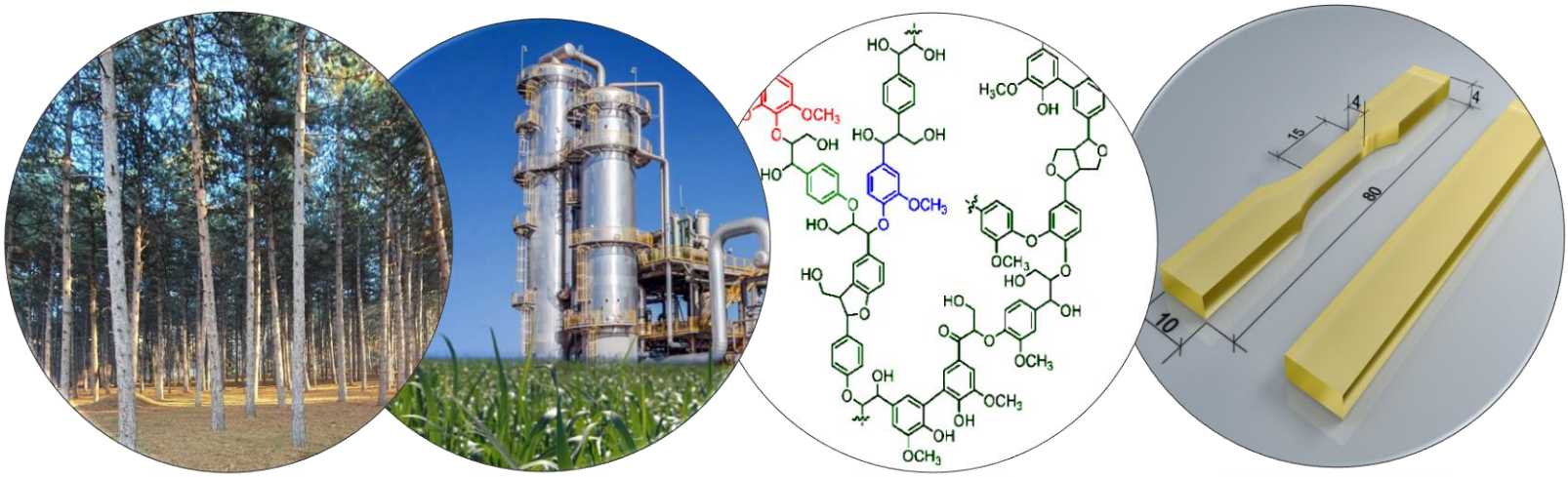
LignoCOST ONLINE TRAINING SCHOOL

'*Modified Lignin Materials for Reactive Polymer Composites: Processing and Characterization* '



REPORT

October 23, 2020

University of Belgrade, Faculty of Technology and Metallurgy (TMF), Faculty of Agriculture, Faculty of Forestry, Innovation center of the TMF (IC TMF), and Military Technical Institute, Serbia

https://lignocostonlinetrainingschool.azurewebsites.net/

Grant Holder Institute
STICHTING WAGENINGEN RESEARCH
Bornse Weilanden 9
Netherlands
6708 WG Wageningen

COST is supported by the EU Framework Programme Horizon 2020

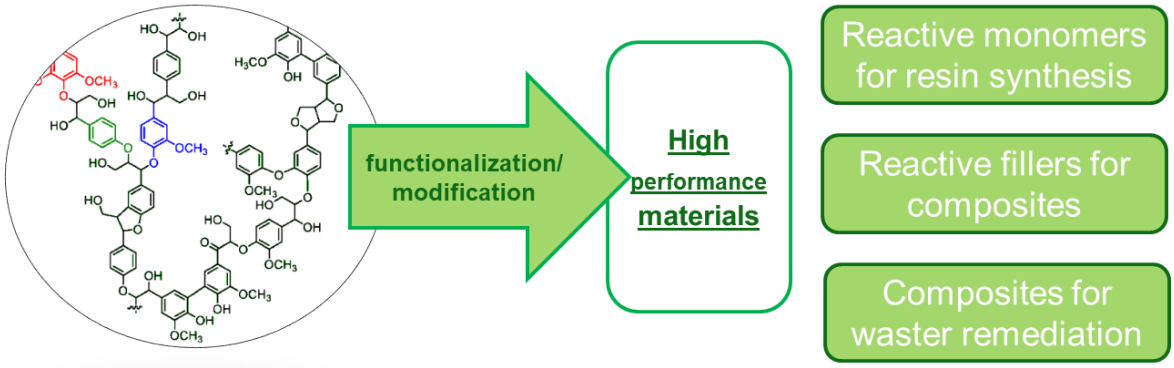
Contents

Summary

The LignoCOST online training school, Modified Lignin Materials for Reactive Polymer Composites: Processing and Characterization, brought together a group of around 91 participants from 26 European countries, including 7 University of Belgrade trainers, to promote knowledge and relevant scientific information with a focus on lignin valorization towards sustainable industrial applications.

