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N°23 - DECEMBER 2012



**“Nature makes polysaccharides,
EPNOE turns them into products”**

editorial

Dear Readers of the EPNOE Newsletter,

It is a great pleasure to write this short message for wishing you, your family and all the people you love a very good, successful and healthy 2013 year.

This last issue of 2012 is, as usual, listing the latest news of our academic, research and industrial members. In addition, we present a small selection of scientific papers published by EPNOE scientists, taken among the more than 400 papers which appeared in international, recognized journals in 2012. They show the wide range of topics studied within EPNOE, and the interest in being in close contacts with EPNOE members.



At the beginning of 2013, the publisher Springer will release a new book written by EPNOE scientists entitled: “The European Polysaccharide Network of Excellence (EPNOE). Research Initiatives and Results”. It is an illustration of the many activities of our network.

Next year will see the development of EPNOE activities around innovation and of course the organisation of the EPNOE conference in Nice. Please note that the dates of EPNOE 2013 changed: we will all meet October 21-24, 2013 on the French Riviera (<http://epnoe2013.sciencesconf.org>).

Happy New Year !



Dr. Patrick Navard
Coordinator of EPNOE
Armines/Mines ParisTech/CNRS
CEMEF - Centre for Material Forming
Sophia-Antipolis
(France)

news

▶ Member's info



Awards

Thomas Heinze, Tim Liebert, and Susanne Schmidt from the university of Jena, were awarded the prize of the Thuringian Ideas Competition for their work in the field of meltable glues based on polysaccharide derivatives. It was honored with a donation of Eur 5.000.

New staff

- Dr. Floriana Constantin is the newest member of staff at the Institute for Textile Chemistry and Textile Physics. Floriana obtained her PhD from University «Politehnica» of Bucharest, Faculty of Applied Chemistry and Materials Science, the title of her thesis is “New reinforcing agents for polymeric resins”.
- Leonore Steuer started her Diploma thesis on “Photoactive cellulose derivatives” at the university of Jena and is supervised by Thomas Heinze.

Events

- Fraunhofer Institute for Applied Polymer Research (Potsdam-Golm, Germany) organises its 5th Biopolymer Colloquium which will take place in Berlin on January 24th, 2013. A flyer with the registration form can be requested at dieter.hofmann@iap.fraunhofer.de.
- Patrick Navard, as the responsible person for all applications, presented the main challenges of the large French project «Biomass for the Future» during its kick-off meeting in Versailles, November 30, 2012 (http://www.international.inra.fr/research/biomass_for_the_future_bff).
- Thomas Heinze was invited to present latest results on polysaccharide research and to introduce EPNOE at the «Bayern Innovativ» meeting that was held on November 20, 2012 at Herzogschloss, Straubing, Germany. More information: bayern-innovativ.de



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EPNOE-related European Project

STEP: Shaping and Transforming in the Engineering of Polysaccharides

The objective of STEP-ITN project was to gain a fundamental understanding of the non-covalent interactions in polysaccharide structures and utilize the knowledge to develop ways and means of overcoming their influence on the polysaccharide conversion processes. Comprised of 8 full partners and 6 associated partners, from both the academic and industrial sectors across 6 different countries in Europe gave the ideal scenario to generate a truly coherent multi-disciplinary and diverse research environment.



Research Focus

- To design modes of transformation that will impart special properties to polysaccharide-based materials, e.g. thermoplasticity.
- To design modes of shaping to engineer polysaccharide-based materials towards desired end-uses.
- To identify and optimize critical variables in conversion, viz. in transformation and shaping processes.
- To characterize materials obtained from the innovative conversion processes and tune their performance to meet end-use requirements.
- To determine feasibility of transferring the innovations to commercial-scale production.

The project ran from October 2008 to September 2012 employing 16 early stage researchers, of which 9 have been awarded doctorate degrees while 6 await their final defence, and 6 experienced researchers throughout the project. 30+ papers were published and 4 patents were granted. Details of all the project partners and further information about the EU project can be found at www.stepitn.eu

List of Members

Univ. Innsbruck, Univ. Maribor, Univ. Nottingham, Univ. Jena, IBWCh, OMPG/TITK, Lenzing AG, Unilever food and health research institute.

This article was proposed and written by Barnaby Caven and Thomas Bechtold, University of Innsbruck.



STEP ITN



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EPNOE-related European Project

FP 7 Project SURFUNCELL – Development of high value products based on renewable resources and

Concern for environment is no longer an abstract ideology. Considerable research attention is now focused on developing more environmentally benign approaches for industry. The EU-FP7 project Surfucell aimed at modifying the surface of readily shaped cellulosic materials in order to achieve new functionalities. At the beginning of the project, several 'demonstrators' or example applications of the envisaged research results were defined. Then ways to achieve these targets were developed, finally narrowing down to the five most promising ones.

