



European Polysaccharide  
Network Of Excellence

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## **“Nature produces polysaccharides, EPNOE turns them into materials”**

### editorial

**T**he business world is entering a difficult period: financial crisis, business difficulties, fear of job losses, restrictions and turbulent times with no clear vision of how to deal with the situation. On the academic side, students are more anxious about their future and some budgets are being frozen. On the industry side companies are fighting for survival and scrutinising all unnecessary spending often with the consequence that all but essential travel is cancelled.

**It is in these difficult times that networking becomes even more valuable.** It allows us to optimize resources by interacting with the appropriate partners and relying more than ever on the expertise of the other members.

As an example, a few weeks ago, one of our Business and Industry Club (BIC) members asked us to prepare a proposal to meet a European Commission call only ten days before the deadline. Despite this very short notice three of our EPNOE partners were able to build a convincing consortium consisting of two large companies and 12 SME's from nine different countries. They invented the scientific paths able to answer the needs of our BIC company and wrote the scientific part of the proposal which was successfully submitted.

The strength of EPNOE was shown in the ability to build the scientific programme owing to its expertise, and to prepare the environmental and technological assessment thanks to its large data bank. One of the EPNOE academic partners was even kind enough to write a short text despite the fact that he was not participating in the project. This further shows the commitment of the EPNOE partners and the value of networking.

Many governments plan to invest heavily in activities that contribute to long term sustainability. The networking potential of EPNOE is ideally placed to support Business and Industry Club (BIC) members in taking advantage of these new opportunities.



**Dr. Patrick Navard**  
Coordinator of EPNOE  
Centre for Material Forming  
Ecole des Mines de Paris / CNRS  
(France)

### news

#### Members' info



#### **1st International Conference on Bamboo Fibre Application**

EPNOE scientists gave plenary and keynote lectures covering the state of the art expertise on cellulose science and technology applicable to bamboo fibre utilisation such as:

- Bamboo fibre extraction methods
- Dissolving and regenerated cellulose production
- Waste management disposables and Chemical recovery LCA
- Bamboo pulp and paper production and quality
- Textile fibre from bamboo
- Bamboo fibre composites, Bamboo biorefinery.

The conference was organized in Quanzhou, Fujian (China) on March 23-26, 2009 by the Sino-Europe Technology Promotion Center (SETPC) and Wageningen University and Research centre (WUR), in The Netherlands, and co-organized by the International Network for Bamboo and Rattan (INBAR) and supported by EPNOE.

Several companies belonging to the Business and Industry Club (BIC) accompanied EPNOE scientists.

#### **Virtual Institute for Bamboo fibre Expertise and Research (VIBER)**

was created during the conference. Two EPNOE scientists, Jan van Dam and Patrick Navard, were appointed as two of the 5 members of the Advisory Board.

#### **1st Biopolymer Colloquium**

Hosted by the Fraunhofer Institute for Applied Polymer Research (IAP) in Potsdam-Golm (Germany), it was held on the occasion of the 60th birthday of the Institute's Director Dr. habil. Hans-Peter Fink on January 20, 2009. Prominent speakers discussed the topics:

- Biopolymers in the focus of industrial research (Dr. Arnold Schneller, BASF)
- New challenges in pulp and cellulose research (Prof. Dr. Herbert Sixta, Technical University, Helsinki)
- Biocomposites and Cellulose (Dr. Johannes Ganster, Fraunhofer IAP)
- Polylactic acid – actual developments and potentials (Bernd Merzenich, Pyramid Bioplastics)



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"Nature produces polysaccharides, EPNOE turns them into materials"



## news

### ► Members' info

#### **New staff:**

University of Innsbruck (Austria)  
Dr Ivana Tatarova joined the group of Prof. Bechtold in the frame of the ITN- STEP (Integrated Training Network- Shaping and Transformation in the Engineering of Polysaccharides) funded by the EU.

#### **New PhD students:**

University of Innsbruck (Austria)  
MSc. Hai Manh Vu joined the group of Prof. Bechtold in the frame of the ÖAD (Österreichisches Austauschdienst); Topic: Chemical and physical processing of natural and regenerated cellulose fibres for modification of material properties.

University of Jena (Germany)  
Melanie Nikolajski, Artificial nanostructures for biofunctionalization of material surface

#### **New diploma students:**

University of Jena (Germany):  
- Marc Kostag, Modification of cellulose in novel solvents  
- Velina Sarbova, Block copolymers of cellulose ethers; joint research projects with Prof. Hiroshi Kamitakahara, Kyoto University  
- Friedrich Scholz, Reactive film-forming polysaccharide derivatives

University of Innsbruck (Austria):  
- Hale Bahar Öztürk, Regenerated cellulosic fibers - Effects of alkali treatment on structure, chemical reactivity and fiber properties

#### **New Post-Doc:**

University of Innsbruck (Austria)  
Dr Haisong Qi, Urea/water/NaOH in cellulose research

#### **Retirement:**

Bjarne Holmbom, Professor of the Laboratory of Wood and Paper Chemistry at Åbo Akademi University (Finland) retired at the end of 2008 after having been a professor for 28 years. His lifelong work has recently been acknowledged with the Finnish Scientific Award in 2005 and the Marucs Wallenberg price, together with Christer Eckerman in 2008. Emeritus Professor Bjarne Holmbom will continue doing research and can be contacted as before. Dr. Stefan Willför has now been appointed to professor and head of the laboratory.