Organizers of the Training school were University of Belgrade, Faculty of Technology and Metallurgy (TMF), Innovation center of the TMF (IC TMF), Faculty of Agriculture, Faculty of Forestry, and Military Technical Institute, Serbia, in the framework of LignoCOST Action. The host of the meeting was Dr. Jelena Rusmirović, research associate from the Department for Materials and Protection, Military Technical Institute, Belgrade, Serbia, and researcher on the innovation projects within the group in IC TMF.

The Training school was divided into two sections. The first section was focused on Lignin depolymerization methods, Lignin chemical modification methods, developing of Lignin based composite materials and using Lignin in environmental protection. The second one was focused on lignin-based materials characterization with the high-light on morphology analysis and mechanical, dynamic-mechanical and thermal analysis.



LignoCOST training school objectives

The LignoCOST Training School provided intensive online presentation and training in research topics on lignin materials processing and characterization within the laboratories of University of Belgrade, Serbia:

Laboratory of Department for Organic Chemistry, TMF and IC TMF

The Lignin depolymerization and chemical modification methods, and structural characterization as well, are developed in TMF/IC TMF laboratory for Organic Chemistry. The selected materials (phosphorylated Kraft Lignin, polymer composites based on phosphorylated Kraft Lignin and polyester resins, and amino-modified lignin bio-sorbents) are used for demonstration in training school presentations/videos.

Laboratory for Electronic Microscopy, Faculty of Agriculture (FoA)

The demonstration of the morphological characterization of the lignin-based materials (lignin isolated from different plant sources and using different isolation methods, modified lignin, amino modified lignin microspheres, etc) was performed on JEOL JSM-6390 scanning electron microscope, and TEM 1400 transmission electron microscope.

Laboratory of Department for Materials and Protection, Military Technical Institute (MTI), Belgrade, Serbia

The demonstration of the mechanical, dynamic-mechanical and thermal characterization of the composites based on (un)modified lignin and different polymer matrices, including composites based on phosphorylated Kraft Lignin/unsaturated polyester resin was performed Instron 1122 Testing machine, MCR 302 Modular Compact Rheometer, and standard flame-retardancy tests.

LignoCOST training school agenda

10.00-10.20 Welcome & Introduction (LignoCOST coordinator and local organizator)

10.20-11.00 Oral and video presentation (35 min + 5 min discussion total 40 min)

Prof. dr Milica Rančić/ University of Belgrade, Faculty of Forestry - Lignin depolymerization methods – From Lignin to Valuable Oligomers/Monomers for Polymer Materials Preparation

11.00-11.40 Oral and video presentation (35 min + 5 min discussion total 40 min)

dr Jelena Rusmirovic/ Military Technical Institute, Department for Materials and Protection, Belgrade, Serbia – Reactive Lignin Materials for High Performance Composites- Modification Methods and Characterization

12.40-12.00 Oral presentation (15 min + 5 min discussion total 20 min)

Ana Popović/ University of Belgrade, Faculty of Technology and Metallurgy - Lignin microspheres: A novel eco-friendly adsorption material

12.00-12.20 Oral presentation (15 min + 5 min discussion total 20 min)

Jelena Bebic/ University of Belgrade, Faculty of Technology and Metallurgy – Porous amino modified lignin materials for enzyme immobilization

12.20-13.20 Break for Lunch on your own

13.20-13.40 Oral presentation (15 min + 5 min discussion total 20 min)

Nikola Stanojevic and Danilo Zivkovic/ White Lemur ltd., Serbia, soma.eco - Using lignin and cellulose-rich waste for the production of innovative biotic materials through the utilization of microorganisms, fungi, and derived enzymes

13.40-14.20 Oral and video presentation (35 min + 5 min discussion total 40 min)

