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802nd Conference

International Conference on

Sustainable Bioplastics

November 10-11, 2016 Alicante, Spain

Keynote Forum (Day 1)



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Jean-François Gerard

Universite de Lyon, France

Electrospun fibers from biosourced and biodegradable polymers for biotechnological applications

Electrospinning process is one of the most promising routes for the design and development of smart textiles based on polymer nanofibers. From a proper selection of the electrospinning process parameters and polymers, (multi)functional textiles could be proposed. In this lecture, we will show how bio-based polymers, such as PLA-based and biodegradable polymers, such as PBAT, can be used to prepare electrospun scaffolds. In the first part, electrospinning is applied to neat polylactic acid (PLA) and to PLA-based blends, i.e. PLA/polyethylene glycol-b-poly-lactic acid block copolymers and PLA/PEG homopolymer. Electrospun membranes exhibit fibers having diameters from 110 to 310 nm depending on the composition and large amounts of porosity (about 80% vol.) which are required for cell culture application. *In vitro* degradation, as well as the hydrophilicity of the electrospun scaffolds, can be finely tuned from material composition. Fluorescence microscopy shows that the PLA electrospun fibers based scaffolds are good candidates for the survival and proliferation of neural stem cells. Even if the introduction of hydrophilic segments, i.e. polyethylene glycol from PLA-b-PEG block copolymer, leads to the same level of proliferation than PLA-based membranes, the PLA/PLA-b-PEG electrospun membranes exhibited the suitable hydrolytic degradation required for implantable scaffolds. The second part deals with the development of biodegradable PBAT electrospun membranes with potential applications in the field of smart textiles. As mentioned previously, the fiber morphology is strongly dependent on the tip-collector distance, concentration, and applied voltage. Smooth fibers and beads free membranes could be prepared and analyzed to establish morphology-properties relationships. PBAT membranes having the best thermal and mechanical properties were selected as host of a curli protein which is able to complex heavy metals. In fact, by electrospinning, porous membranes exhibiting a large surface-to-volume ratio could be proposed for chelation of pollutants such as nickel.

Biography

Jean-François Gerard has got his PhD in Polymer Science in 1985 and his research work was mainly focused on the synthesis of zwitterionic polyurethanes from sulfobetainic diols for self-emulsifying systems. He joined CNRS as a Scientist and his expertise deals with interfaces in polymer-based materials and nanostructured polymers. He is an author of about 240 papers in international journals and 110 invited lectures in international conferences. He is also the Vice President of the European Center for Nanostructured Polymers and President of the European Polymer Federation.

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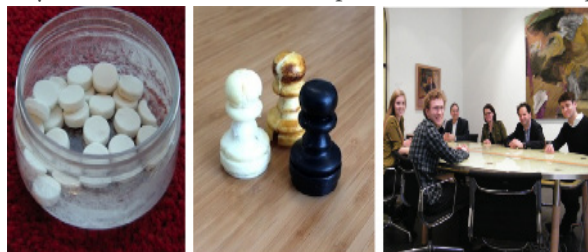


Gadi Rothenberg

University of Amsterdam, Netherlands

Plantics: Plastics made from plants

How often is it that you invent something that can truly change people's lives and make the world a better place? We've been working on catalyst discovery and development for bulk chemicals and sustainable energy for over a decade, and during those years we found quite a few nice things, but nothing truly spectacular. And then, five years ago, we discovered by accident a new type of biodegradable polymer made from 100% plant-based materials. It would be nice to say that this involved years of study and preparation, but in fact we were just very lucky. This new plastic is inherently non-toxic and non-hazardous. Excitingly, it is cheap enough to replace polyurethane and in some cases polypropylene and PET on a kilogram to kilogram basis (see Figure 1). It is now being manufactured on ton scale by a spin-off company, Plantics BV, which is situated at the Port of Amsterdam. During the scaling up and manufacturing we have found a host of new and exciting things. In the lecture, I will tell you how we discovered this plastic, and discuss the pros and cons of making chemicals and polymers from biomass. I will



also show examples of this new type of plastics and share our stories of trying to bring a new material into the conservative industrial sectors of injection moulding, agro-products, building materials and oil drilling additives.

Figure 1. Left: Pellets of our bioplastic that can be used in injection moulding or compression moulding. **Centre:** solid chess pawns pressed from the bioplastic (the black color is achieved by mixing 1 wt% of carbon black into the polymer mixture).

Right: A conference table which was made from the bioplastic, in collaboration with product design students of the Amsterdam University of Applied Sciences.

