July 2021 **EPNOE Newsletter**

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Editorial

Dear Readers,

Summertime is here in Europe and we deserve a break to recover of a tsunami of online activities. It is a moment to enjoy time with people we love most and get lazy moments that will inspire us to be creative later. We have many activities lined up for the second semester of this year such as the EPNOE webinar in September, the EPNOE2021 conference in October in Nantes and much more. The EPNOE member area is active and running now and we are able to offer numerous opportunities to engage our members in project applications, organization of workshops, collaboration with other societies and networking with the best experts in the field. EPNOE members are spread in 17 countries and we offer unique opportunities to meet and exchange ideas in a trustful environment. We have a membership campaign ongoing and now it is definitely the time for you to become an EPNOE member with the advantage of discounted membership fees and discounted fees in our events and other unique benefits for your company, university or research institution.

Enjoy your summer break. We are looking forward to seeing you in EPNOE.

Pedro Fardim
President of EPNOE

Find us on

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News & Announcements

EPNOE CONFERENCE 2021

Make sure to register before July 30th for the major EPNOE event this year: the **7th International Polysaccharide Conference**, in Nantes, France, 11-15 October 2021 and take advantage of the Early Brid rate, .

We have an exciting programe set up for you, and **we are still welcoming submission of poster abstracts till the end of August.**

Don't miss the opportunity to join the EPNOE community in Nantes!

Register here To go to the Event Website

Thank You to the sponsors of the 7th International Polysaccharide Conference

ELSEVIER

Carbohydrate Polymers and Carbohydrate Polymer Technologies & Applications

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FLOWER Flax composites, LOW weight, End of life and Recycling

For more information concerning this campaign, email: **contact@epnoe.eu**

EPNOE Talks

In this edition we have the pleasure to talk with Prof. Emeritus Bjarne Holmbom from Abo Akademi University in Finland. Prof. Holmbom is highly recognised expert in the field of Wood Chemistry and winner of Finnish Science Award and Marcus Wallenberg Prize. In this talk Prof. Holmbom speaks about opportunities to exploit

wood as a whole in a new era of biobased materials with emphasis on health applications of hemicelluloses and extractives.

Eseia - EPNOE workshop - June 29th

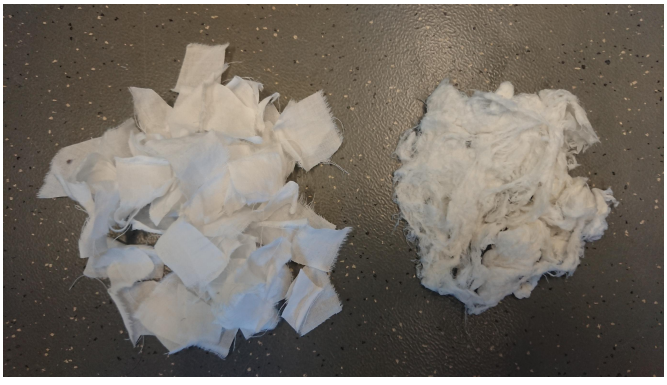
Eseia and EPNOE joined forces and had a very productive workshop in June. Members from both associations joined the online event.

Both organisations introduced themselves with different presentations and in the afternoon we had breakout sessions to allow discussions and brain storming. The conclusions reached in these breakouts were then shared with the group.

We look forward to working with the eseia team in the future!

Members will find the material from this event in the EPNOE member area.

We are happy to welcome Sharetex as a new EPNOE member!



New company finds a circular solution to textile waste

ShareTex has developed a new technology to recycle cellulose-based waste textiles. Our process is based on a decrystallization step that transforms cellulose-based waste textiles into a pure cellulose dissolving pulp. As opposed to other technologies, our process allows to recycle cellulose-based textiles several times and offers the possibility to recycle not only cotton, but also other fibers such as viscose.
https://sharetex.com/

For more information click here

EPNOE Webinar Series – September 2nd, 13:00 to 14:30
Theme topic: Biomedical Applications

Plenary lecture by **Prof. João Mano**, CICECO - University of Aveiro
Blue polysaccharides in tissue engineering

Research presentation by **João Carvalho**, CICECO - University of Aveiro
Polysaccharide based bio-inks for 3D-bioprinting applications