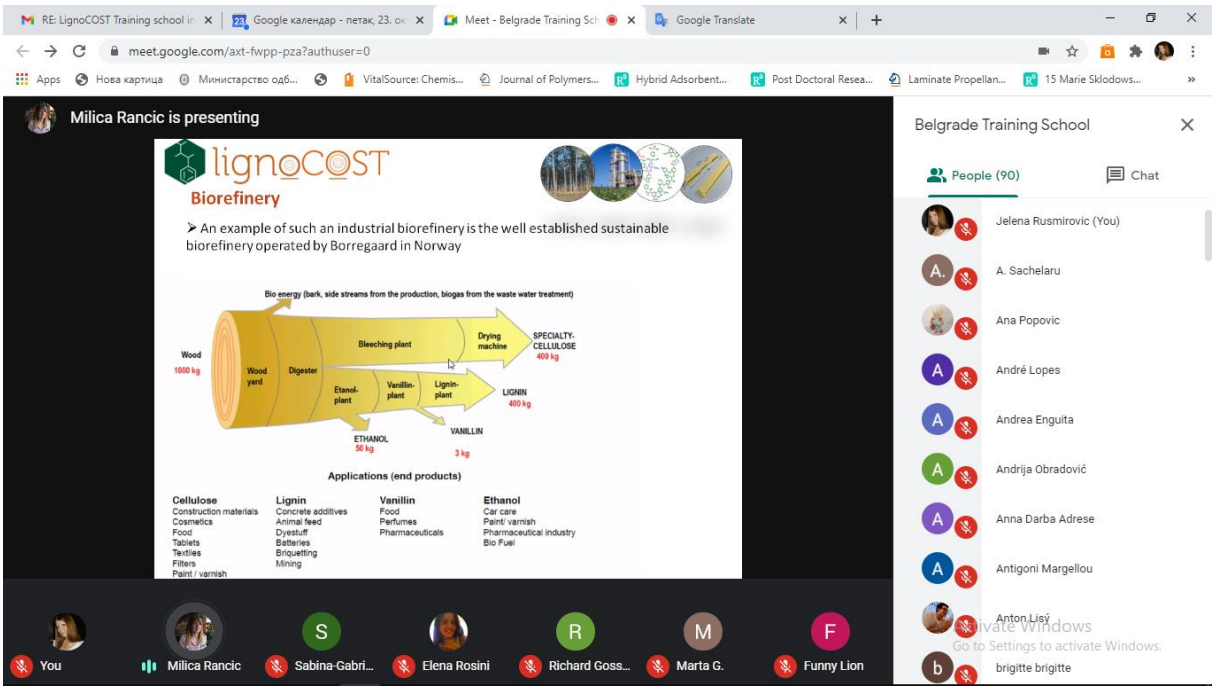
dr. Tihomir Kovacevic, Military Technical Institute, Department for Materials and Protection, Belgrade, Serbia - Mechanical and Rheological Characterization of Lignin based Materials

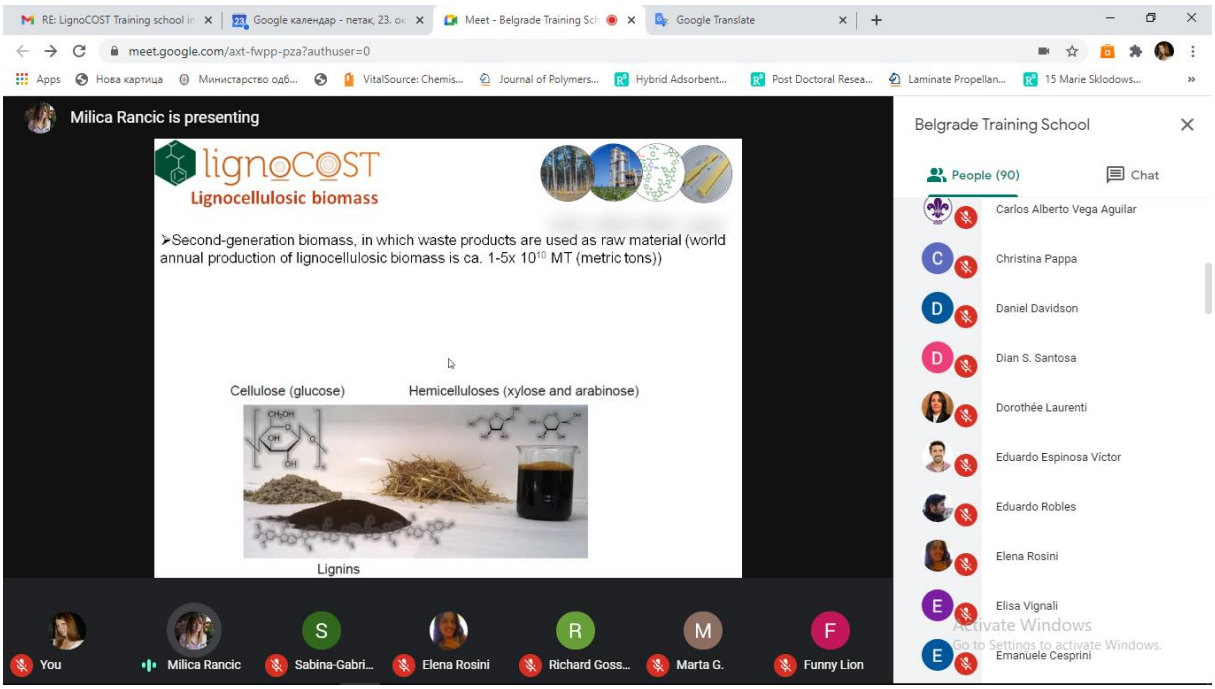
14.20-15.00 Oral and video presentation (35 min + 5 min discussion total 40 min)

