N°5 - DECEMBER 2007

European Polysaccharide Network Of Excellence



# *"Nature produces polysaccharides, EPNOE turns them into materials"*

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## editorial

The EPNOE Association was formed in Paris on December 14, 2007. This non-profit organisation will be the permanent structure of the EPNOE network. It will serve as the platform for management, communication and general collaboration with industry.

The management activity of EPNOE Association will be targeted towards two main objectives:

- to boost common research between EPNOE Members
- to organise education by promoting academic courses and degrees on polysaccharides and by organising web-based lectures.

The communication part will be composed of all the actions needed to promote the field of polysaccharides as well as the research and education excellence of EPNOE Members.

EPNOE Association will also be the place where EPNOE Members will collectively approach industry offering services to the members of the Business and Industry Club. The first meeting of this club, open to all companies, will be held in Paris on February 8, 2008.

After having participated extensively in the Europe-Japan meeting in Kyoto in October 2007, EPNOE Members are playing a major role in organising further international meetings on polysaccharides. The next one will be a joint EPNOE-American Chemical Society symposium which will share ideas from European and US researchers on future directions for the development of polysaccharide based materials. This will be held during the next American Chemical Society meeting in New Orleans (April 5-8, 2008).

Two more meetings of this kind are planned in 2009; a Europe-Asia symposium on polysaccharide materials and processing in India during the annual Polymer Processing Society meeting and a further Europe-Japan meeting on Cellulose which will be held in Hamburg.

On behalf of all EPNOE Members, I wish you a very fruitful and happy 2008 year.

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

## news

### Conferences

**1st EPNOE Business and Industry Club meeting**

- Date: 8 February 2008
- Place: Paris (France)
- Information: www.epnoe.eu

EPNOE organises a free meeting dedicated to the companies working or planning to work in the polysaccharide field. (More information on page 2)

**3rd APT_pack (Advanced knowledge of Polymer deformation for Tomorrow's Packaging) workshop for industry**

- Date: 10 March 2008
- Place: Paris (France)
- Information: www.apt-pack.com

APT_pack is an European project dealing at a knowledge based strategy for the design of polymer packaging using thermoforming and injection stretch blow moulding.

**Joint ACS CELL-EPNOE Open Workshop**

- Date: 9 April 2008
- Place: New Orleans (USA)
- Information: annika.h.holmbom@abo.fi

The objective of this half-a-day workshop is to give an overview of the research challenges facing US and EU in the area polysaccharides as a source of new materials.

### Members' info

**New PhD Students:**

Institute of Macromolecular Chemistry, Iasi (Romania)

Gabriela Nistor, in collaboration with the Institute Of Chemistry, Physical Chemistry, University of raz, Austria). Topic of the thesis: New oxidative systems for the chemical modifications of various polysaccharides.

University of Jena (Austria)

New PhD student Carlos Castro «Synthesis and characterization of nano- and microgels from cellulose ethers and polyacrylates» in the University of Jena.

University of Innsbruck (Austria)

Dr. Rita Mussak finished her PhD studies and is currently working on Industrial Uses of Natural Dyes and cellulosic substrates in a cooperation project with Tunisia.

Jan Siroky, 6-month student exchange program with Leeds University and CD-Lab Dornbirn with the topic "Cellulose Fibre Modification"



# 1st EPNOE Business and Industry Club meeting

## Friday 8 February 2008 - Paris

**Programme of the Meeting**

09:00 - 09:20 Coffee-registration
09:20 - 09:40 Welcome - presentation of EPNOE (P. Navard)
09:40 - 09:50 EPNOE Research (K. Stana-Kleinschek)
09:50 - 10:05 EPNOE Education (P. Fardim)
10:05 - 10:45 Scientific poster session: EPNOE research - Coffee
10:45 - 12:05 Oral scientific presentations:
- 10:45 - 11:05 Towards a complete characterisation of dissolving pulps (J. Puls)
- 11:05 - 11:25 New challenges around polysaccharide chemistry (T. Heinze)
- 11:25 - 11:45 EPNOE, a catalyst for innovation across the polysaccharide world (J. Mitchell)
- 11:45 - 12:05 Opportunities and challenges of polysaccharides in the biomedical field (D. Ciechanska)

12:05 - 12:35 EPNOE Business and Industry Club – BIC (P. Navard)
12:35 - 13:40 Lunch
13:40 - 14:00 Marketing studies / exotic polysaccharides (J. van Dam)
14:00 - 14:15 European Bioplastics – vision 2020 (H. Käb)
14:15 - 14:25 EPNOE Toolbox (V. Ribitsch)
14:25 - 15:25 Business and Industry Club activities poster session -Coffee
15:25 - 15:45 General discussion
15:45 End of the meeting

**Location and Registration**

The 1st EPNOE Business and Industry Club meeting will take place in «Ecole des Mines de Paris» 60-62, boulevard Saint Michel - Paris (6ème) - close to the «Jardin du Luxembourg».
Registration to the 1st EPNOE Business and Industry Club meeting is free of charge (next meetings will be exclusively open to Business and Industry Club Members). Please visit the EPNOE web site www.epnoe.eu and complete the registration form.
Upon receipt of your registration we will send you more information about hotels and transportations.