The webinars are free and available to all, but registration is necessary

Register here

Lenzing
Innovative by nature

Lenzing and Södra join forces for post-consumer textile recycling

SÖDRA

Millions of tons of textile waste are created every year; most of it ends up in landfills. In the spirit of the circular economy transition, both Lenzing, a leading global supplier of wood-based specialty fibers, and Södra, a world-class producer of pulp, have independently addressed the issue and developed appropriate solution options so far. Both companies are experts in their respective fields with many years of large-scale industrial experience. Now they signed a cooperation agreement with the clear objective of making a decisive contribution to addressing the enormous textile waste. Together, they give textile recycling a huge boost by developing technologies further towards a broader, industrial-scale use of post-consumer cellulosic waste.

More information

New research profile will enable new markets for fibre products

A new research profile, NeoPulp, will help the forest industry to broaden the use of fibre-based materials with resource-efficient processes. In total, the participating parties are investing EUR 11.5 million over eight years.

Resource-efficient manufacturing processes and biomaterials from the forest are a priority research area at Mid Sweden University, where the FSCN research centre collaborates with the forest industry and other related industries.

Mid Sweden University is now taking a new step to deepen its understanding of industry's processes in an ambitious research profile. Partner companies include ABB, Holmen, IPCO, More Research, Rottneros, Stora Enso and Valmet.

NeoPulp will support the industry to broaden the usability of fibre-based materials, reduce the production footprint and attract R&D staff to the industry, which are required for the industry to contribute to the bioeconomy and replacement of fossil based raw materials, says Birgitta Engberg, associate professor at Mid Sweden University and one of the active researchers in NeoPulp.

The research group within NeoPulp, from top left: Birgitta Engberg, Kaarlo Niskanen, Amanda Mattsson, Per Engstrand, Olof Ferritsius. From bottom left: Johan Persson, Gunilla Pettersson, Armando Cordova, Juha Fiskari, Magnus Norgren. Photo: Mid Sweden University.

Read more

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Projects

University of Jena, Germany - FunPolyGel - Preparation of Functional Polysaccharide Gels using Selective Synthesis Methods

Grant number:FKZ 2220NR252X
Funding agency:Fachagentur Nachwachsende Rohstoffe e. V.
start date:July 1st 2021; end date:June 31th, 2024

Within the project, innovative hydrogels and aerogels will be developed from polysaccharides that are of great importance in the German agriculture-, forestry-, and food sector (starch, cellulose, hemicelluloses). This will provide a valuable contribution to a sustainable valorization of renewable resources. Goal of the project is to develop novel modular methods for the preparation of polysaccharide based hydrogels and aerogels that will enable tailoring of the material properties and application potential.

Novel polysaccharide derivatives with “complementary” reactive groups will be prepared using modular synthesis concepts. These groups can be converted with great efficiency, under mild reaction conditions (e.g., in water), and strictly chemoselective (i.e., exclusively with the corresponding “complementary counterpart”). The modular concept will be used to crosslink polysaccharides into defined 3D-networks and likewise to introduce functionalities that are of importance for the desired applications.
Hydrogels will be obtained by selective crosslinking of reactive polysaccharide derivatives in water. They will be employed for specific applications or converted into aerogels using suitable drying techniques. The modular synthesis concept provides many possibilities to tune the material properties. Comprehensive structure property relationships will be established as basis for a rational material design. Thus, hydrogels and aerogels can be tailored for specific applications in biomedicine, environmental technologies, and agriculture. Fundamental aspects such as loading / release of active substances, selective absorption of pollutants, storage of water / nutrients, and biological properties (biocompatibility, biodegradability) will be studied

University of Jena, Germany - Collaborative research Center 1278 - Multifunctional nanoparticles based on polysaccharides for targeted drug delivery with two-step release behavior

Grant number: SFB 1278/2
Funding agency: German Science Foundation
start date:July 1st 2021; end date:June 30th, 2025