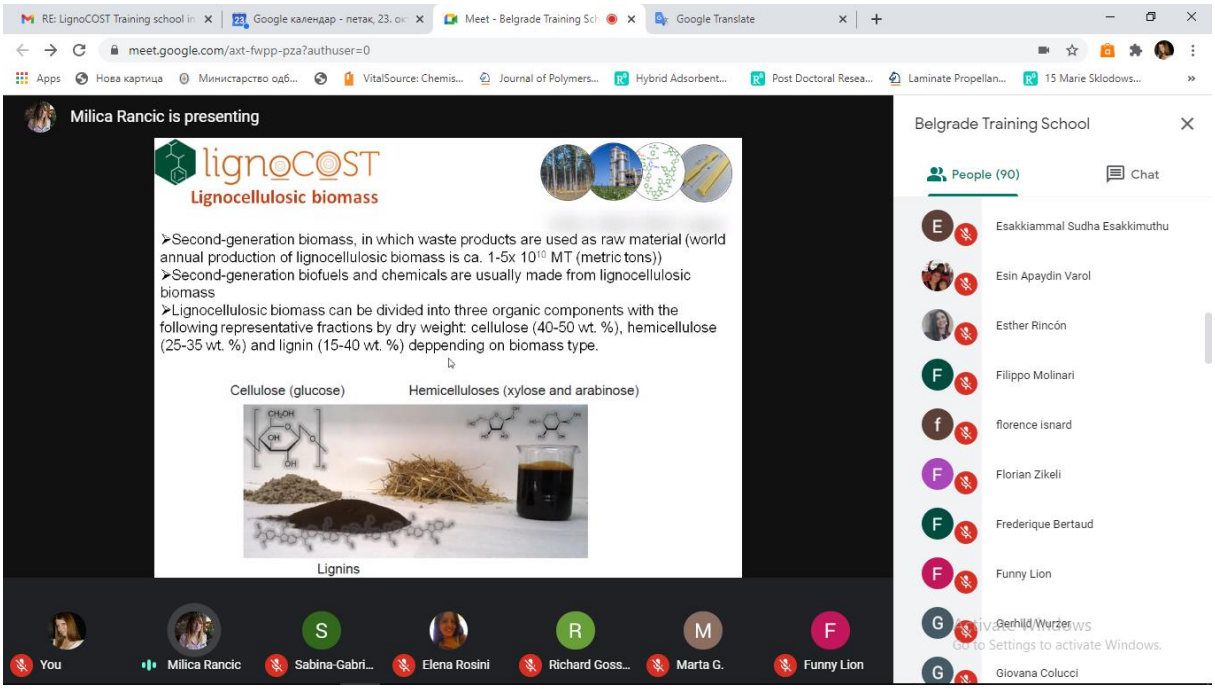
prof. dr Vladimir Pavlovic/University of Belgrade, Faculty of Agriculture - Scanning and Transmission Electronic Microscopy in Lignin based Materials Characterization

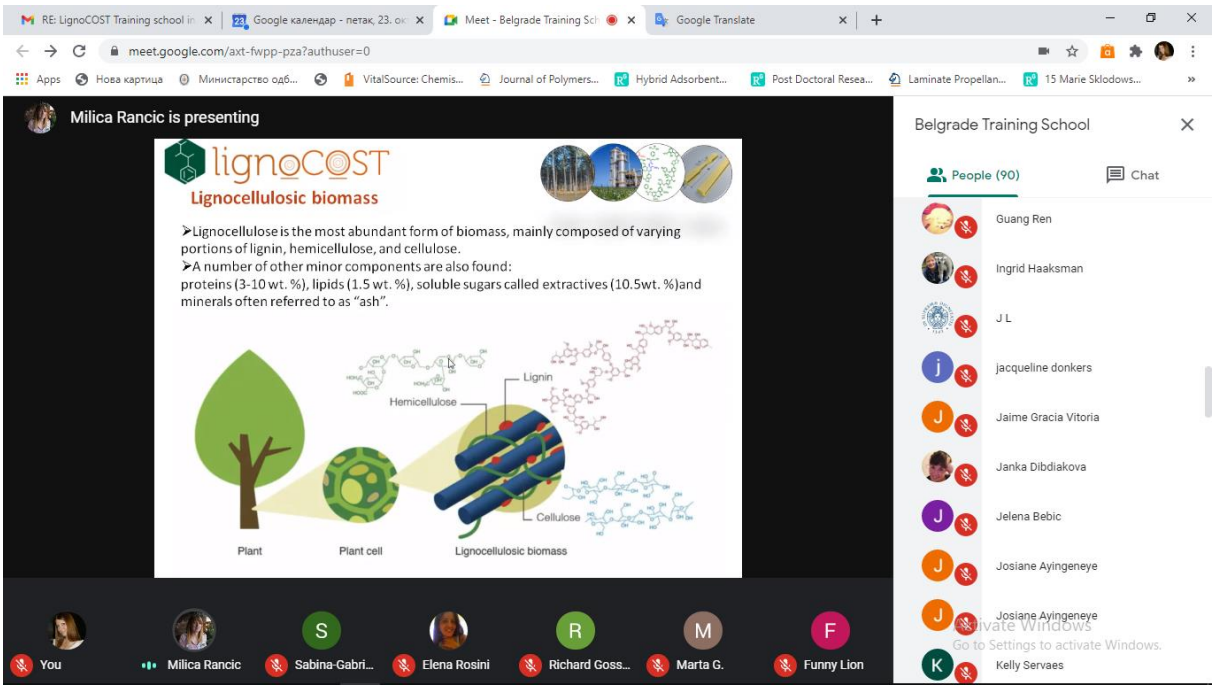
15.00-15.20 Closing of the training school (LignoCOST coordinator and local organizator)