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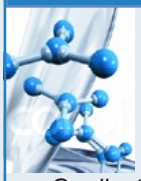
# news

## Forthcoming Articles



The dissolution of microcrystalline cellulose in sodium hydroxide-urea aqueous solutions, *M. Egal, T. Budtova et P. Navard* - Cellulose

Gradient in dissolution capacity of successively deposited cell wall layers in cotton fibres, *N. Le Moigne, E. Montes, C. Pannetier, H. Hofte et P. Navard* - Macromolecular Symp.

Selectively Dendronized Cellulose: Synthesis and Characterization; *M. Pohl, J. Schaller, F. Meister, Th. Heinze* - Macromolecular Rapid Communications

Interactions of Ionic Liquids with Polysaccharides - 1: Unexpected acetylation of cellulose with 1-ethyl-3-methylimidazolium acetate; *S. Köhler, T. Liebert, M. Schöbitz, J. Schaller, F. Meister, W. Günther, Th. Heinze*; Macromolecular Rapid Communications

Study of the surface properties of some polyolefin/lignocellulosic materials composites treated by plasma, *G. Constantinescu, M.totolin, A. cojocariu, V. I. Popa, C. Vasile* - Cellulose Chemistry and Technology

Inclusion complexes of sulconazole with beta-cyclodextrin and hydroxypropyl beta-cyclodextrin: characterization in aqueous solution and in solution state; *M. Spulber, M. Pinteala, V. Harabagiu, P. Guegan, B. C. Simionescu* - Journal of Inclusion Phenomena and Macrocyclic Chemistry

Polydimethylsiloxane-modified chitosan I. Synthesis and structural characterisation of graft and crosslinked copolymers; *D. Enescu, V. Hamciuc, L. Pricop, T. Hamaide, V. Harabagiu, B. C. Simionescu*; Cellulose Chemistry and Technology

Polyrotaxanes composed of cyclodextrin and polydimethylsiloxanes: synthesis, morphology and thermal behavior; *N. Marangoci, A. Farcas, M. Pinteala, V. Harabagiu, B. C. Simionescu, T. Sukhanova, S. Bronnikov, A. Grigoryev, G. Gubanova, M. Perminova, A. Perichaud* - High Performance Polymers

Effect of water content on thermal and dynamic mechanical properties of xanthan powder: a comparison between standard and novel techniques; *I. E. Raschip, I. Yakimets, C. P. Martin, S.S. Paes, C. Vasile, J. R. Mitchell* - Powder Technology



# Description of EPNOE research

## Fundamental Theme 4: Polysaccharide – polysaccharide assemblies, development of polysaccharide re – assemblies

Polysaccharides are very closely mixed in nature to bring strength, softness and resistance to microbes or fungi to plants and animals. The aim of this Fundamental Theme, part of the EPNOE research road map, is to perform the same types of polysaccharide - polysaccharide assemblies in order to prepare new materials.

The first part of this on-going research work was to select 15 different polysaccharides (see figure 1), and to organise a joint work programme between four EPNOE partners (the Institute of Biopolymers and Chemical fibres in Poland, the University of Jena in Germany, TITK in Germany and Cemef in France).

The strategy is to investigate their simultaneous dissolution, gelling or aggregation behavior in N-methylmorpholine-N-oxide, NaOH and ethylmethylimidazolium acetate – an ionic liquid. So far carrageenan, cellulose carbamate, carboxymethylcellulose and cationic starch show suitable solution properties in NaOH as well as xanthan, locust bean gum, xylan, guar gum and gum tragacanth in EMIMac, respectively. Consequently, these polysaccharides were first used for spinning blend fibers. Although the spinning of such new fibers needs very intensive optimizing, shaped bodies with acceptable characteristics were obtained. The next step includes fiber testing by EPNOE partners from Austria, Slovenia and Germany employing methods such AFM analysis, tensiometry, SEM, WAXS, NMR as well as electro-kinetic measurements. Swelling and dissolution behavior, abrasion resistance, strength and dyeability will reveal fundamental information about physical properties.

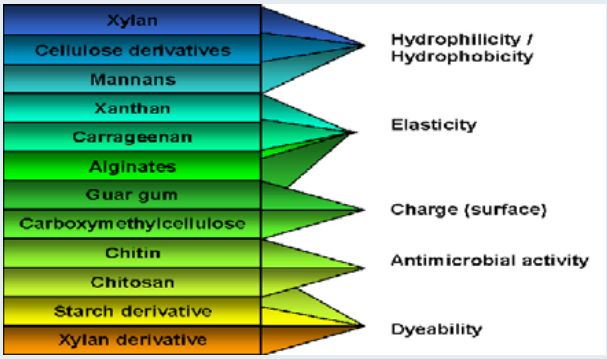



Figure 1. Desired effects of secondary polysaccharides.