The overall goal of this project is to develop safe, polysaccharide-based and drug-loaded nanoparticles (NPs) with tissue-specificity that are suitable for clinical translation in inflammatory diseases. Recent results indicate that acetylation of proteins significantly affects the regulation of the immune system and cellular stress responses. Therefore, histone deacetylase inhibitors (HDACi) represent promising molecules to prevent or modulate inflammation- or infection-associated organ dysfunction. However, direct administration of HDACi is connected with low tissue-specifity as well as side effects. Polysaccharide-based expedient drug carriers have been studied in previous investigations. Importantly, a flexible drug carrier system for valproic acid (VPA), which shows rapid cellular uptake, excellent biocompatibility and HDACi-activity, was developed. Thus, VPA remains the primary HDACi of the project. However, to realize a two-step release kinetics, different HDCAi will be covalently bound to the polysaccharide backbone via newly incorporated linkers. Potential linker structures include esters, thioesters, disulfides, and hydrazones that are cleaved under physiological conditions in living cells with different rates. Tissue-specifity of the carrier devices will be realized by functionalization with targeting moieties, e.g. dye molecules, specific peptides or antibodies, focusing on the targeting of liver or kidney. Liver and kidney dysfunction as a consequence of a dysregulated host response to infection are present in life threatening

systemic syndromes, such as sepsis or haemolytic-uremic syndrome (HUS). To date, there is a lack of target-oriented organ-specific molecular therapies to improve organ function. As functionalization of polysaccharides with bulky substituents is challenging, polysaccharide derivatives bearing drug- and targeting moieties will additionally be synthesized separately and combined during the NP preparation (Figure A02-1). NPs will be analyzed with respect to cellular uptake, toxicity, biocompatibility and biological activity in state of the art in vitro models, including 2D and 3D liver and kidney cell-culture systems as well as real-time electric cell-substrate impedance sensing (ECIS). In a second step, cells will be subjected to pathogen associated molecular patterns (PAMPs), such as lipopolysaccharide (LPS) or Shiga toxin, followed by NP-treatment, to assess NP effects under pathologic conditions. The targeting strategies will be evaluated with regard to cell type-specific NP-delivery and enhanced drug release as well as efficacy in cells of interest. Promising HDACi-coupled NPs will be further characterized in vivo regarding their safety and their therapeutic potential in suitable disease models.

More Information

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Events

RRB 2021
RENEWABLE RESOURCES & BIOREFINERIES
17th International Conference
on Renewable Resources & Biorefineries
6 - 8 September 2021
Aveiro • Portugal
www.rrbconference.com

GHENT UNIVERSITY

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Polish Chitin Society Conference **"New aspects in chemistry and application of chitin and its derivatives",** which will be held on **September 23rd—24th, 2021. More information is available on the website**

More info

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Research

Plantago species for production of complete bioactive wound dressings

Laura Činč Ćurić[1], Uroš Maver[1]
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The genus *Plantago* belongs to the *Plantaginaceae* family and includes about 275 species. It is a perennial herb that is distributed worldwide and is found in meadows, lawns, and uncultivated soils. *Plantago* has been used in traditional medicine for centuries for its anti-inflammatory, antibacterial, antiviral, cytotoxic, analgesic, and antifungal activities. The major bioactive compounds in *Plantago* are phenylethanoid glycosides, iridoid glycosides, flavonoids, and phenolic acids. The medicinal value of Plantago is also attributed to polysaccharides and their intrinsic ability to form gels.

The use of *Plantago* species in wound healing was described by the ancient Greeks in the first century AD. Extracts from the plants have been shown to possess anti-inflammatory activity and promote wound healing [1]. The polysaccharides of the plants exert their effects in various ways, such as I) attachment to wound surface proteins and facilitation of wound healing; II) function as a physical barrier, reducing water evaporation and serving as an obstacle to microorganism invasion; III) activation of growth factors and promotion of wound healing.

Our aim is to produce novel (almost entirely) plant-based wound dressings. For the latter, polysaccharides isolated from different *Plantago* species will be used to prepare 3D printed matrices, while bioactive extracts from the same plant infused

directly into these matrices will complete these new materials.

The *Plantago*-based wound dressings, produced in this way will be tested for their wound healing ability by variety of means. These will range from release tests of known active molecules from the plant, to a whole range of physicochemical and mechanical methods, and testing their healing potential using human skin-derived cells.