Proof of presence






Milica Rancic is presenting
lignoCOST
Lignocellulosic biomass
➢Second-generation biomass, in which waste products are used as raw material (world annual production of lignocellulosic biomass is ca. 1-5x 10¹⁰ MT (metric tons))
➢Second-generation biofuels and chemicals are usually made from lignocellulosic biomass
➢Lignocellulosic biomass can be divided into three organic components with the following representative fractions by dry weight: cellulose (40-50 wt. %), hemicellulose (25-35 wt. %) and lignin (15-40 wt. %) deppending on biomass type.
Cellulose (glucose)
Hemicelluloses (xylose and arabinose)
Lignins
Belgrade Training School
People (90)
Chat
Esakkiammal Sudha Esakkimuthu
Esin Apaydin Varol
Esther Rincón
Filippo Molinari
florence isnard
Florian Zikeli
Frederique Bertaud
Funny Lion
Gerhild Wurzer
Giovana Colucci
You
Milica Rancic
Sabina-Gabri...
Elena Rosini
Richard Goss...
Marta G.
Funny Lion


Milica Rancic is presenting
lignoCOST
Lignocellulosic biomass
➢Lignocellulose is the most abundant form of biomass, mainly composed of varying portions of lignin, hemicellulose, and cellulose.
➢A number of other minor components are also found:
proteins (3-10 wt. %), lipids (1.5 wt. %), soluble sugars called extractives (10.5wt. %)and minerals often referred to as "ash".
Lignin
Hemicellulose
Cellulose
Plant
Plant cell
Lignocellulosic biomass
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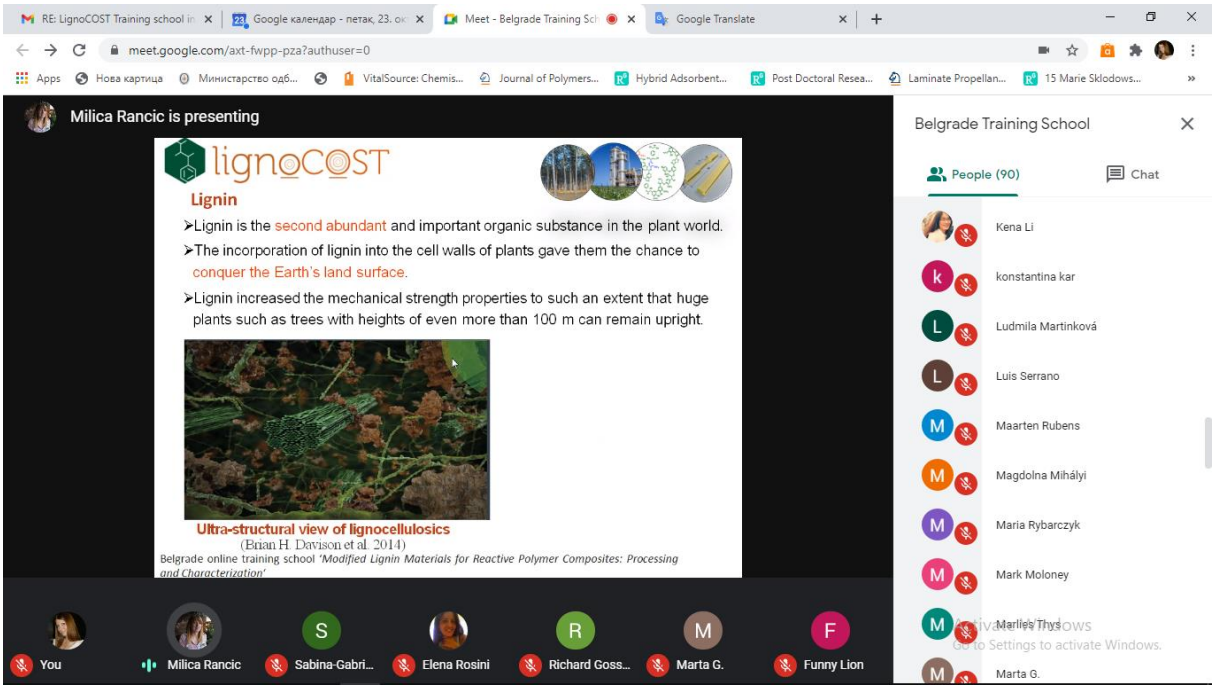
People (90)
Chat
Guang Ren
Ingrid Haaksman
J L
jacqueline donkers
Jaime Gracia Vitoria
Janka Dibdiakova
Jelena Bebic
Josiane Ayingeneye
Josiane Ayingeneye
Kelly Servaes
You
Milica Rancic
Sabina-Gabri...
Elena Rosini
Richard Goss...
Marta G.
Funny Lion


