18th International Symposium on Wood, Fibre and Pulp Chemistry (ISWFPC)  
September 8-11 2015, Vienna, Austria

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1 Introduction

The biannual ISWFPC gathered researchers from academia and industry from all over the world. In three parallel sessions 93 oral presentations and three plenary lectures were held. During the whole conference about 150 posters were available, some of them (about 15) were last minute posters, meaning that no extended abstracts are available for these.

The oral presentations were divided into the following topics: Analytical (9), Biotechnology (3), Wood (6), Fibres (4), Biorefinery (12), Pulping (6), Bleaching (4), Paper (5), Materials (22), Cellulose (11), Lignin (11). The distribution between the topics reveals that the central topics concerned processes and products in the wood plant biorefinery area, in particular the conversion of cellulose into non-traditional products. For the plenary lectures no abstracts are available, but for more details the oral presentations as well as of the posters the extended abstracts of the conference can be recommended. The Programme is found at the end of this report and copies of the abstracts can be ordered from Innventia Information Centre, library@innventia.com.

A brief overview of mainly the oral presentations and plenary lectures are given below. As mentioned, the lignin presentations were few and in general not of high quality.

2 Biorefinery

In a plenary lecture “Biorefinery products for chemical intermediates - An Industry Perspective” by Kindler, BASF, Germany, it was emphasised that there is enough renewables to substitute the oil. The forecast by BASF is that the 2nd generation (non-edible) biomass such as wood, switch grass, straw can, and will play an important role to provide raw materials for fuel and chemicals through lignocellulose biorefineries. He stressed the importance for the involved industries to define the interface between the biomass providers and chemical industries; a “Verbund” is needed between the two. What determines the potential is the cost per performance. In the costs one can distinguish the raw material cost, production costs and also the logistics – the location of the biomass and how to solve the transportation required. The performance is needed to be compatible with those of existing petrochemical products and platform chemicals. The much higher O/C ratio and molecular mass of lignocellulosics compared to the naphta fraction needs to be overcome by catalytic cracking of the former. In this
context, the development of hydrothermally stable catalysts able to selectively degrade C-O bonds is needed. Obviously, BASFs vision is a new provider of building blocks to produce similar polymers e.g. polyesters as today. In summary, Kindler stressed the importance of biodegradability of new developed products and hoped for an open dialog with players along the whole value chain (1+1>2!).

The potential of bio-films based on modified xylan was presented by Quaresma, University of Aveiro, in “Modification of xylan from E. globulus kraft pulp for packaging applications”. The xylan was isolated from bleached eucalypt pulp, partially carboxymethylated (DS = 0.2) and then modified with adipic acid dihydrazide (ADH). The bifunctional ADH function as a soft segment in the crosslinking with the carboxyxyylan, by formation of an amide linkage between the carboxyl group and amine group. The formed film are more elastic and improved grease and water barrier properties compared to the parent carboxymethyl xylan.

3 Analytical

Detection of lignin-carbohydrate bonds still fascinates analytical chemists. In a presentation by del Río (IRNAS-CSC, Seville) “Isolation and Chemical Composition of Lignin- Carbohydrate Complexes from Non-Woody Plants” the LCC-isolation protocol developed by other groups (Lawoko et al., 20013 and Li et al., 2011; Du et al., 2013) for hardwood and softwood were applied to abaca and sisal, and evaluated with derivatization followed by reductive cleavage (DFRC) degradation. Two fractions: glucan-lignin (GL) and xylan-lignin (XL) were quantitatively obtained. Just as it has been reported for woody plants, a higher yield was obtained for the GL fractions for the two studied annuals. The GL fractions were enriched in glucan and depleted in lignin and the XL fractions where enriched in both xylan and lignin while depleted in glucan. The lignins in both sisal and abaca are known to be acetylated at the gamma-carbon of the side chain. The used DFRC degradation method makes it possible to demonstrate the presence of ester-linkages, by GC/MS. By comparing the ion chromatograms of degradation products from the GL and the XL fractions with the corresponding MWL preparation, it could be shown that the acetyl groups are cleaved during the LCC preparation, probably due to the used tetrabutylammonium hydroxide (TBAH). From the MWL it was found that sisal contained acetylated structures in both syringyl (80%) and guaiacyl (48%) units, whereas the main part of the syringyl units (84%) were acetylated in contrast to the small fraction of acetylated guaiacyl units (4%). The composition of GL and XL differed between the two plant sources regarding the lignin structure. The S/G ratio of the XL fraction of sisal and abaca were considerably higher (2.8 and 3.4, respectively) than the corresponding MWL (1.4) whereas that of the GL fractions were
slightly lower than the MWL. The conclusion is that the LCC isolation protocol is not applicable to samples with acetylated structures (lignin or carbohydrate derived) such as annual plants.

4 Materials
The group around Sixta at the Aalto University, Finland is one of the leading research groups on regenerated cellulose. In a plenary lecture, Sixta gave an historical expose of the development of regenerated cellulose fibres, “Textiles from Regenerated Cellulose”. The viscose process is by far the most common process for regenerated cellulose fibres. The global production 2014 was distributed between the viscose (4.8 Miot), acetate derivative (1 Miot) and Lyocell (0.2 Miot), and the overall production shows a steep steadily growth for cellulose fibres. The most common spinning technique is the wet-spinning process, but for Lyocell fibres the air-gap spinning, rendering in an improved molecular orientation, is used.