#### **Sustainable Bioenergy Centre:**

The University of Nottingham will play an important role in the 30M euro Sustainable Bioenergy Centre launched by the BBSRC on 27 January. Professor Katherine Smart from Nottingham University's Division of Food Sciences leads the research programme on lignocellulosic conversion to bioethanol. Further details see: <http://www.bsbec.bbsrc.ac/uk>

#### **Christian-Doppler Association:**

The special 'CD-Lab for chemistry of cellulosic fibers and textiles' funded by the Austrian Christian-Doppler Association and established in Dornbirn, Austria (Thomas Bechtold) is finishing. The 7th year meeting was held in the location of the Lenzing AG company on 4-5 December 2008.

### ► Forthcoming articles



Ethylation of arabinoxylan from *Ispaghula* (*Plantago ovata*) seed husk; *S. Saghir, M. Saeed Iqbal, A. Koschella, Th. Heinze* - Carbohydrate Polymers

Studies of the molecular flexibility of novel dendronized carboxymethyl cellulose derivatives ; *M. Pohl, G.A. Morris, S.E. Harding, Th. Heinze* - European Polymer Journal

Evidence for unconventional boronate structures at trans-diol moieties of carbohydrates ; *M. Meiland, Th. Heinze, W. Günther, T. Liebert* - Tetrahedron Letters 50

Xylan and xylan derivatives – basis of functional polymers for the future, Book chapter ; *Th. Heinze, S. Daus* - Natural Polymeric Biomaterials, Reza Arshady (Ed.), Kentus Books, London, UK

Possibilities for the physical modification of cellulose shapes using ionic liquids; *F. Wendler, B. Kosan, M. Krieg, F. Meister* - Macromolecular Symposia

Cellulose multicomponent fibers from ionic liquids; *B. Kosan, A. Nechwatal, F. Meister* - Chemical Fibers International

Biofunctional Surfaces based on Dendronized Cellulose; *M. Pohl, N. Michaelis, F. Meister, Th. Heinze* - Biomacromolecules

Keratin-chitosan composites; *K. Wrzesniewska-Tosik, D. Wawro, M. Kucharska* - Fibres & Textiles in Eastern Europe.

Partially resorbable surgical meshes - biological and medical studies; *A. Niekraszewicz, M. Kucharska, K. Struszczyk, M. Struszczyk, M. Wisniewska-Wrona* - Fibres & Textiles in Eastern Europe

**Contribution of EPNOE members to a special issue of Macromolecular Symposia: see list of articles on page 3.**



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## EPNOE activities

### 1st EPNOE Conference: Polysaccharides as a Source of Advanced Materials

September 21-24, 2009 Turku/Åbo, Finland

**W**e warmly welcome researchers, scientists and professionals from industry together with representatives from universities with an interest in polysaccharides to Turku, Finland for the first international conference organized by The European Polysaccharide Network of Excellence (EPNOE).

Many distinguished international scientists have been invited to give plenary and keynote lectures alongside invited speakers from the field of polysaccharide chemistry and technology.

A feature of the conference will be to develop strong links between academic and institutional research scientists and industry and we are particularly keen to involve young people in what will be an exciting scientific area in the future.

Detailed information about both the scientific and social programs are available on the website ([www.congress.utu.fi/epnoe2009](http://www.congress.utu.fi/epnoe2009))

Topics of parallel sessions:

- 1 Functional versatility in industrial applications
  - S1 PS in forest biorefinery
  - S3 PS in paper and packaging
  - S5 PS in pharmaceutical and medical applications
  - S7 Biodegradable PS-synthetic polymer blends
  - S9 PS in food and cosmetic applications
  - S11 PS in nano-objects for industrial applications

- 2 New frontiers in PS research
  - S2 Biosynthesis, biomimetics and biotransformation
  - S4 New sources of PS and their functionality
  - S6 New applications for PS and their derivatives
  - S8 New methods for PS modification
  - S10 Biofuels and bioenergy based on PS
  - S12 New analytical methods for PS research

An intensive course for students and researchers will be offered by EPNOE members on September 20, 2009. The topic of the course is «Advanced Methods in Polysaccharide Research». You can register for this course when you register for the conference.