References:

Degradation processes in the cellulose/N-methylmorpholine-N-oxide system studied by HPLC and ESR. Radical formation/recombination kinetics under UV photolysis at 77 K. Konkin A., Wendler F., Meister F., Roth H.-K., Aganov A., Ambacher O. 2007. Cellulose 14/5: 457-468.

N-Methylmorpholine-N-oxide ring cleavage registration by ESR under heating conditions of the Lyocell process. Konkin A., Wendler F., Meister F., Roth H.-K., Aganov A., Ambacher O. 2007. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy. In press.

Thermal stability of Lyocell solutions: Experimental and Modeling using Cluster analysis and Partial Least Squares Regression. Wendler F., Kolbe A., Kraft J., Einax J.W., Heinze T. 2007. Macromol. Theory Simul. In press.

Preparation and Thermoplastic Processing of Modified Plant Proteins. Bräuer S., Meister F., Gottlöber R.-P., Nechwatal A. 2007. Macromolecular Materials and Engineering 292/2: 176-183.

Dissolution and forming of cellulose with ionic liquids. Kosan B., Michels C., Meister F. 2007. Cellulose. In press.

Frank Wendler
Fundamental Theme 4 leader
Thuringian Institute of Textile and Plastics research - Division of Native Polymers and Chemistry (Germany)

# Zoom on EPNOE Partners' research

## Modified bacterial cellulose: a modern and versatile material

Some kinds of bacteria from the genus Acetobacter are known for their ability to produce cellulose extracellularly. From the chemical point of view, bacterial cellulose is identical to that of plant origin and differs from the latter only in its supermolecular structure

Properties of bacterial cellulose can be modified directly at the biosynthesis step, by addition of some modifiers into the culture medium (Fig.1). A method of bacterial cellulose modification using aminosaccharides and oligo-aminosaccharides has been developed at the Institute of Biopolymers and Chemical Fibres, Lodz, Poland [1]. This novel biomaterial is characterised by many unique features, such as bacteriostatic activity against Staphylococcus aureus and Escherichia coli as well as bactericidal activity against Escherichia coli, biocompatibility, high water retention, biodegradability and non-allergenity, which make it the ideal material for wound dressings.

Tests of wound dressings based on modified bacterial cellulose, showed good stimulation of factors accelerating the healing process, good conformability to the wound site and good protection against secondary infection.

Recently the Institute of Biopolymers and Chemical Fibres carried out extensive research on biosynthesis of modified bacterial cellulose in tubular form, which can be applied in medicine as vascular grafts (Fig.2) as well as on partially resorbable synthetic fibre/modified bacterial cellulose surgical meshes intended for hernia treatment (Fig.3).

Another interesting application of modified bacterial cellulose is in loudspeaker membranes [2,3]. Modified bacterial cellulose is characterized by high sonic velocity and high internal loss, which makes it much better suited material for clearer and more detailed sound reproduction than conventional electroacoustic transducers (Fig.4). Bacterial cellulose has a future that our institute is exploring intensively.

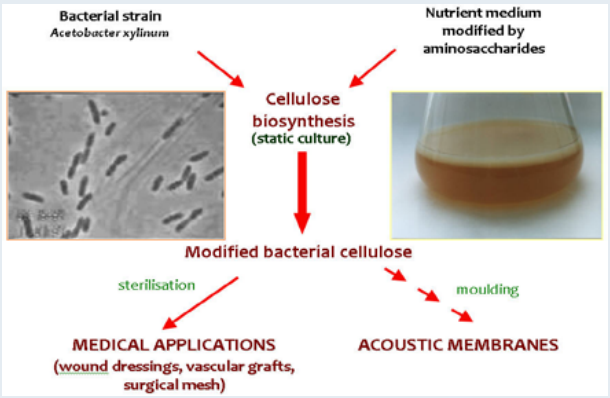



Figure 1. Preparation scheme for medical articles and acoustic membranes based on modified bacterial cellulose.

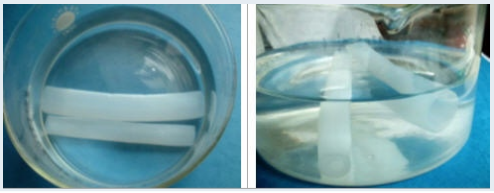


Figure 2. Modified bacterial cellulose in tubular form.

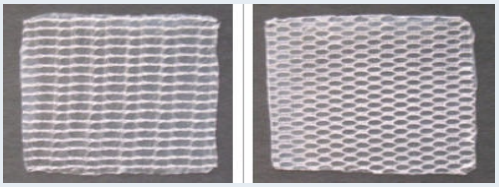


Figure 3. Composite synthetic fibre/modified bacterial cellulose surgical meshes for hernia treatment.

Figure 4. Dome loudspeakers (in the middle) equipped with membranes based on modified bacterial cellulose

References:
1. Polish patent PL 190961 "Method of obtaining modified bacterial cellulose"
2. Polish patent application P-342956 (2000) "Electro-acoustic transducer membrane"
3. Polish patent application P-342957 (2000) "Dome-type loudspeaker"

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