - Website www.lignocost.eu + www.cost.eu/actions/CA17128 + social media channels

Workshop

- Zoom hosted by RISE
- Participants: *149*
- Countries: *35*
- 4 key note speakers from industry and bioeconomy organisation
- Results and achievements working groups
- Parallel working group meetings in break out rooms
- Plenary summary
- Closure

Working groups

Working Group	Title	Nominated WG Leader
1	WikiLignin, lignin infrastructure	Bernard Kurek, INRAE (FR)
2	Production and catalytic conversion technologies, incl. TRL assessment	Pieter Bruijnincx, Utrecht University (NL)
3	Industrial application requirements versus lignin properties	Karolien Vanbroekhoven, VITO (B)
4	Development of value chains for lignin valorisation	Per Tomani, RISE (SE)
5	Technical and full sustainability aspects, LCA, market deployment potential and implementation	Apostolis Koutinas, Agricultural University of Athens (GR)

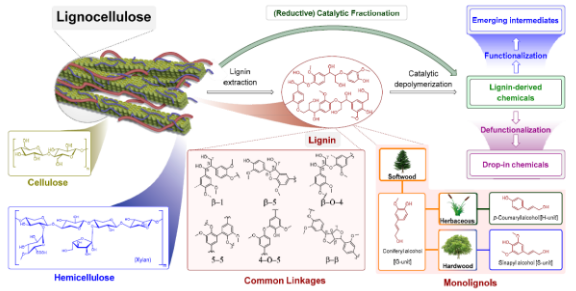
Goals and achievements working groups

WG1 Wiki lignin and lignin producers survey (Bernard Kurek)

- A first set up of the structure and information needed to fill the **Wiki lignin database** has been defined
- Via WUR library a strategy is under development to use published data via specific keywords in the database
- Wiki lignin will first become available for LignoCOST participants; later on the website
- A deliverable report is expected by October with an **Overview of existing lignin production and valorisation research infrastructure**

WG2 Lignin production and catalytic conversion technologies (Pieter Bruijnincx)

- **Upstream lignin fractionation**: 5 families identified with task leaders nominated
  - 1) Lignin-first 2) Pulping processes 3) Organosolv 4) Bio-tech E.g: enzymatic, microorganisms
  - 5) Ionic liquid and deep eutectic solvents
- **Downstream from lignin to chemicals**: 6 families identified with task leaders nominated
  - 1) Hydrogenolysis (e.g. Metal catalysed), 2) Biotech, 3) Base catalysed 4) Pyrolysis / Combustion / Gasification, 5) Oxidative, 6) Lignin modification
- Information on lignin production and lignin catalytic conversion, including TRL, is collected
- A **Review paper** on "Development of **'Lignin-First' Approaches** for the Valorization of Lignocellulosic Biomass" published by Tamás I. Korányi,Bálint Fridrich, Antonio Pineda, and Katalin Barta, Molecules. 2020 Jun; 25(12): 2815. Published online 2020 June 18. doi: 10.3390/molecules25122815. Contributions from Budapest, Groningen, Cordoba and Graz.



WG3 Industrial lignin applications versus lignin properties (Karolien Vanbroekhoven)

- 7 priority value chains / applications have been selected for WG3 / WG4
  - 1) Resins (chosen as first model value chain)
  - 2) Marine fuels
  - 3) Commodity & fine chemicals
  - 4) Polymer blends
  - 5) Bitumen – asphalt
  - 6) Adsorbents - Water treatment
  - 7) Carbonized materials
- Task (co)leaders appointed for 7 taskforces and Factsheets have been prepared
- The factsheets will be compiled to form the 1st deliverable (2021)
- There is a strong link to WG4. The same value chains / products were selected for both WGs.

WG4 Value chain development for lignin valorization (Per Tomani)

Selected value chains

- 1) Resins (chosen as first model value chain)
- 2) Marine fuels
- 3) Commodity & fine chemicals
- 4) Polymer blends
- 5) Bitumen – asphalt
- 6) Adsorbents - Water treatment
- 7) Carbonized materials

- Detailed template for 1st value chain on PF resins for panels have been prepared and filled. Information will be complemented by interviews with companies to validate and update results.
- Next templates for carbon fibres and asphalt.

WG5 Techno-economic and LCA aspects (Apostolis Koutinas)

- A literature review on TEE and LCA is ongoing
- Definition of scope and data collection on promising value chain for industrial application has been done
- Third step is the integration in existing biorefinery concepts
- Value chains resins will be first model value
  - Interaction needed for getting input data and evaluate the results
  - LCA and TEA require common input data. A template for Data on mass and energy balances will be distributed to WG4 partners. Info on of legislation, regulations and certifications will be included. This information is hard to get from the network.
  - Both studies can be combined to get an overall result (environmental impacts can be converted into cost)
  - Social economic aspects could be incorporated

- Collaboration with IEA Task 42 Biorefineries with ENEA Italy
  - Joint activity on techno-economic evaluation and LCA with ENEA and WG5 (led by Apostolis Koutinas)

Closure

- Special thanks for the local organizer committee
  - Maria Ölmhult and Per Tomani
- Thanks for the key note speakers
- Thanks for participation and input for the discussions
- We will come back.....

Outlook for GP3 (01/05/2020-30/04/2021)

- Due to COVID-19 physical meetings were postponed or re-scheduled in online events:

- **Friday 23 October 2020** ONLINE TRAINING SCHOOL – 'Modified Lignin Materials for Reactive Polymer Composites: Processing and Characterization', organised by the University of Belgrade, Faculty of Technology and Metallurgy (TMF), local organizer: Dr. Jelena Rusmirovic
  - >> 60 participants including many young researchers
- **8-10 February 2021** – co-located WG and MC meetings in Pisa (ONLINE?, to be confirmed)

- Short Term Scientific Missions (STSMs) on hold
- ITC Conference Grants on hold

- **3 December 2020** 7th Biorizon Annual Event on Bio-Aromatics - Virtual Edition, organized by VITO (Karolien Vanbroekhoven; *NOT ORGANISED BY LIGNOCOST*)