**Early registration:** deadline June 30, 2009

**Symposium venue:** University of Turku, ICT building

**Conference website:**

<http://congress.utu.fi/epnoe2009/>

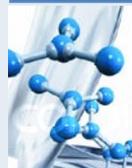
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We are looking forward to seeing you in Turku in September!

Prof. Pedro Fardim, Åbo Akademi University, Finland  
Chairperson of the organizing committee

#### ▶ Forthcoming articles



**Special issue on Macromolecular Symposia, with the following contributions from EPNOE members:**

Hot Topics in Polysaccharide Chemistry - Selected Examples; *T. Heinze*

Unconventional Cellulose Products through Nucleophilic Displacement Reactions; *K. Petzold-Welcke, N. Michaelis, T. Heinze*

Novel Cellulose Ether 3-Mono-O-(3'-hydroxypropyl) Cellulose: Synthesis and Structure Characterization; *K. Schumann, T. Heinze*

Regioselectively Oxidized Cellulose Ethers; *X. Yin, A. Koschella, T. Heinze*

Unconventional Reactivity of Cellulose Dissolved in Ionic Liquids; *M. Schöbitz, F. Meister, T. Heinze*

Possibilities for the Physical Modification of Cellulose Shapes Using Ionic Liquids; *F. Wendler, B. Kosan, M. Krieg, F. Meister*

Bio-based Nanocomposites of Cellulose Acetate and Nano-Clay with Superior Mechanical Properties; *M. Hassan-Nejad, J. Ganster, A. Bohn, M. Pinnow, B. Volkert*



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## Zoom on EPNOE Partners' research

### Cyclic oligosaccharides and supramolecular chemistry

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**P**olysaccharides are by far one of the most representative classes of polymers whose properties are controlled to a high extent by interchain noncovalent interactions.

The chemical nature of the identical or different structural units, their relative position and bonding in the macromolecular chain, the molecular weight and the processing conditions also influence the characteristics of polysaccharide based materials.

Another key factor is represented by the molecular shape – linear, cyclic, branched. The successful separation of lower cyclic homologues, namely cyclodextrins (CDs), promoted developments based on host-guest interactions between the relatively inner, hydrophobic cavity of CD molecules and guest compounds such as organic/inorganic compounds or polymers, resulting in rotaxane-type supramolecular assemblies of different structures (Figure 1).

The main purpose of this approach is to modify the properties (solubility, volatility, processing properties, etc.) of the included compounds. Rotaxane assemblies are of academic and technological interests as model compounds in mimicking the processes developed by living entities or in biomedical (drug delivery) and technical applications, including nanotechnologies (sensors, molecular wires, nanoreactors).

#### Cyclodextrin-polymer rotaxanes

Siloxane oligomers - well known hydrophobic materials, oily fluids at room temperature - were transformed in solid materials with interesting microstructure (Figure 2) through their complexation with CDs.



Figure 2: SEM image of polydimethylsiloxane/γ-CD polyrotaxane

The processing properties (film forming ability either from solution or from solid state) and the optoelectronic properties (Figure 3) of conjugated polymers appropriate as components in molecular electronics or electrochemical light emitting cells, such as polyfluorenes and polyazomethines, were improved by encapsulating their macromolecular chains into CD molecules.

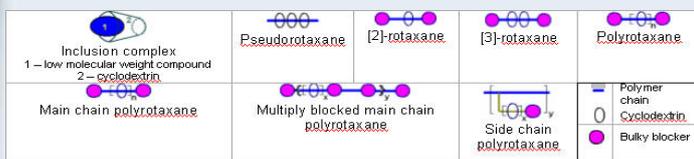


Figure 1: Rotaxane structures

#### Cyclodextrin-drug conjugates

The most common application of CDs in the pharmaceutical industry derives from their ability to form inclusion complexes with different drugs. The solubility, the dissolution rate and the bioavailability of poorly water soluble drugs are strongly enhanced. The complexation of antifungal drugs, such as sulconazole nitrate and of 5-flucytosine, as well as of C60 bioactive compound with different native and modified CDs allowed the investigation of the solution and solid state properties of the resulted inclusion compounds. Bioactive conjugates with 10-50 times higher water solubilities as compared to the non complexed drugs were prepared by this approach.

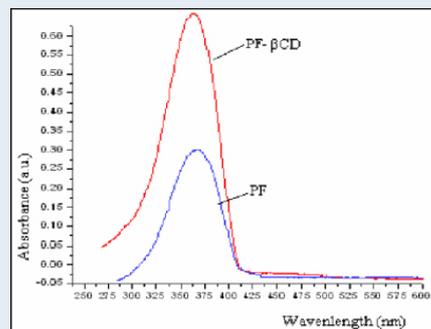


Figure 3: UV-vis spectra of polyfluorene/CD rotaxane (PF-βCD) and of the non complexed polymer (PF)

Dr. Valeria Harabagiu, "Petru Poni" Institute of Macromolecular Chemistry, Iasi (Romania).