Various solvents to prepare the cellulose containing dope has been tested in different processes e.g.; NaOH/ carbondisulphide (viscose), Cu(NH)2(OH)2 (cupro), carbamate, NaOH/ZnO (Biocelsol), NaOH:urea/7:12 (NaOH-Urea). The development of the original viscose process was towards high tenacity fibres with wet modulus strength, required a retardation of the coagulation process. Besides of a high wet modulus, the developed Modal fibres have attractive properties like decreased shrinking, fibrillation and improved tenacity. The Lyocell process uses N-Methylmorpholine N-oxide (NMMO) as solvent. Lenzing are the sole producer of this fibres and a fourth plant will start up in the near future. Compared to the viscose process, it is simpler and environmentally friendly. The cross section of the fibres are smaller as compared to modal and viscose fibres. The crystallites of Lyocell fibres are longer and thinner, show less clustering, more anisotropic and have elongated voids as compared to viscose fibres. In spite of being an excellent solvent witch can be regenerated, the drawback of the NMMO solvent is its instability; it is sensitive to acids, releases formaldehyde and has an autocatalytic decomposition. 1-ethyl-3-methyl-imidazolium acetate (EmimAc) is another good solvent for cellulose and has been used extensively. To the drawback is counted the limited thermal stability and that it, like all ionic liquids (ILs), tends to accumulate ash. An alternative IL is 1,5-diaza-bicyclo[4.3.0]non-5-enium (DBNH) acetate, which is stable up to 80 °C and more tolerant to water, up to 5% water besides the water in the pulp fibres. Compared to the NMMO process, higher cellulose concentration of the dope and the dissolution and spinning can be performed at lower temperature. The milder
conditions decrease the degradation with a beneficial effect on yield as well as on the strength properties. Needless to say, the father of the process is named Herbert Sixta.

In a presentation by Nypelö, BOKU, Austria, atomic force microscopy (AFM) and strength-barrier analysis was used to study, the “Interaction of cellulose nanofibrils (CNF) and modified hemicelluloses in films” have been studied (a cooperation between BOKU and VTT). CNF was combined with hydroxypropylated hemicelluloses derived from softwood and hardwood, respectively, and sorbitol as a plasticizer. The degree of substitution (DS) of the hemicelluloses ranged between 0.28-0.73. The composition of CNF and hemicellulose/sorbitol was 70:30, thus the latter were held constant independent of additive. Compared to when neat sorbitol was added to the CNF, the oxygen transmission was increased and the transparency increased by addition of the modified hemicelluloses. It was found that the DS as well as source of hemicellulose influenced the transmission; hardwood hemicellulose and low DS rendered in films of highest transmission. By replacing the sorbitol with hemicelluloses, in particular softwood derived, the tensile strength was improved whereas the strain was slightly reduced. AFM adhesion mapping, i.e. measuring the adhesion between the AFM tip and sample surface, revealed that an even distribution of additives (the chemical composition), within the film matrix has a positive impact on the physical nature of the films. When the hemicelluloses were partly replaced with sorbitol, an improvement of the distribution of the additives was observed. It should be noted that the AFM is a surface characterisation method, meaning that the cross sectional distribution of the additives cannot be studied with this technique.

A procedure to prepare templates for functional membranes using TEMPO oxidized cellulose nanofibrils (TCNF) and poly(vinyl alcohol) (PVA) was presented by Hakalahti, VTT (“Cellulose nanofibril films as templates for functional membranes”). The mechanical properties of the produced water stable films could be tuned by adjusting the degree of hydrolysis as well as amount of PVA; the PVA could act as a crosslinker or a softening agent depending on concentration. The surface carboxyl groups of the films give an ion capturing property to the films. In addition, the attachment of stimuli-responsive polymers is possible, as exemplified with grafting of the thermo-responsive poly(N-isopropyl-acrylamide) (PNIPAM) onto the film.

There is a great interest in using nanocellulose and functionalized nanocellulose as reinforcing components in construction materials such as films, fibres, aerogels and in composites. The main drawback is the poor compatibility with non-polar polymers and solvents. To overcome this obstacle, the cellulose have been surface modified with polymers or functionalised e.g. by alkylation. Another approach was presented by Zhang, Georg-August Univ. Göttingen, in “Stimuli-Responsive Films from Cellulose-Based Organogel Nanoparticles”. Surface-stearoylated cellulose nanoparticles (SS-CNPs) was produced with a DS = 1.3, while preserving the
crystalline core of the cellulose particle. The SS-CNP suspensions showed a thermo-reversible gelation behaviour; at low temperature (4 °C) it became a viscoelastic gel and when the temperature increased (25 °C) the sample regressed to its initial state. Films with a solvent-switchable surface wettability were made by solvent casting of SS-CNP dispersed in THF. Rhodamine is a photo stable fluorescent dye used in biomedical sensing and imaging. By incorporation of (2-stearoyl aminoethyl) rhodamine B the SS-CNP films became UV- and temperature responsive with switchable colours and correlated fluorescence. After illumination at 365 nm 30 min the colour switched to magenta and an increase in the absorption at 560 nm, and the colour faded when treated at 135 °C for 60 min along with declining Abs560. The SS-CNP films also showed a responsive shape-memory behaviour, which was nicely illustrated by a film of the film. Shortly, a stable spiral form can be obtained either by treating the film in water at elevated temperature or soaking it in THF. An external force was used to straighten the shape. After cooling or evaporation of the THF, SS-CNP film reverted to the spiral form. The original flat form could be recovered when kept under THF atmosphere for a couple of secs. Due to the biocompatible nature of cellulose, the SS-CNP films were suggested for versatile biomedical applications.