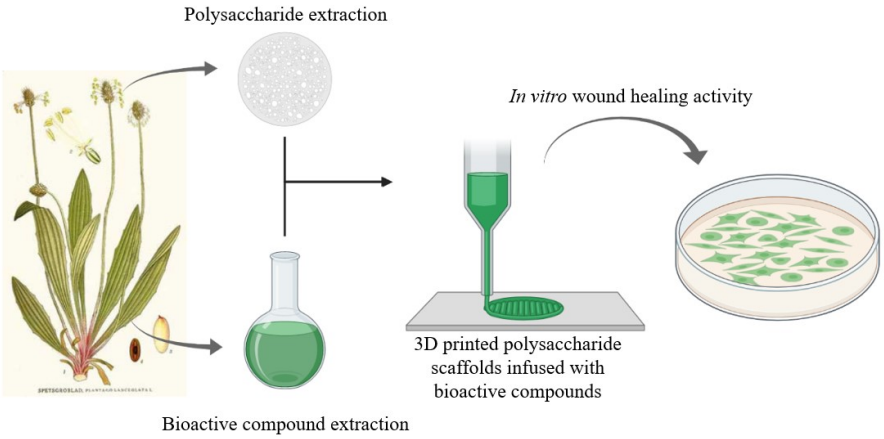

Figure 1: Schematic description of extracting bioactive compounds and polysaccharides, 3D printing of scaffolds and *in vitro* testing of wound healing activity.

1. Gonçalves, S. and A. Romano, *The medicinal potential of plants from the genus Plantago (Plantaginaceae).* Industrial Crops and Products, 2016. **83**: p. 213-226.
2. Hemmati, A.A., et al., *Healing effect of quince seed mucilage on T-2 toxin-induced dermal toxicity in rabbit.* Exp Toxicol Pathol, 2012. **64**(3): p. 181-6.

Morphological and rheological properties of PLA, PBAT, and PLA/PBAT blend nanocomposites containing CNCs

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2 Polymers Composites and Hybrids (PCH), IMT Mines Ales, Ales, France
* Correspondence: pierre.carreau@polymtl.ca

Morphological and rheological properties of poly(lactic acid), PLA (semicrystalline and amorphous), and poly(butylene adipate-co-terephthalate), PBAT, and their blends (75 wt%/25 wt%; PLA/PBAT) were investigated in the presence of cellulose nanocrystals (CNCs) prepared from solution casting followed by melt mixing. For the solution casting step, the CNCs were either incorporated into the matrix, dispersed phase, or both. The dispersion and distribution of the CNCs in the neat polymers and localization in their blends were analyzed via scanning electron microscopy (SEM) and atomic force microscopy (AFM). The highly dispersed CNCs in the solution cast nanocomposites were agglomerated after melt mixing. In the blends with 1 wt% CNCs, the nanoparticles were mostly localized on the surface of the PBAT droplets irrespective of their initial localization. The rheological behavior of the single polymer matrix nanocomposites and their blends was determined in dynamic and transient shear flow in the molten state. Upon melt mixing the complex viscosity and storage modulus of the solution cast nanocomposites decreased markedly due to re-agglomeration of the CNCs. Under shearing at 0.1 s^{-1}, a significant droplet coalescence was observed in the neat blends, but was prevented by the presence of the CNCs at the interface in the blend nanocomposites.

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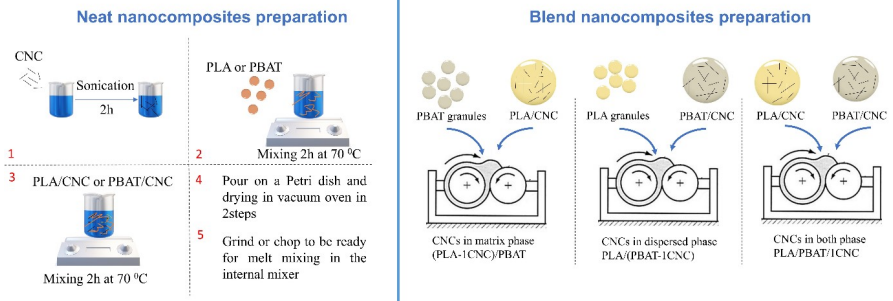

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On the Development of All-Cellulose Capsules by Vesicle-Templated Layer-by-Layer Assembly

Eivazi, A., Medronho, B., Lindman, B., Norgren, M. (2021).
On the Development of All-Cellulose Capsules by Vesicle-Templated Layer-by-Layer Assembly
Polymers, *13*, *589*.