In the first demonstrator, antimicrobial materials (silver nanoparticles) are used to modify cellulose fibres used in textiles. The antimicrobial yarn has applications in general hygiene. It was taken care that the nanoparticles are not below a certain size so that they cannot penetrate the skin. The first T-shirts have been already manufactured with the yarn, and production is ready for ramping up to industrial scales.

The second demonstrator deals with the removing of hormone impurities from drinking water. There are strong evidences that traces of hormones from contraceptive pills may cause diminished fertility in men. Specific enzymes are attached to the inner surface of hollow-fibre water purification membranes. Nanostructuring the inside of the fibres allows to bind the enzymes chemically to the surface that they are not washed away with the water. The hormones are digested as they pass through. This demonstrator is at pilot stage.

Food packaging forms the focus of the third demonstrator. Cellulose foils are easily penetrated by water vapour; as a result, food becomes dry. The humidity also makes it easier for oxygen to penetrate the film. At present synthetic polymer films are coated on the cellophane foils to prevent water penetration; these polymer films are non-renewable and have a high environmental impact. A more environmentally friendly approach to films for food packaging was developed.

The fourth demonstrator aims at protecting paper from UV light. If paper is not carefully cleaned to remove lignin, it acquires an unattractive yellow hue over the course of time. Removing lignin needs a lot of chemistry and energy. Shielding the paper from UV light allows a higher amount of lignin in the paper sheet saving material and energy.

The fifth demonstrator is a high tech bio-sensoric device based on cellulose derivatives able to bind protein receptors which interact specifically with pathogen proteins. This interaction allows simple but very effective diagnoses. This very promising device will have to pass several evaluation steps before being accepted as a diagnostic tool.

Particular emphasis was placed on the life cycle analyses for each demonstrator. Care was taken to minimize energy and hazardous chemical materials used at each stage of the manufacturing process.

The project ended in November 2012. The mutual research of 7 academic and 6 industrial partners offers new products and processes. The European Community will have some economic advantage from this R&D project.

Volker Ribitsch, Coordinator, University Graz, Austria



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Scientific papers

Selection of articles published by EPNOE partners in 2012

University of Jena (Germany)

- K Petzold-Welcke, K Schwikal, St Daus, Th Heinze (2012) Xylan derivatives and their application potential - Mini-review of own results. *Carbohydrate Polymers* CARBPOL-D-12-01501R1
- Th Elschner, K Ganske, Th Heinze (2012) Synthesis and aminolysis of polysaccharide carbonates. *Cellulose* 2012, DOI: 10.1007/s10570-012-9819-9
- Kuzmina, Th Heinze, D Wawro (2012) Blending of Cellulose and Chitosan in Alkyl Imidazolium Ionic Liquids. *ISRN Polymer Science #251950*, in press
- J Wotschadlo, T Liebert, J H Clement, N Anspach, St Hoepfener, T Rudolph, R Müller, U S Schubert, Th Heinze (2012) Biocompatible Multishell Architecture for Iron Oxide Nanoparticles. *Macromolecular Bioscience* DOI: 10.1002/mabi.201200243.
- T Mohan, C S P Zarth, A Doliška, R Kargl, Th Grießer, S Spirk, Th Heinze, K Stana-Kleinschek (2012) Interactions of a cationic cellulose derivative with an ultrathin cellulose support. *Carbohydrate Polymers* DOI: 10.1016/j.carbpol.2012.10.026
- Th Elschner, Wondraczek, T. Heinze (2012) Syntheses and detailed structure characterization of dextran carbonates. *Carbohydrate Polymers* DOI: 10.1016/j.carbpol.2012.01.091

University of Nottingham (UK)

- J I Enrione, P C Díaz, S B. Matiacevich, S E Hill (2012) Mechanical and Structural Stability of an Extruded Starch-protein-polyol. *Food System. Journal of Food Research* 1 pp224-232
- S E Harding, F Almutairi, G G Adams, G Morris, C J Lawson, R J Gahler, S Wood (2012) Dilute Solution Viscometry Studies on a Therapeutic Mixture of Non-digestible Carbohydrates. *International Journal of Biotechnology for Wellness Industries* 1, pp107-114
- T Heinze, Y Wang, A Koschella, A Sullo, T J Foster (2012) Mixed 3-mono-O-alkyl cellulose: Synthesis, structure characterization and thermal properties. *Carbohydrate Polymers* 90, pp380-386
- H V Masey O'Neill, N Liu, J P Wang, A Diallo, S Hill (2012) Effect of Xylanase on Performance and Apparent Metabolisable Energy in Starter Broilers Fed Diets Containing One Maize Variety Harvested in Different Regions of China. *Asian-Aust. J. Anim. Sci.* 25, pp515-523
- I Tatárová, W MacNaughtan, A P Manian, B Široká, T Bechtold (2012) Steam Processing of Regenerated Cellulose Fabric in Concentrated LiCl/Urea Solutions *Macromolecular Mats & Eng* 297, pp540-549