Carbon dots (CDs) is a new type of materials with sizes below 10 nm. They are biocompatible materials with stable photoluminescence. In a nice presentation “Luminescent biohybrid nanomaterials from nanocellulose and carbon dots (CDs)”, Ilari, Aalto University described how carboxylated cellulose nanofibrils (CNF) and cellulose nanocrystals (CNC) can be modified with luminescent, water dispersible CDs. Aminated carbon dots (NH₂-CD) were made and attached to carboxymethylated CNF or TEMPO oxidised CNC, respectively. An amide constitutes the covalent bond, and was possible to achieve in aqueous media after activation of the carboxyl group by EDC/NHS (N-(3-dimethylaminopropyl)-N’-ethylcarbodiimide hydrochloride/ N-hydroxysuccinimide). The process was followed in detail and materials like hydrogels and nanopaper was made. Transparent, smooth and fluorescent nanomaterials were produced. Potential areas for use are biosensing, bioimaging, energy conversion and anti-counterfeit applications.

5 Lignins

John Ralph, University of Wisconsin, presented a review on gene manipulation studies aiming to control the lignin type in plants, “Designer lignins”. One of the driving forces is to increase the susceptibility for pulping; it is much easier to delignify plants rich in syringyl groups (S-lignin) compared to those with guaiacyl lignin (G-lignin). It has been shown that the yield after pulping a polar mutant having 100% syringyl units is 87%, i.e. considerably higher than the original plant which also consists of G-lignin besides of some
hydroxypropyl type (H- lignin). The challenge is to add genes to introduce S-units in pine wood normally lacking S- lignin, so far 8 % S has been successfully introduced. Ralph stressed that S-lignin actually already exists in a few softwood species – this was something he repeated for all examples of gene modification: this is not something completely new, Mother Nature has already done it! Introduction of tricin, a flavanoide monomer, present in annuals, at the end of lignin during the polymerisation is another way to facilitate the degradation of lignin. In real samples tricine units have been identified, likely taking part in the lignification as a nucleation site.

Something Ralph call “zip-lignins” is another way to increase the ease of delignification. This is done by introducing ester linages which is susceptibility towards alkaline degradation, and will thus speed up the delignification process.

“Preparation and characterization of stimuli-responsive lignins” was presented by Crestini, Univ. of Rome. pH- and light sensitive lignins were made by grafting benzene onto the phenol groups of lignin followed by diazocoupling, thereby creating diazobenzene structures. The modified lignins showed change in absorption upon radiation as well as pH-induced change in colour. Thermally-reversible gels were produced from lignins having furan or maleimide groups as chain ends. The etherification of phenols and aliphatic alcohol groups with maleimide was not completed when stopped after 60 minutes, whereas the introduction of furan groups was complete. The combination of these end groups enabled formation of crosslinks and gel state when increasing the temperature to 70 °C, whereas the liquid state was regained upon further increase to 120 °C. This work had been conducted in cooperation between Univ. of Rome and KTH.

In a poster “Purification of Technical Lignins with Ionic Liquids”, it was stated that ionic liquids (ILs) are suitable for selective isolation of purified technical lignin components with antioxidant activity. The conclusions were based on results using three different technical lignins (HKL from the LignoBoost process, soda lignin from alder wood and the residue from the ethanol production, respectively) were tested and two types of ILs based on 1-Butyl-3- methylimidazolium (Bmim): [Bmim]Cl and [Bmim]Me₂PO₄, of which the latter showed to be the preferred solvent for the purpose. The study, presented by Lauberts, was made in cooperation between the Univ. of Latvia, the Latvian State Institute of Wood Chemistry and KTH.

6 Fibres
Deep eutectic solvents (DES) are defined as a system that consists of at least two components that form a eutectic mixture with lower melting point than any of the individual components. It has been used for studies on cellulose dissolution, functionalization and for pre-treatment. Tenhunen, VTT, presented how choline chloride:urea/1:2 can be used for as swelling agent and rheology modifier for making
cellulose dope solutions in “Process for Spinning Wood-based Pulp Filaments from Deep Eutectic Solvent Dope”. Bleached softwood kraft pulp and the DES were mixed at 100 °C overnight, before poly(acrylic acid) (PAA) was added. The gel-like dope was extruded and coagulated in ethanol. After drying, the fibres were exposed to heat induced esterification to crosslink the cellulose and the PAA, contributing to improved water stability. Since the cellulose was not exposed to dissolution-regeneration the cellulose I structure was retained in the obtained fibres. The benefit of the suggested process is that all components/chemicals are potentially biobased and can be recovered and/or re-used. The DEA was recovered by evaporation of the ethanol in the coagulation bath. The process show high potential for up-scaled production of high-performance cellulose fibre yarns for textile and composites etc.

