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“It is important to join forces to stimulate the commercial use of lignin in sustainable products”

Who are we

By the Action chair Richard Gosselink

In this second Newsletter from the LignoCOST network (CA17128 - Establishment of a Pan-European Network on the Sustainable Valorisation of Lignin) we will describe who we are, what our aim is and which progress we made.

Lignin is removed during paper making and is released in the production of cellulosic ethanol. Currently, the base case for lignin is to use it simply as an internal energy source in the pulping and biorefinery industries. However, the industry is more and more convinced that economic valorization of this aromatic side stream is absolutely essential to make the processing of lignocellulosic feedstocks market competitive. In addition to those processes that consider lignin a side stream, much attention is nowadays given to the development of biorefineries, in which, next to cellulose, lignin actually is one of the main, high-value intermediate product streams to be further processed into a portfolio of biobased products, materials and secondary energy carriers.

To unlock the potential of lignin, an interdisciplinary and cross sectorial approach is needed by grouping relevant expertises within one pan-European network to tackle and overcome the challenges faced in industrial lignin valorization. **This fulfills our aim to stimulate the industrial application of lignin.**

LignoCOST brings together partners with outstanding and complementary expertises, active over the whole lignin value chain from production to applications. With over 300 participants from 36 European countries, 4 Near Neighbour Countries and 4 International Partner Countries a **very strong network** has been created. More than 20 companies are represented in LignoCOST.

Working groups

LignoCOST has been organised via the following working groups:

WG1 WikiLignin, tool for lignin information (Bernard Kurek, INRAE, FR, bernard.kurek@inrae.fr)

The purpose of WG1 is to develop a database comprising lignin sources, availability, properties and repository of state-of-the-art analytical methodologies and turn key methods for industry.

WG2 Production and catalytic conversion technologies, including Technology Readiness Level (Pieter Bruijnincx, UU, NL, P.C.A.Bruijnincx@uu.nl).

The focus of WG 2 is on bio- and chemo-catalytic conversion technologies including technology readiness level (TRL) assessment of ligno cellulosic raw material.

WG3 Industrial application requirements versus lignin properties (Karolien Vanbroekhoven, VITO, B, karolien.vanbroekhoven@vito.be)

The focus of WG3 is on industrial application requirements (market demand) versus lignin properties (supply). Bringing these two topics together will result in viable industrial opportunities for lignin application.

WG4 Development of value chains for lignin valorisation (Per Tomani, RISE, SE, per.tomani@ri.se).

The focus of WG4 is to create industrial viable opportunities for lignin valorisation by identifying industrial chains from supplier to end user. Development of value chains for lignin valorization.

WG5 Technical and full sustainability aspects, LCA, market deployment, potential and implementation (Apostolis Koutinas, AUA, GR, akoutinas@aua.gr).

Life cycle analysis is an important tool for evaluating the opportunities for the implementation of lignin in industrial processes. WG5 will evaluate the LCA's for the most promising opportunities.

“LignoCOST is formed by stakeholders from the whole value chain, including companies, RTOs and universities”

Results & Achievements

By working group leaders

WG1 has prepared a Wiki-LIGNIN data base which is filled with more than 950 papers and classified according to 7 categories into a simple-to-use web interface. During the 26 April WG Day improvements of this web-tool, aggregating all the newest information on lignin structures, properties, characterization techniques and applications were discussed. Preparation of the lignin fact sheets and of the survey and review of analytical methods for lignin and their applications has started. A focus will be done on new applications and new methods that can be identified within the Wiki LIGNIN database.