Polymeric multilayer capsules formed by the layer-by-layer (LbL) technique are interesting candidates for the purposes of storage, encapsulation, and release of drugs and biomolecules for pharmaceutical and biomedical applications. With the developed approach it was possible to tune the size and net charge of the all-cellulose core-shell particles. The driving force for adsorption is essentially electrostatic and, thus strongly pH dependent. Electron microscopy revealed core-shell particles with a shape reminiscent of the spherical vesicle template.

This simple and reliable approach can be expanded and consider chemical functionalization or the inclusion of other compounds for specific and target properties. Therefore, the development of nano and micro cellulose-based multilayer containers, using a simple and inexpensive LbL approach, paves the way to novel advanced cellulose-based materials and/or hybrid systems of superior features. The importance of this work lies in the fact that the developed vesicle-template strategy can be readily extended to other liposome-based systems.

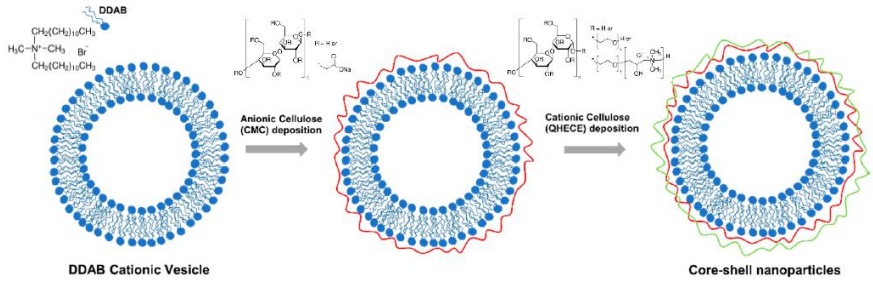

Figure: *Schematic representation of the alternating LbL deposition of anionic CMC and cationic QHECE onto a cationic DDAB vesicle.*

Click here for more information

Hydrophobic interactions control the self-assembly of DNA and cellulose

Lindman, B., Medronho, B., Alves, L., Norgren, M., Nordenskiöld, L. (2021).
Hydrophobic interactions control the self-assembly of DNA and cellulose
Quarterly Reviews of Biophysics, *54*, *e3, 1–22.*

Desoxyribosenucleic acid, DNA, and cellulose molecules self-assemble in aqueous systems. This aggregation is the basis of the important functions of these biological macromolecules. DNA, cellulose and surfactants are very different, but the balance between hydrophilic and hydrophobic interactions has common features. The driving force for the association of DNA and cellulose has been ascribed to hydrogen bonding. Regarding the formation of the DNA double helix, we argue that hydrogen bonding has been overemphasized and that the driving force is instead due to hydrophobic interactions; hydrogen bonds form but they do no drive association. The insolubility of cellulose in water has been ascribed to strong hydrogen bonds between

cellulose molecules. Again, we stress that the association of cellulose molecules in an aqueous environment is driven by hydrophobic interactions.

These arguments get strong support from theoretical work but also in studies where the hydrophobic interactions have been weakened by additives. To date a very limited number of additives have been studied in relation to base-stacking in DNA and cellulose dissolution and regeneration. Further work on modifying the hydrophobic interaction would be fruitful and simple surfactant systems can offer an excellent basis for such work. It is believed that the same considerations as discussed in this review apply to many other biomacromolecules, including other polysaccharides.

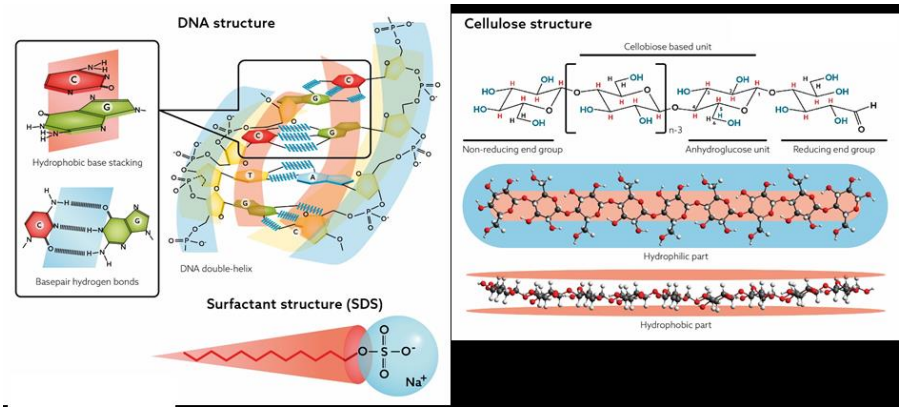

Figure: *Amphiphilic nature of DNA, cellulose and surfactants.*

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Education

Welcome to new students and researchers

University of Jena, Germany
Lennart Skodda joined the group as Master Student working in the field of modular approaches on xylan-based hydrogels (supervised by Thomas Heinze and co-supervised by Martin Gericke)