One poster presented the possibility to produce carbon fibre precursors by solvent spinning. The study “Carbon fibres from lignin-cellulose precursor” had been conducted in cooperation between Swerea IVF and Innventia. Two types of LignoBoost kraft lignin of fuel grade were used: one obtained from processing of hardwood (HKL) and the other from processing of softwood (SKL). Also two types of celluloses were tested: one dissolving grade and one fully bleached softwood kraft pulp. The air-gap spun precursor fibres, containing 70 % lignin and 30 % cellulose, demonstrate mechanical properties equivalent to commercial textile fibres. Precursor fibres based on SKL were more easily stabilised as compared to those made from HKL, and was further concerted into CF. The obtained CFs had mechanical properties equal to or greater than those reported for neat lignin-based carbon fibres produced by melt spinning. An advantage of the wet-spun precursor fibres is that they are more flexible and easier to handle with a decreased risk of brittle fracture. The potential for further improvement for the new type of carbon fibre is considered very high.

*according to the speaker Procter and Gamble has patented a process for producing a biobased PAA – but it was not used in this study.
Wednesday, September 9th

Track 1: Lecture Hall XX
8:00 Registration opens
8:30-9:00 Opening Ceremony

Track 2: Lecture Hall XXI
9:00-9:45 Biorefinery products for chemical intermediates - An Industry Perspective
A. Kindler, BASF Ludwigshafen, Germany

Track 3: SR

Plenary
Biorefinery products for chemical intermediates - An Industry Perspective
A. Kindler, BASF Ludwigshafen, Germany

Biorefinery (chair: M. Ek) Materials (chair: O. Rojas) Paper (chair: A. Sundberg)
Our Industry’s Need to Refine Lignin prior to Use in a Way Similar to Crude Dimitris S. Argyropoulos

Value-added Biomaterials and Biofuels from Lignocellulosics based on a Biorefinery Scenario Run-Cang Sun


New biosourced amphiphilic conjugates from xylan oligomers and fatty acid derivatives by click chemistry D. da Silva Perez, M. Chemin, F. Ham-Pichavant, G. Chollet, H. Cramail, S. Grelier

Mechanical properties of hardwood fibres and fibre to fibre bonds M. Jajcinovic, W.J. Fischer, U. Hirn, W. Bauer

Morphological characterization of pulp fibers and fines M. Mayr, W.J. Fischer, R. Eckhart, W. Bauer

Track 1: Lecture Hall XX

Cellulose (chair: D. da Silva Perez)

Stability of cellulose nanocrystal submonolayers and morphological differences between cellulose I and III on cationized surfaces R. Salminen, E. Kontturi

A general approach to functionalization of never-dried cellulose materials: a mild click chemistry protocol in water H. Hettegger, M. Beaumont, A. Potthast, T. Rosenau

Molecular- Sieving Gas Separation with Nanoporous Metal/Organic Frameworks Synthesized on Highly-Dense Nanocellulose Matrix M. Matsumoto, T. Kitaoka

Track 2: Lecture Hall XXI

Analytical (chair: E. Sjöholm)

New Developments in the Characterization of Cellulose Derivatives: Gradient Separations by Degree of Substitution and Two-Dimensional Separations W. Radke, H.O. Ghareeb, M. Shakun, T. Heinze

Isolation and Chemical Composition of Lignin-Carbohydrate Complexes from Non-Woody Plants J.C. del Río, J. Rencoret, P. Prinsen, E.M. Cadena, A.T. Martínez, A. Gutiérrez

Behavioral analyses of a detergent in kraft pulp washing process by cryo-TOF- SIMS/SEM D. Aoki, K. Tokugawa, Y. Matsushita, M. Ishiguro, Y. Noda, K. Fukushima

Track 3: SR 12

Biotechnology (chair: A. Gutierrez)


Lipoxygenase: a new versatile oxidative enzyme in lignin upgrade C. Crestini, H. Lange

Comparison of lignocellulose pretreatment and enzymatic hydrolysisin deep eutectic solvents and ionic liquids R. Wahistrom, J. Hiltunen, L. Kuutti, K. Kruus, A. Suurnäkki, S. Vuoti
Wednesday, September 9th

**Track 1: Lecture Hall XX**
**Biorefinery** (chair: E. Capanema)

- Fundamental biomass characteristics that affect enzymatic digestibility of autohydrolysis pretreated biomass

- Fast, facile and reproducible approach for lignosulfonate isolation
  I. Sumerskii, G. Zinovyev, P. Korntner, T. Rosenau, A. Potthast

14:30-14:55

**Track 2: Lecture Hall XXI**
**Cellulose** (chair: D. Evtuguin)

- Alternative preparation pathways to cellulose nanocrystals by hydrogen chloride vapour
  E. Kontturi, M. Lorenz, A. Bismarck