Milica Rancic is presenting
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Lignin
➢Lignin is the second abundant and important organic substance in the plant world.
➢The incorporation of lignin into the cell walls of plants gave them the chance to conquer the Earth's land surface.
➢Lignin increased the mechanical strength properties to such an extent that huge plants such as trees with heights of even more than 100 m can remain upright.
Ultra-structural view of lignocellulosics
(Brian H. Davison et al. 2014)
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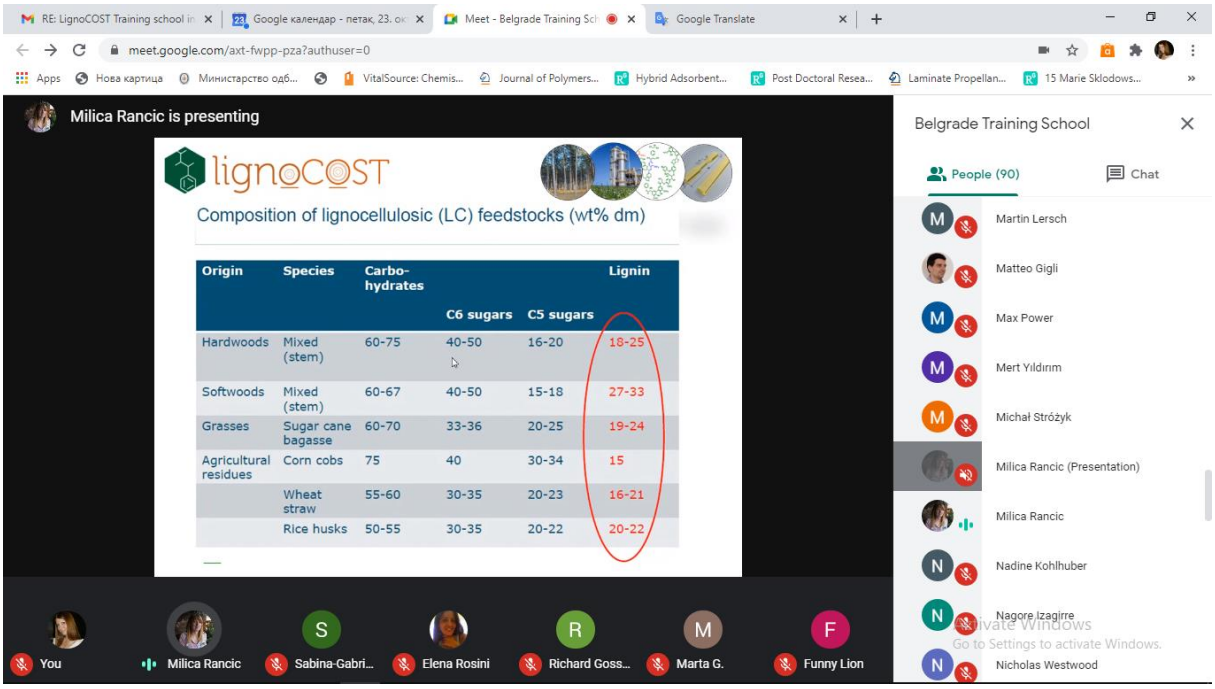
People (90)
Chat
Kena Li
konstantina kar
Ludmila Martinková
Luis Serrano
Maarten Rubens
Magdolna Mihályi
Maria Rybarczyk
Mark Moloney
Marlies Thys
Marta G.
You
Milica Rancic
Sabina-Gabri...
Elena Rosini
Richard Goss...
Marta G.
Funny Lion