PhD defenses

University of Jena, Germany
Susanne Schmidt defended her PhD thesis entitled "Cellulose and starch - Environmentally benign sythesis of tosylates and esterification of starch for the preparation of UV-curable hot-melt adhesives"
Lars Gabriel defended his PhD thesis entitled "Functional polymers based on polysaccharides: Synthesis, characterization, and properties"

ICMAB Spain

Irene Anton, Nanoparticles and Nanocomposites (NN) group at ICMAB, defended her PhD thesis: **"Opportunities for bacterial nanocellulose in healthcare. Uses as a cell carrier, corneal bandage and tissue reinforcement"** on Thursday, 3 June 2021 in an online session. For more information, **click here**.

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Open Positions

PhD student positions
University of Innsbruck Research Institute for Textile Chemistry and Textile Physics, Dornbirn, Austria
in the following areas:
− Modification of bio-based fiber surface and interfaces in composites and hybrids
− Development of textile based conductive structures and energy storage systems
− Recycling and reuse of post-consumer textile waste
Apply by July 31st, 2021
Contact: Prof. Tung Pham (tung.pham@uibk.ac.at)
More information: **Click here**

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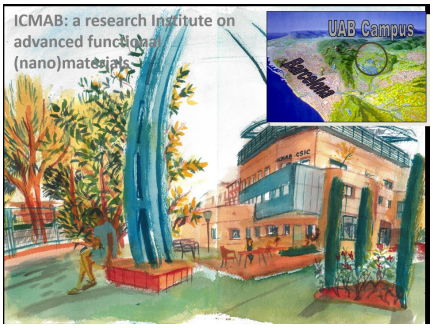
Member in highlight

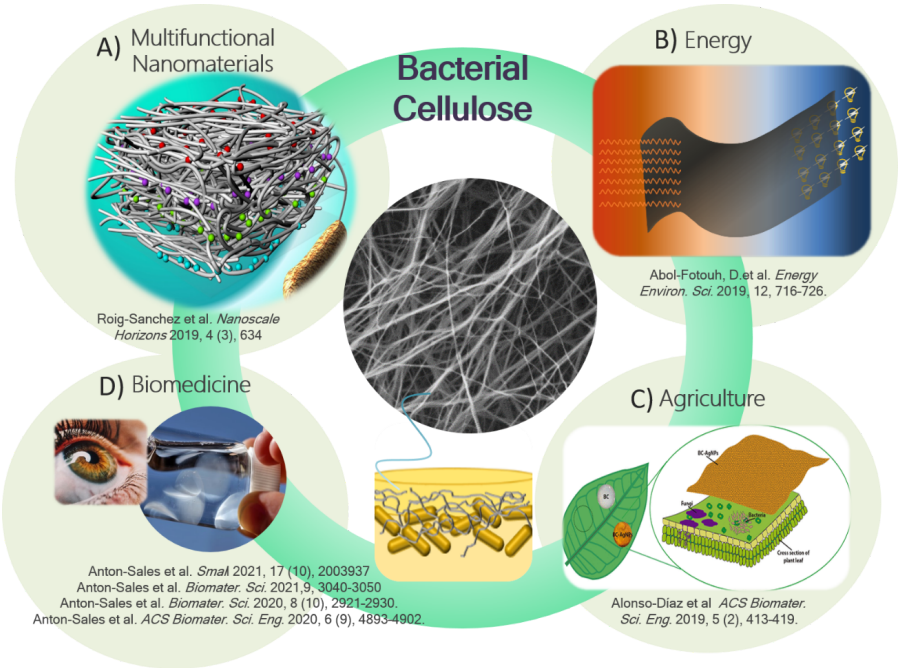
Group of Nanoparticles and Nanocomposites from the Institute of Materials Science of Barcelona



The Institute of Materials Science of Barcelona (**ICMAB-CSIC**) is a multidisciplinary research centre focused on cutting-edge research in functional advanced materials in the fields of energy, electronics, and nanomedicine. The ICMAB is located at the campus of the Universitat Autònoma de Barcelona (**UAB**), surrounded by other research and technological centres and with access to many state-of-the art equipment and scientific facilities. The ICMAB was selected as Severo Ochoa Centre of Excellence in 2016, becoming one of the top research centres in Spain in Materials Science, and renewed this seal of excellence in 2020.