- Structural study of methyl glucosides mimicking methyl cellulose
  Y. Yoneda, S. Kawai, T. Kawada, T. Rosenau

14:00-14:25

**Track 3: SR 12**
**Materials** (chair: R. Venditti)

- Interaction of CNF and modified hemicelluloses in films
  T. Nypelö, C. Laine, U. Henniges, T. Tammelin

- Cellulose nanofibril films as templates for functional membranes
  M. Hakalahti, T. Hänninen, A. Salminen, A. Mautner, A. Bismarck, T. Tammelin

14:00-14:25

**Track 1: Lecture Hall XX**
**Biorefinery** (chair: H. Jameel)

- Novel biorefinery concept based on gamma-valerolactone/water fractionation
  H.Q. Le, Y. Ma, M. Borrega, H. Sixta

- Catalysis for conversion of biorefinery lignin to high value chemicals – structural and computational analysis for improved catalyst design
  J.J. Bozell, T. Elder, B. Biannic, D. Cedeno

- Modification of xylan from E. globulus kraft pulp for packaging applications
  A. Quaresma, V. Dias, S. Magina, D. Evtuguin

16:00-16:25

**Track 2: Lecture Hall XXI**
**Paper** (chair: G. Mortha)

- Development of innovative binders for a biodegradable and environmentally friendly coated paper
  B. Busnardo, R. Ganzerla, M. Moretti

- An innovative "green" lignin coating to improve properties of paper from recycled fibers
  F. Bardot, E.S. Esakkimuthu, G. Mortha

16:00-16:25

**Track 3: SR 12**
**Materials** (chair: H. Kamitakahara)

- Polymer reinforcement with microfibrillated lignocellulose
  W. Gindl-Altmutter, S. Veigel, S. Herzele, F. Liebner

- Preparation of hemicellulose-g-P4-VP copolymer and its characterization
  X. Zhou, M. Ge

16:00-16:25

**Track 1: Lecture Hall XX**
**Biorefinery** (chair: H. Jameel)

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  A. Quaresma, V. Dias, S. Magina, D. Evtuguin

16:30-16:55

**Track 2: Lecture Hall XXI**

- Fiber Charge Density Measurement by the Polyelectrolyte Titration Method
  C. Zhao, H. Zhang, Z. Li, X. Zeng, H. Li

16:30-16:55

**Track 3: SR 12**

- Thermo-responsive Cellulose Paper via ARGET ATRP

17:00-17:25
### Thursday, September 10th

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<td><strong>Advances in IONCELL-P, an ionic liquid based hemicellulose extraction method</strong>&lt;br&gt;A. Roselli, S. Hellsten, M. Hummel, H. Sixta</td>
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<td><strong>Molecular Weight and Structure</strong>&lt;br&gt;Characterisation of Lignin by Multi-Detector GPC&lt;br&gt;B. Sabagh, B. Schaefer</td>
<td><strong>Chemical mapping of lignin precursors in the xylem of freeze-fixed Ginkgo biloba by the cryo-TOF-SIMS/SEM system</strong>&lt;br&gt;K. Fukushima, Y. Hanaya, D. Aoki, Y. Matsushita, K. Kuroda</td>
<td><strong>Interaction of hemicelluloses and cellulose and their influence on the cellulose microfibrillation process</strong>&lt;br&gt;L. Falcoz-Vigne, L. Heux, K. Mazsaus, Y. Nishiyma, Y. Meyer</td>
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<td><strong>Plantrose(TM) lignins: a new type of technical lignins</strong>&lt;br&gt;E. Capanema, M. Balakshin</td>
<td><strong>Effect of cooking, oxygen delignification and bleaching on final sugar content of prehydrolysed softwood kraft pulps</strong>&lt;br&gt;C. Chirat, S. Das, L. Lachenal</td>
<td><strong>New Model of Wood Cell Wall Microfibril and Its Implications</strong>&lt;br&gt;U.P. Agarwal, S.A. Ralph, R.S. Reiner, C. Baez</td>
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<td><strong>Up-grading lignin side streams by chemical modification</strong>&lt;br&gt;M. Orlandi, A. Salanti, L. Zoia</td>
<td><strong>Computational Study of Copper-Phenanthrolines as Pulping Catalysts</strong>&lt;br&gt;T. Elder, A. Rudie</td>
<td><strong>Raman fingerprint of different wooden cells: a comparison of species and positions</strong>&lt;br&gt;B. Prats-Mateu, N. Gierlinger</td>
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<td><strong>Application of the Adsorptive Bubble Separation (ABS) to Wood and Wood Byproducts</strong>&lt;br&gt;R. Wanschura, M. Baumgartner, E. Windelisen, K. Richter</td>
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### Thursday, September 10th

**Track 1: Lecture Hall XX**

**Biorefinery** (chair: T. Elder)

- Improving the economics of bio-based process by upgrading the value of the non-sugar residue  
  R. Phillips, C.G. Culbertson
- Assessing Biorefineries Using Wood for the BioEconomy – Current Status and Future Perspective of IEA Bioenergy Task 42 “Biorefining”  
  G. Jungmeier, R. van Ree, H. Stichnothe, I. di Bari