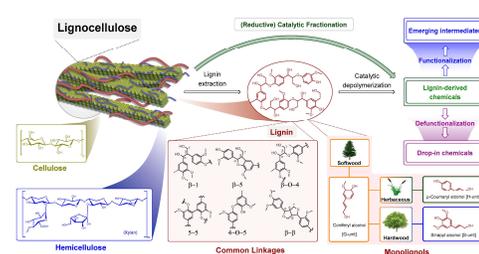
Category	Search	Records	Sort
Applications (776)	Q: e.g. economic AND smith, apply OR pear, "wind energy", cover NOT sheep	Records 1 - 50 / 954	Sort by Year of publication (Descending)
Properties (160)			
Analytical methods (116)			
Lignin-first (100)			
Industrial lignins (72)			
Subject			
Lignin (739)			
Cellulose (84)			
Biomass (82)			
Phenols (87)			
Fourier transform infrared spectroscopy (86)			
Year of publication			
2021 (842)			
2020 (72)			
2019 (123)			
2018 (16)			
2017 (9)			
Author			
Wang, Y. (20)			
Li, Y. (18)			

Joint review on Development of 'Lignin-First' Approaches for the Valorization of Lignocellulosic Biomass, by T I Korányi, B Fridrich, A Pineda, K Barta, *Molecules* 2020 25 2815

<https://doi.org/10.3390/molecules25122>

815

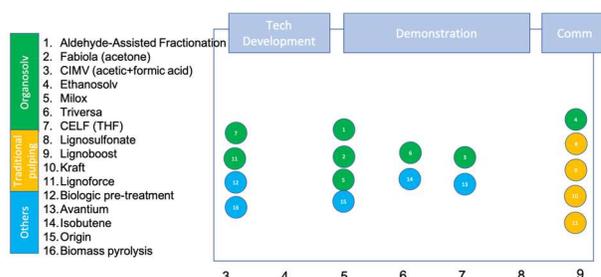
(Hungary, The Netherlands, Spain, Austria)



LignoCOST outreach to academia, industry and public

Harmonization has to be done with WG2 and WG3 working on selected value chains for lignin. These two information notes and deliverable report should be delivered to LignoCOST consortium during the next 3 months.

WG2 has been working on gathering information on the various upstream technologies for lignocellulose processing and lignin isolation as well as on the various, general catalysis strategies under development that further convert the isolated lignin into valuable products. A more detailed overview was prepared to review the different processes:



Group photo of online Working Groups meeting 26 April 2021 organized by WFRB (Netherlands)

Results & Achievements

By working group leaders

WG3 is working on the first deliverable, i.e., an inventory of relevant applications where lignin or lignin derivatives can replace fossil-based compounds. Therefore 7 different applications have been selected, namely: resins, marine fuels, flavours and fragrances, polymeric blends, asphalt, and adsorbents. For all these applications detailed fact sheets are prepared. Then, comparison with properties of available lignin sources and derivatives in relation to the application requirements will be made. Missing information will be used for defining research.

WG4 The first value chain we started to cover is lignin phenol formaldehyde (LPF) resin applications. We have used this value chain to create a template for all selected value chains. The documentation focus on the commercialisation potential of LPF resins in wood based panels. The other value chains are aligned with the applications selected in WG3. For those value chains the collection of data has been started and will be finalised in the coming months. After that, the value chains will be reviewed by selected end-user companies.

WG5 will support the most promising lignin valorisation value chains via sustainability evaluation including profitability and environmental impact assessment. Within this grant period, WG5 focused on developing inventories for mass and energy balances for promising value chains of lignin valorisation (e.g. LPF resins). Methodologies on techno-economic evaluation and life cycle assessment have also been developed, and will be implemented after the process design task has been completed. An important aspect during this period was the collaboration between LignoCOST and the research center ENEA (Italy) within the international network IEA Bioenergy Task 42 – “Biorefining in a Circular Economy” for the creation of an updated state-of-the-art report on lignin valorisation and its potential market applications. Moreover, the contribution of the Aristotle University of Thessaloniki (Greece), Lund University (Sweden) and the University of Salerno (Italy) to the lignin alternative process superstructure under development was very helpful to advance the technical know-how.