The group of Nanoparticles and Nanocomposites (**N&N**) of ICMAB), led by Prof Anna Roig, is mainly focused on the rational synthesis of nanoparticles and nanocomposites and on the study of their structural-functional properties including nano-bio interactions. Our vision is to see some of the materials we developed impacting in the fields of Nanomedicine, Information Technologies or Energy and Environment.

In more recent years, the N&N group has enlarged its interest to naturally derived polymers, mainly nanocellulose produced biotechnologically by bacterial cultures (*i.e.* bacterial cellulose, BC). This polysaccharide exhibits a unique combination of properties that fascinates materials scientists from diverse backgrounds making it a promising candidate for an ever-increasing number of applications. The N&N group works to expand the applicability landscape of BC in biomedicine (mainly in regenerative ophthalmology and hernia repair), thermoelectric materials and agriculture. Moreover, we also carry out research on the control of the BC properties during and after its biosynthesis and have developed various methods to modifiy BC with functional nanoparticles (see Figure below). Additionally, we always try to close collaborate with relevant final users.



If you want to know more about our research and other activities follow us on Twitter: @NNgroupICMAB and surf our website: https://nn.icmab.es.

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Recent Scientific Publications of EPNOE Members

View List of Publications

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Call for Papers

Polymers | Special Issue "Cellulose and Lignin Feedstock for Renewable Materials" in
https://www.mdpi.com/journal/polymers/special_issues/cellulose_lignin_feedstock
Deadline (20 September 2021)

Lignin and cellulose are prominent renewable and sustainable resources whose processing into novel materials has been a very appealing research field for many years. This is reflected in both applications—earlier and novel—and new scientific questions. These abundant natural resources already occupy a leading place regarding the bulk use of renewable feedstock, offering a wide variety of properties and applications that are hardly matched by any other natural or synthetic compound. This Special Issue attempts to connect a state-of-the-art fundamental understanding of different molecular aspects with novel cellulose and/or lignin-based applications and renewable materials.

Guest editors: Bruno Medronho and Magnus Norgren

MDPI Coatings | Special Issue **"** Polymer Coatings, Films, and Dyes**"** (open untill 30 September 2021) Guest editors: dr. Alenka Ojstršek and dr. Selestina Gorgieva, University of Maribor, Slovenia
https://www.mdpi.com/journal/coatings/special_issues/polymer_dyes

MDPI | Bio-Based Materials from Plant Cells: Strategies for Building Functional Bio-Assemblies and Composite Structures (open till January 21st, 2022)

Plant cells are fascinating hierarchical bio-assemblies that are perfectly designed to fulfill a specific role in nature (structural, protection, energy storage, transportation, etc.) and can adapt in an evolutive environment via polymer remodeling. Though plants have been used for several thousands of years to satisfy human needs such as food, textile, mud houses, etc., new uses may arise from the growing interest in the development of bio-based and smart materials in technical and high-performance applications. In this regard, ongoing interdisciplinary research gathering plant biology, biotechnologies, wood science, and polymers and materials science is a driving force to boost ideas and innovations around the efficient use of wood and plant biomass for the development of new bio-based materials with original functionalities.
In this Research Topic, we welcome mini-reviews, opinions, and original research articles describing current fundamental science and innovative technologies for the controlled and tailored growth, modification, functionalization, and deconstruction/reassembly of plant cells and tissues in view of developing functional bio-based materials from plants. We would particularly like to encourage contributions dealing with non-classical biomass sources and innovative processes for the functionalization, deconstruction of plant cell structures, and reassembly of building blocks.

For all the calls on the EPNOE website, **click here**

*For more information, visit **our website** or send an email to **contact@epnoe.eu***