**Track 2: Lecture Hall XXI**

**Lignin** (chair: Y. Matsumoto)

- Radical chain and heterolysis reactions in lignin pyrolysis as studied with model dimers  
  H. Kawamoto, K. Matsuda, S. Saka
- Effect of alpha-acetyl group on the oxidative coupling of sinapyl alcohol by Ag₂O  
  T. Kishimoto, N. Takahashi, M. Hamada, N. Nakajima

**Track 3: SR 12**

**Materials** (chair: T. Nypelö)

- Stimuli-Responsive Films from Cellulose-Based Organogel Nanoparticles  
  K. Zhang
- Development of new polyester film from cedar-organosolv lignin and its application for a separator in electric double layer capacitor  
  A. Kubota, T. Isozaki, T. Yamada, K. Koda, Y. Uraki

### Lunch

**Track 1: Lecture Hall XX**

**Track 2: Lecture Hall XXI**

**Track 3: SR 12**

### Coffee and Poster

**Track 1: Lecture Hall XX**

**Biorefinery** (chair: A. Martinez)

- Generate platform chemicals out of lignin with reductive approach  
  H. Schwarz
- Process Simulation and Environmental Life Cycle Assessment of a Lignin Extraction Process in a Kraft Pulp Mill  
  C. Culbertson, R. Venditti, H. Jameel, R. Phillips

**Track 2: Lecture Hall XXI**

**Lignin** (chair: Y. Uraki)

- A novel phenolation process of softwood kraft lignin for adhesive application  
  J. Liu, J. Du, H. Jameel, H.-M. Chang
- Why is the rate of the beta-O-4 bond cleavage dependent on the type of aromatic nucleus in the delignification during alkaline pulping process?  
  S. Shimizu, T. Yokoyama, Y. Matsumoto

**Track 3: SR 12**

**Materials** (chair: S. Fu)

- Thermo-responsive supramolecular hydrogels of end-functionalized methyl celluloses  
  H. Kamitakahara, M. Yamagami, R. Suhara, A. Nakagawa, A. Yoshinaga, T. Takano
- Characterization of Tencel® gel: a cellulose II gel featuring particle-like morphology  
  M. Beaumont, M. Opietnik, A. Potthast, T. Rosenau

### 16:00-16:25

**Production of bioethanol and market pulp from Eucalyptus grandis under the approach of an integrated forest biorefinery**  
N. Cabrera, F. Arrosbide, M. Guigou, F. Cebreiros, N. Cassella, C. Lareo

**Preparation and Characterization of an Aminated Lignin**  
W. Zhou, F. Chen

**Chemically cross-linked cellulose nanofibril (CNF) hydrogels: Rheology and analysis of the mesh size**  
L. Jowkarderis, T.G.M. van de Ven
## Track 1: Lecture Hall XX
### Plenary
**8:30 - 9:15**
**Designer lignins**
J. Ralph, University of Wisconsin, Madison, USA

### Lignin (chair: C. Crestini)
**9:20-9:45**
**New insights into residual lignin structure of eucalypt sulphite pulp**
D. Evtuguin, S. Magina, A.P. Marques

**9:50-10:15**
**Synthesis and NMR Characterization of Lignin Tetramers**
F. Lu, F. Yue, J. Ralph

**10:20-10:45**
**Chemical structure assignment for minor lignin components present in spruce MWL by NMR**
L. Zhang

### Materials (chair: W. Gindl-Altmutter)
**11:15-11:40**
**Lignin and lignocellulose nanofibers: Fundamentals and application prospects**

**11:45-12:10**
**Magnetic ferrite nanoparticles immobilized in situ on the surfaces of cellulose nanocrystals**
S. Fu, C. Tian

**12:15-12:40**
**Luminescent biohybrid nanomaterials from nanocellulose and carbon dots (CDs)**
J. Guo, K. Junka, I. Filipponen, J. Laine, O.J. Rojas

### Coffee

### Cellulose (chair: E. Kontturi)
**A new synthetic approach to sterically hindered ethers of hydroxypropyl cellulose by reductive etherification**
K.M. Klinger, D. Gray

**Investigating the effect of residual lignin on cellulose nanofibrils and nanopapers properties**
E. Rojo, M.S. Peresin, J. Laine, O.J. Rojas

**Regeneration of aqueous periodate solution from dialdehyde cellulose production by ozone treatment determined by RPHPLC with UV detection**
S. Koprivica, R. Scholz, D. Bauer, W. Roggenstein, T. Rosenau, A. Potthast

### Analytical (chair: S. Sarkanen)
**Comprehensive lignin analysis by quantitative 13C NMR spectroscopy: Possibilities and limitations**
M. Balakshin, E. Capanema

**Mountain pine beetle infestation: GCxGC-TOFMS and GC-MS of Lodgepole pine (Pinus contorta) acetone extractives**
R.K. Moore

**Effect of iron on the long-term stability of cellulose: comparison between spectroscopic and molecular kinetics**
S. Zaccaron, P. Calvini, R. Ganzerla