Joint paper by groups in Italy and the Netherlands as a results from a STSM:

Nicola Di Fidio, Johan W. Timmermans, Claudia Antonetti, Anna Maria Raspolli Galletti, Richard J. A. Gosselink, Roel J. M. Bisselink, Ted M. Slaghek, “Electro-oxidative depolymerisation of technical lignin in water using platinum, nickel oxide hydroxide and graphite electrodes”. *New J. Chem.*, 2021, 45, 9647 (Italy, Netherlands), <https://pubs.rsc.org/en/content/articlehtml/2021/nj/d1nj01037a>



Dissemination & Communication

By the Science Communication Manager (Konstantinos Triantafyllidis, AUTH, GR, ktrianta@chem.auth.gr)

LignoCOST aims to coordinate and combine multidisciplinary knowledge and expertise and deliver high quality research and technological output. Joint reports and publications from different countries and groups is one of the primary objectives of the Action. More than twenty joint publications and conference presentations have taken place (<https://lignocost.eu/dissemination/>).

Communication of our activities to a wider spectrum of industry and potential markets, as well as towards the broader public, across the borders of Europe, aims to increase the awareness and acceptance of lignin and waste biomass derived fuels, chemicals and materials (<https://lignocost.eu/communication/>).

STSMs

By the STSM Coordinator (Filomena Barreiro, IPB, PT, barreiro@ipb.pt)

STSM is the acronym for **Short Term Scientific Missions**. This tool within the COST action allows researchers to visit other labs within the EU for a short stay of several weeks to a longer stay of 3 – 6 months. The STSM coordinator in this COST action is Filomena Barreiro. Please contact her when you have questions regarding this program and how to apply. Up to now 26 STSMs have been awarded with this grant (<https://lignocost.eu/stsm/summary-of-stsms-gp-1-en-2/>). Also for the coming grant period, starting at 1 November 2021, again STSM grants will be available. Please take note when the announcement is made.

ITC Conference Grants

By the ITC Conference Grants Coordinator (Marta Goliszek, UMCS, PL, marta.goliszek@poczta.umcs.lublin.pl)

Inclusiveness **Target Countries** (ITC) Conference Grants aim at supporting PhD students and ECI researchers from participating ITCs, to attend international (preferably European) conferences related to the objectives of our Action, with a poster or oral presentation. Two ITC conference grants have been awarded up to now and more grants will be available in the coming periods.

* The following countries are considered as ITC: Bosnia-Herzegovina, Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Luxembourg, Malta, Montenegro, Poland, Portugal, Romania, Slovenia, Slovakia, fYR Macedonia, Republic of Serbia and Turkey.

Organised events

Kick off and 1st MC meeting, October 4th 2018, Brussels (B)

Exchange meeting LigniVAL and LignoCOST, January 14-15, 2019, Cordoba (ES)

Co-located working groups + 2nd MC meeting, March 13-15, 2019, Wageningen (NL)

Co-located working groups + 3rd MC meeting, November 13-14, 2019, Régua (P)

Online Workshop 'Current status of lignin valorisation in Europe' in Stockholm (SE), October 12, 2020

Online Training school 'Modified Lignin Materials for Reactive Polymer Composites: Processing and Characterization' organised by University of Belgrade, Serbia, October 23, 2020

Online working groups day, organised by WFBR (NL), April 26, 2021

Online 4th MC meeting, June 30, 2021

Coming networking activities

Online Lignin conference, September 1+2, 2021, organised by University of Pisa

5th EuChemS Conference on Green and Sustainable Chemistry online 26 – 29 Sept 2021

General Information

For more information please consult our website

www.lignocost.eu

Social media:

Facebook > <https://www.facebook.com/lignocost/>

Linkedin > <https://www.linkedin.com/company/lignocost>

Twitter > <https://twitter.com/lignocost>

Persons interesting in lignin valorisation, please contact us to join this International pan-European network.

CA17128 LignoCOST is a networking Action, supported by COST, to stimulate and financially contribute to the organisation of short term scientific missions between partner institutions, networking events, workshops, and training schools. No support is available to perform research & development activities.



Grant Holder Institute

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COST description

COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

www.cost.eu