Milica Rancic is presenting
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Composition of lignocellulosic (LC) feedstocks (wt% dm)
Origin | Species | Carbo-hydrates | | Lignin
C6 sugars | C5 sugars
Hardwoods | Mixed (stem) | 60-75 | 40-50 | 16-20 | 18-25
Softwoods | Mixed (stem) | 60-67 | 40-50 | 15-18 | 27-33
Grasses | Sugar cane bagasse | 60-70 | 33-36 | 20-25 | 19-24
Agricultural residues | Corn cobs | 75 | 40 | 30-34 | 15
Wheat straw | 55-60 | 30-35 | 20-23 | 16-21
Rice husks | 50-55 | 30-35 | 20-22 | 20-22
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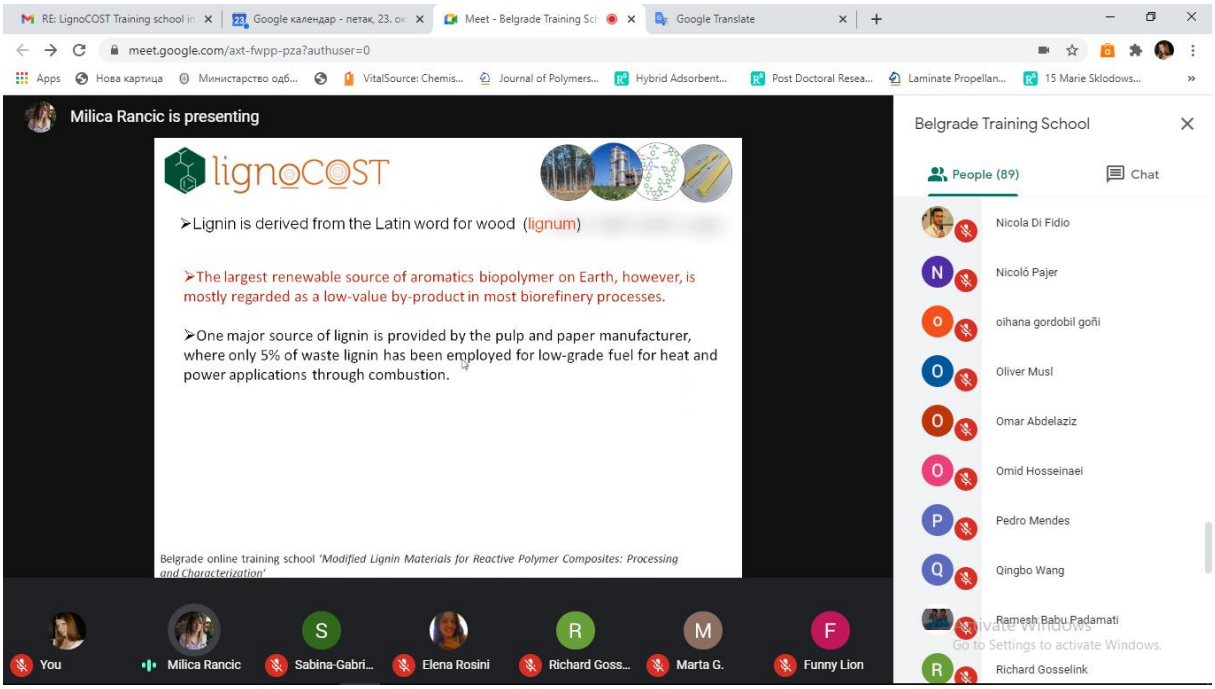
Martin Lersch
Matteo Gigli
Max Power
Mert Yıldırım
Michał Stróżyk
Milica Rancic (Presentation)
Milica Rancic
Nadine Kohlhuber
Nagore Izagirre
Nicholas Westwood
You
Milica Rancic
Sabina-Gabri...
Elena Rosini
Richard Goss...
Marta G.
Funny Lion