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## Track 2: Lecture Hall XXI
### Pulping (chair: C. Chirat)
**9:20-9:45**
**Utilization of CCE filtrate to improve kraft pulp refiinability and strength properties**
J.L. Colodette, J. Resende, F. Gomes, R.C. Oliveira

**9:50-10:15**
**Characterization of dissolving pulp fiber swelling in dilute cupriethylenediamine solution by MorFi analysis: correlation with Fock reactivity**
A.J. Benoit, R. Passas, C. Chirat, D. Lachenal

**10:20-10:45**
**Chemical transformations in eucalyptus, sugarcane bagasse and straw during hydrothermal, acid and alkaline pretreatments**
D.M. de Carvalho, O. Sevastyanova, L.S. Penna, B.P. da Silva, M.E. Lindstrom, J.L. Colodette

### Coffee

### Wood (chair: F. Chen)
**The surface charge of wood**
T. Luxbacher, B. Michen

**Structure of wood cell wall based on high-resolution transmission electron microscopy**
M. Reza, J. Ruokolainen, T. Vuorinen

**Microstructural changes of cellulose in wood by moist-thermal treatment**
T. Kuribayashi, Y. Ogawa, Y. Nishiyama, L. Heux, Y. Saito, Y. Matsumoto

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## Track 3: SR 12

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Friday, September 11th

**Lunch**

**Track 1: Lecture Hall XX**
Fibers (chair: M. Kostic)
- Man-made cellulose fibers – review and outlook
  T. Röder, J. Moosbauer, S. Schlader, G. Kraft

**Track 2: Lecture Hall XXI**
Bleaching (chair: D. Lachenal)
- Isolation and characterisation of chromophores in pulps: A review
  V. Zungu, B. Sithole, D. Ramjugernath

**Track 3: SR 12**
Materials (chair: H. Kawamoto)
- Transparent aerogels from liquid-crystalline TEMPO-oxidised nanocellulose reinforced with PMMA and equipped with evenly distributed, covalently immobilized, highly photoluminescent carbon dots
  S. Quraishi, S. Plappert, P. Taupe, B. Ungerer, T. Rosenau, F. Liebner

**Track 1: Lecture Hall XX**
Bleaching (chair: T. Hosoya)
- Process for Spinning Wood-based Pulp Filaments from Deep Eutectic Solvent Dope
  T.-M. Tenhunen, M. Hakalahti, J. Kouko, A. Salminen, T. Härmäsalmi, T. Hänninen

**Track 2: Lecture Hall XXI**
Fiber (chair: T. Röder)
- Reactions between lipophilic extractives and peracetic acid during post-bleaching: a study of model compounds
  J.-E. Raitanen, A. Sundberg, J. Konn, S. Willför

**Track 3: SR 12**
Materials (chair: M. Balakshin)
- Electroconductive and antimicrobial composite films of nanocellulose, polypyrrole and silver nanoparticles
  C. Xu, J. Liu, P. Bober, T. Lindfors, R.-M. Latonen

**Coffee and Poster**

**Track 1: Lecture Hall XX**
Investigations on the decomposition mechanism of chlorine dioxide at alkaline pH
J. Marcon, G. Mortha, N. Marlin, F. Molton, C. Duboc, A. Burnet

**Track 2: Lecture Hall XXI**
Superhydrophobic effect on viscose fabric obtained by plasma surface modification and incorporation of metal ions
M. Kostic, A. Kramar, B. Obradovic, M. Kuraica:

**Track 3: SR 12**
Textile fibers from recycled waste materials
Y. Ma, M. Maattanen, A. Sarkilahti, M. Hummel, A. Harlin, H. Sixta

**Closing Ceremony**

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The ISWFPC 2015 is certified as ÖkoEvent for its environmentally friendly organization.
ISWFPC 2015 - Poster presentations

Note:

• All posters are **on display throughout the whole conference** (Wednesday through Friday).

• Authors of posters with **odd numbers** should be present at their posters during poster sessions on the **first day** of the conference (Wednesday, September 09).

• Authors of posters with **even numbers** should be present at their posters during poster sessions on the **second day** of the conference (Thursday, September 10).

• This **list contains only posters with a corresponding extended abstract** having been submitted for inclusion in the proceedings. The number in this list corresponds with the number in the conference proceedings (vol. 2).

• Authors of **posters without corresponding extended abstract** will receive their **poster number upon registration**.
P1: A novel method of micro-fibrillated cellulose preparation and its characterization
Aijiao Wang, Qun Li, Fei Li

P2: Cellulose degradation during closed vessel aging
Myung-Joon Jeong, Sinah Lee, Antje Potthast, Kyu-Young Kang

P3: Comparison of Cellulose Supramolecular Structures Between Nanocrystals of Different Origins
Umesh P. Agarwal, Richard S. Reiner, Christopher G. Hunt, Jeffery Catchmark, E. Johan Foster, Akira Isogai

P4: Cooperative Asymmetric Organocatalysis with Proline and Nanocellulose
Xin Jin, Takuya Kitaoka