Center for Materials Forming, Mines Paristech-CNRS (France)

- W Liu, T Budtova (2012) Ionic liquid: A powerful solvent for homogeneous starch cellulose mixing and making films with tuned morphology. *Polymer* 53, pp5779-5787
- V Collin, I Boudimbou, E Peuvrel-Disdier (2012) New insights in dispersion mechanisms of carbon black in a polymer matrix under shear by rheo-optics. *J. Appl. Polym. Sci.*, DOI: 10.1002/app.37769
- J. Bikard, T. Coupeze, G. Della Valle, B. Vergnes (2012) Simulation of bread making process using a direct 3D numerical method at microscale: analysis of baking step. *Int. J. Mat. Form.* 5, pp11-24
- WG Glasser, RH Atalla, J Blackwell, R Jr Brown, W Burchard, AD French, D.O Klemm, P Navard, Y Nishiyama (2012) Erratum to: about the structure of cellulose: debating the Lindman hypothesis. *Cellulose*, DOI 10.1007/s10570-012-9702-8
- E Privas, P Navard (2012) Preparation, processing and properties of lignosulfonate-flax composite boards. *Carbohydrate Polymers*, doi.org/10.1016/j.carbpol.2012.04.060
- K A Le, R Sescousse, T Budtova, T. Budtova (2012) Influence of water on cellulose-EMIMAc solution properties: a viscometric study. *Cellulose* 19, pp45-54



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University of Innsbruck (Austria)

- H E Emam, A P Manian, B Siroka, H Duelli, B Redl, A Pipal, T Bechtold (2012) Treatments to Impart Antimicrobial Activity to Clothing and Household Cellulosic-Textiles - Why «Nano»-silver?, *Journal of Cleaner Production*, DOI <http://dx.doi.org/10.1016/j.jclepro.2012.08.038>
- A Mahmud-Ali, C Fitz-Binder, T Bechtold (2012) Aluminium based dye lakes from plant extracts for textile coloration. *Dyes and Pigments* 94, pp533-540
- G Fauland, A Lenz, C Rohrer, T Bechtold (2012) Assessment of moisture management performance of multilayer compression bandages. *Textile Research Journal*, in press
- C Fitz-Binder, T Bechtold (2012) Ca²⁺ sorption on regenerated cellulose fibres, *Carbohydrate Polymers* 90/2, pp937-942
- H E Emam, A P Manian, B Siroka, T Bechtold (2012) Copper inclusion in cellulose using sodium D-gluconate complexes, *Carbohydrate Polymers*, DOI: 10.1016/j.carbol.2012.07.003 accepted

Wageningen university and research (the Netherlands)

- R ten Bos, J E G van Dam (2012) Sustainability, polysaccharide science and bioeconomy. *Carbohydrate Polym* (in press)
- E R P Keijsers, G Yilmas J E G van Dam (2012) Cellulose resource matrix. *Carbohydrate Polym* (in press).
- J Zhao, H A Schols, Z Chen, Z Jin, P Buwalda, H Gruppen (2012) Substituent distribution within cross-linked and hydroxypropylated sweet potato starch and potato starch. *Food Chemistry* 133(4), pp1333-1340
- M P Gool, K Toth, H A Schols, G Szakacs, H Gruppen (2012) Performance of hemicellulolytic enzymes in culture supernatants from a wide range of fungi on insoluble wheat straw and corn fiber fractions. *Bioresource Technology* 114, pp523-528
- S Kuhnel, L A M Pouvreau, M M Appeldoorn, S W A Hinz, H A Schols, H Gruppen (2012). The ferulic acid esterases of *Chrysosporium lucknowense* C1: Purification, characterization and their potential application in biorefinery. *Enzyme and Microbial Technology* 50(1), pp77-85
- M C Jonathan, J J G C v d Borne, P v Wiechen, C Souza da Silva, H A Schols, H Gruppen (2012) In vitro fermentation of twelve dietary fibers by faecal inoculum from pigs and humans. *Food Chemistry* 133(3), pp889-897

University of Utrecht (the Netherlands)