Milica Rancic is presenting
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➢Lignin is derived from the Latin word for wood (lignum)
➢The largest renewable source of aromatics biopolymer on Earth, however, is mostly regarded as a low-value by-product in most biorefinery processes.
➢One major source of lignin is provided by the pulp and paper manufacturer, where only 5% of waste lignin has been employed for low-grade fuel for heat and power applications through combustion.
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People (89)
Chat
Nicola Di Fidio
Nicoló Pajer
oihana gordobil goñi
Oliver Musl
Omar Abdelaziz
Omid Hosseinaei
Pedro Mendes
Qingbo Wang
Ramesh Babu Padamati
Richard Gosselink
You
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Sabina-Gabri...
Elena Rosini
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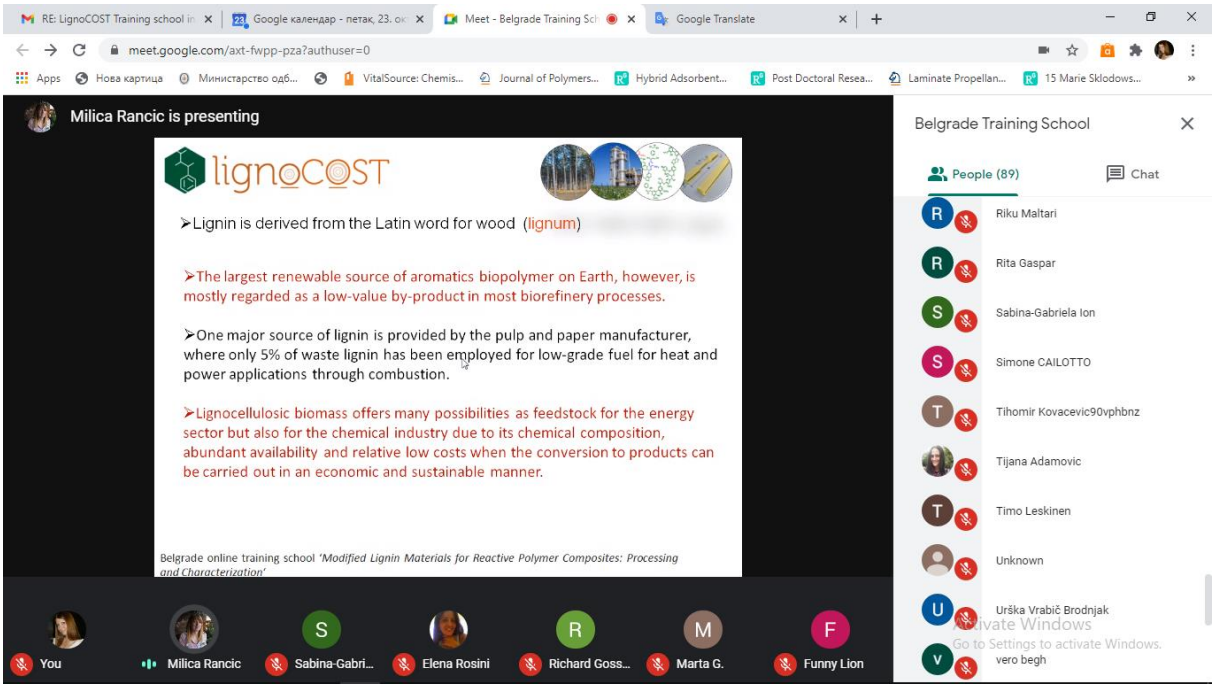
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➢One major source of lignin is provided by the pulp and paper manufacturer, where only 5% of waste lignin has been employed for low-grade fuel for heat and power applications through combustion.
➢Lignocellulosic biomass offers many possibilities as feedstock for the energy sector but also for the chemical industry due to its chemical composition, abundant availability and relative low costs when the conversion to products can be carried out in an economic and sustainable manner.
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People (89)
Chat
Riku Maltari
Rita Gaspar
Sabina-Gabriela Ion
Simone CAILOTTO
Tihomir Kovacevic90vphbnz
Tijana Adamovic
Timo Leskinen
Unknown
Urška Vrabič Brodnjak
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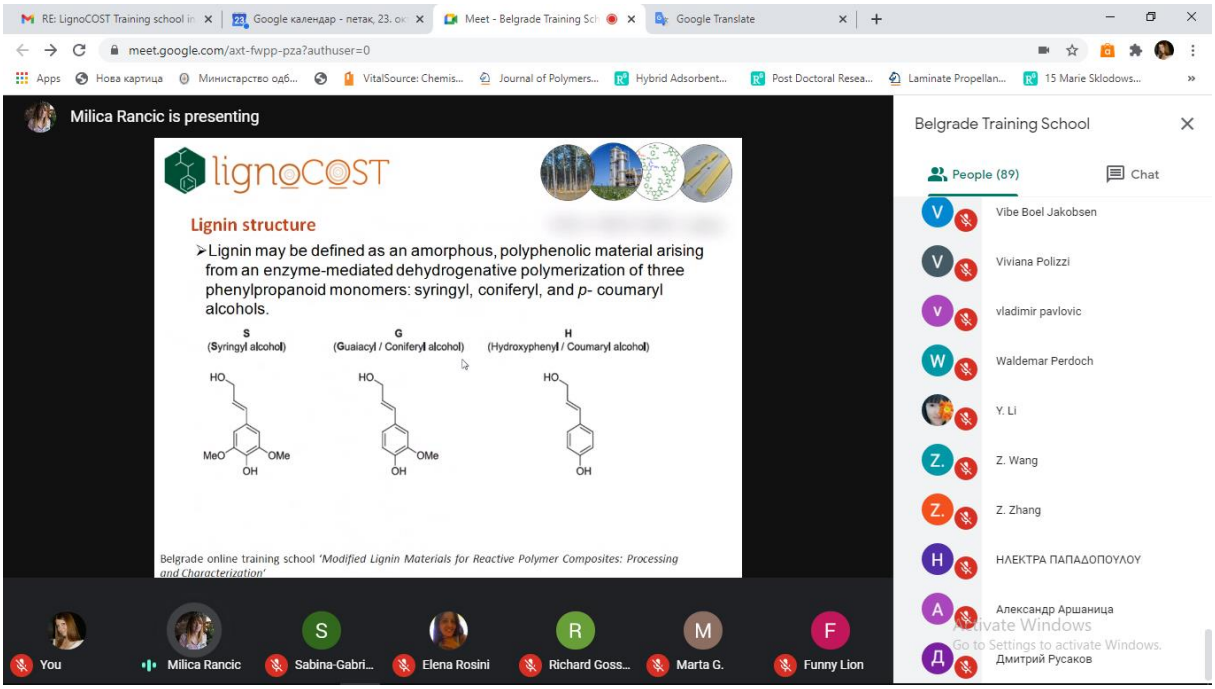
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Министарство одб...
VitalSource: Chemis...
Journal of Polymers...
Hybrid Adsorbent...
Post Doctoral Resea...
Laminate Propellan...
15 Marie Sklodows...
Milica Rancic is presenting
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Lignin structure
Lignin may be defined as an amorphous, polyphenolic material arising from an enzyme-mediated dehydrogenative polymerization of three phenylpropanoid monomers: syringyl, coniferyl, and p- coumaryl alcohols.
S
(Syringyl alcohol)
G
(Guaiacyl / Coniferyl alcohol)
H
(Hydroxyphenyl / Coumaryl alcohol)
HO
MeO
OMe
OH
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Marta G.
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Vibe Boel Jakobsen
Viviana Polizzi
vladimir pavlovic
Waldemar Perdoch
Y. Li
Z. Wang
Z. Zhang
ΗΛΕΚΤΡΑ ΠΑΠΑΔΟΠΟΥΛΟΥ
Александр Аршаница
Activate Windows
Go to Settings to activate Windows.
Дмитрий Русаков