P5: Enhancing Antibacterial Activity of Cationic Microfibrillated Cellulose by Adsorbing Triclosan
Xu Zeng, Hongjie Zhang, Zhiqiang Li, Huiren Hu

P6: Evaluation of cellulose hydrolysis during peracetic acid delignification
Sinhae Lee, Bong Suk Yang, Myung-Joon Jeong, Antje Potthast, Kyu-Young Kang

P7: Formation of Irreversible H-bonds in Cellulose Materials
Umesh P. Agarwal, Sally A. Ralph, Rick S. Reiner, Nicole M. Stark

P8: Homogeneous Esterification of Pre-Hydrolysis Kraft Pulp in [DBNH][OAc]
Tia Kakko, Shirin Asaadi, Alistair W.T. King, Michel Hummel, Herbert Sixta, Ilkka Kilpeläinen

P9: How cellulose can be degraded – different approaches to get to DP 100 and below
Thomas Zweckmair, Sonja Schiehsler, Martin Siller, Stefan Koch, Thomas Rosenau, Antje Potthast

P10: Influence of the intrinsic characteristics of cellulose on the production of manmade cellulosic fibers from ionic liquid solution
Anne Michud, Michael Hummel, Herbert Sixta

P11: Microwave-assisted synthesis of eucalyptus cellulose carbamate
Diana B. Lanieri, Maria S. Peresin, Mirtha G. Maximino

P12: Production of nanocellulose from commercial E. globulus kraft wood pulp: influence of xylan removal
Ana Reis, Rui Duarte, Maria T. Gomes, António Mendes de Sousa, José Ataide, Dmitriy Evtuguin

P13: Structural and Morphological Characterization of Ultrasound Pretreated Wood Cellulose Pulp
Atsile Ocwelwang, Bruce Sithole, Deresh Ramjugernath

P14: Synthesis and characterization of biodegradable cellulosic polycations with antimicrobial properties
Hassan Amer, Nora Odabas, Markus Gorfer, Ute Henninges, Antje Potthast, Thomas Rosenau

P15: Ternary Phase Equilibria of Cellulose-EMIM Acetate-Water System
Lalaso V. Mohite, Santosh S. Shingote, Neelesh Bharti Shukla, K. Gurudatt

P16: The macroscopic effects of ultrasound coupling
TEMPO oxidizing cellulose
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P17: A Lignin-containing Hemicelluloses-based Stimuli-sensitive Hydrogel and Its Adsorption Behavior
Xiyi Song, Fangeng Chen, Shangjun Liu

P18: A rapid, efficient, and facile solution for dental hypersensitivity: The tannin–iron complex
Dongyeop X. Oh, Dong Soo Hwang

P19: Acetic Acid Lignin as A Precursor for Development of Dye Adsorbent
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P20: Adsorbents based on hydrolysis lignin and polyacrylonitrile

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Yu.G. Khabarov, N.Yu. Kuzyakov, G.V. Komarova, V.A. Veshnyakov
P22: Cellulose-based Superabsorbent Hydrogels Prepared from Bleached Hardwood Kraft Pulp
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P23: Chitin nanofibrillar metalation with greatly improved toughness by ALD
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P24: Electrospinning of lignin/chitin composite nanofibers
Heiko Lange, Elisavet D. Bartzoka, Pierfrancesco Morganti, Claudia Crestini

P25: Hemicellulose-based hydrogels promising for metal ion removal
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P26: Nano and Micro Crystalline Cellulose as Modifier of Polylactic Acid Foams
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P27: Obtaining And Investigation Of Activated Carbon From Waste Hydrolysis Lignin
S. Nenkova, R. Nikolov, L. Raycheva, I. Valchev

P28: Polyelectrolyte Complexes Of Xylan And Chitosan – Effects Of The Order Of Addition And Ionic Strength
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P29: Preparation and Properties of Fatty Acid Esters of Softwood Kraft Lignin
Richard Venditti, Siddhesh Pawar, Hasan Jameel, Hou-min Chang, Ali Ayoub

P30: Preparation of cellulose nanofibrils films from wood fibers and non-wood fibers
Shiyu Fu, Qijun Meng, Yilong Liang, Lucian A Lucia

P31: Preparation of iron oxide particles decorated lignin-based carbon nanofibers as electrode material for pseudocapacitor
Linping Wang, Aori Gele, Yuxiang Sun

P32: Synthesis and Characteristics of Lignin-Phenol-Formaldehyde Resole Adhesives
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P35: Thermochemical formation of copolymer polyacrylonitrile / hydrolysis lignin complexes
Yu.N. Sazanov, S.M. Krutov, D.S. Kosyakov, E.V. Ipatova, G.N. Fedorova, E.M. Kulikova, N.N. Saprykina

P36: Thermodynamic properties of epoxy resins synthesized from the lignin selectively depolymerized in acidic non-polar solvent
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P37: Thermoresponsive supramolecular hydrogels of end-functionalized methylcelluloses
Hiroshi Kamitakahara, Mao Yamagami, Ryo Suhara, Atsushi Nakagawa, Arata Yoshinaga, Toshiyuki Takano

P38: Carbon fibres from lignin-cellulose precursor
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