- J A Posada, A D Patel, A L Roes, K Blok, A P C Faaij, M K Patel (2012) Potential of bioethanol as a chemical building block for biorefineries: Preliminary sustainability assessment of 12 bioethanol-based products. *Bioresource Technology*. Article in Press
- B M K Manda, K Blok, M K Patel (2012) Innovations in papermaking: An LCA of printing and writing paper from conventional and high yield pulp. *Science of the Total Environment* 439, pp307-320
- A D Patel, K Meesters, H den Uil, E de Jong, K Blok, M K Patel (2012) Sustainability assessment of novel chemical processes at early stage: Application to biobased processes. *Energy Environ. Sci.* 5, pp8430-8444
- G-Q Chen, M K Patel (2012) Plastics Derived from Biological Sources: Present and Future: A Technical and Environmental Review. *Chemical Reviews (Chem. Rev.)* 112, pp2082-2099
- H L Bos, K P H Meesters, S G Conijn, W J Corré, M K Patel (2012) Accounting for the constrained availability of land: a comparison of bio-based ethanol, polyethylene, and PLA with regard to non-renewable energy use and land use. *Biofuels, Bioproducts & Biorefining* 6, pp146-158



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Abo Akademi (Finland)

- H Lindqvist, K Salminen, J Kataja-aha, E Retulainen, P Fardim, Sundberg A (2012) The effect of fibre properties, fines content and surfactant addition on dewatering, wet and dry web properties, *Nordic Pulp Pap. Res. J.* 27:1, pp104-111
- V Kisonen, P Eklund, M. Auer, R Sjöholm, A Pranovich, J Hemming, A Sundberg, V Aseyev, S Willför (2012) Hydrophobication and characterization of O-acetyl galactoglucomannan for papermaking and barrier applications, *Carbohydr. Res.*352, pp151-158
- A Strand, A., D Zasadowski, D., M Norgren, M., E Hedenström, S Willför, A Sundberg, (2012) Selective froth flotation of pitch components from spruce TMP process water. *Appita* 65-4, pp337-346
- K Parikka, A-S Leppänen, C Xu, L Pitkänen, P Eronen, M Österberg, H Brumer, S Willför, S., M Tenkanen (2012) Functional and anionic cellulose-interacting polymers by selective chemo-enzymatic carboxylation of galactose-containing polysaccharides. *Biomacromolecules* 13 (2012) 8, 2418-2428 (American Chemical Society, ISSN: 1525-7797)
- B T Kusema, T Tönnov, P Mäki-Arvela, T Salmi, S Willför, B Holmbom, D Yu Murzin (2012) Acid hydrolysis of O-acetyl-galactoglucomannan. *Catalysis Science & Technology* DOI: 10.1039/c2cy20314f

Institute of Biopolymers and Chemical Fibres-Lodz (Poland)

- L Pighinelli, M Kucharska, M Wśniewska-Wrona, B Gruchała, K Brzoza-Malczewska (2012) Biodegradation Study of Microcrystalline Chitosan and Microcrystalline Chitosan/ β -TCP Complex Composites. *International Journal of Molecular Sciences*, 13 (6)
- L Pighinelli, M Kucharska. (2012) Chitosan-hydroxyapatite composites. *Carbohydrate polymers*, in press

University of Maribor

- R Kargl, T Mohan, S Köstler, S Spirk, A Doliska, K Stana-Kleinschek, V Ribitsch (2012) Functional patterning of biopolymer thin films using enzymes and lithographic methods. *Advanced Functional Materials* DOI: 10.1002/adfm.201200607.
- M R Kulterer, V Reichel, R Kargl, S Köstler, V Sarbova, T Heinze, K Stana-Kleinschek, V Ribitsch (2012) Functional polysaccharide composite nanoparticles from cellulose acetate and potential applications. *Advanced Functional Materials* 22, pp1749-1758
- T Mohan, S Sperk, R Kargl, A Doliska, A Vesel, A Salzmann, R Resel, V Ribitsch, K Stana-Kleinschek (2012) Exploring the rearrangement of amorphous cellulose model thin films upon heat treatment. *Soft Matter* 8, pp9807-9815
- T Mohan, R Kargl, S Köstler, A Doliska, G Findenig, V Ribitsch, K Stana-Kleinschek (2012) Functional polysaccharide conjugates for the preparation of microarrays. *ACS Appl. Mat. Interfaces* 4, pp2743-2751
- R Kargl, T Mohan, M Bracic, M R Kulterer, A Doliska, K Stana-Kleinschek, V Ribitsch (2012) Adsorption of carboxymethyl cellulose on polymer surfaces : evidence of a specific interaction with cellulose. *Langmuir* 28, pp11440-11447