Biography

Gadi Rothenberg has obtained his BSc in Chemistry in 1993, and PhD in Applied Chemistry from the Hebrew University of Jerusalem in Israel in 1999. He was a Marie Curie Fellow at the University of York (UK) and moved to the University of Amsterdam, where he is now a Professor and Chair of Heterogeneous Catalysis and Sustainable Chemistry at the Van 't Hoff Institute for Molecular Sciences. He also teaches courses on catalysis, thermodynamics and scientific writing. He has published two books and over 160 papers in peer-reviewed journals. His textbook "Catalysis: Concepts & Green Applications" is a Wiley-VCH bestseller. He has also invented 15 patents, and co-founded the companies like Sorbisense A/S, Yellow Diesel BV and Plantics BV. His latest inventions are a new catalyst for cleaning cyanide from wastewater and a metal-free super-capacitor material.

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**Matjaz Kunaver***National Institute of Chemistry, Slovenia*

Biomass waste: A source of raw materials and nanocellulose

Biomass represents an immense and renewable source for the production of bio-fuels and valuable chemicals. Using liquefaction reaction, lignocellulosic components are depolymerized to low molecular mass compounds with high reactivity, high hydroxyl group content and can be used in many useful applications. We used liquefied biomass as a feedstock in polymer chemistry, such as synthesis of polyesters, polyurethane foams and adhesives. Herein, we also report on the optimized procedure for rapid preparation of nanocrystalline cellulose by liquefaction of its amorphous part of cellulose, lignin and hemicelluloses in ethylene glycol under acidic catalysis. Lignocellulosic biomass which was dispersed in glycol and methane sulfonic acid was used as a catalyst. The NCC was isolated as a residue, rinsed with 1,4-dioxane and centrifuged. The product was a NCC suspension in 1,4-dioxane or similar medium polar solvent. The crystallinity index was from 83% to 90% and the yield was more than 67% while using cotton as the starting material. Method for preparation of NCC by acid hydrolysis in ethylene glycol is a model procedure for NCC isolation from different natural cellulosic sources such as biomass with high yields and with high crystallinity index. A special attention was given to the utilization of the liquefied lignocellulosic materials as a new energy source with high heating value. The utilization of liquefied lignocellulosic materials can at least partially reduce the crude oil consumption, thus increasing the use of the renewable resources in large extent.

Biography

Matjaz Kunaver has done his MSc from the University of Leeds, UK in 1991 and has received his PhD degree in 1998 at the University of Leeds, UK. He is a Senior Scientist Researcher at the National Institute of Chemistry, Laboratory for Polymer Chemistry and Technology, Ljubljana, Slovenia and is an Assistant Professor at the University of Ljubljana and Polymer Technology College. His main fields of research are the utilization of biomass as a feedstock for polymer synthesis and production of nanocellulose. He has published more than 50 original scientific papers and 6 patents.

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Maximilian Lackner

University of Applied Sciences FH Technikum Wien, Austria

PBAT: A versatile material for biodegradable and compostable packaging

PBAT (polybutyrate adipate terephthalate) is a biodegradable random copolymer. The co-polyester of adipic acid, 1,4-butanediol and dimethyl terephthalate is available commercially as resin and as compound with PLA or starch. Today, the building blocks are made from fossil resources, with some manufacturers having plans to switch to renewable resources. As a “drop-in” polymer, PBAT resembles LDPE in its properties. Global annual production capacities are currently around 100,000 tons. Typical applications are packaging (e.g. plastic films and bottles), coatings (e.g. of paper and cardboard) and foam. A major advantage of PBAT is its compostability, in contrast to polylactic acid (PLA), where industrial fermentation conditions (60°C) are necessary. The cost of PBAT is between those of PLA and PHA. In this keynote lecture, properties of PBAT and its compounds will be presented, alongside application examples and an outlook into the future.

Biography

Maximilian Lackner has earned his PhD in 2003 and his habilitation in 2009 from Vienna University of Technology. He has held Several Senior Leadership positions in the Polymer Industry in Austria and China. He has Founded 5 companies, amongst them one for Antimicrobial Polymers and one in the area of Bioplastics, Lackner Ventures & Consulting GmbH. This company collaborates with JinHui Zhaolong, one of the largest PBAT manufacturers. His research interests include PHA and PBAT. Lackner Ventures & Consulting GmbH runs a research project to produce PHB from CO₂ and sunlight using cyanobacteria. He has authored more than 100 scientific articles. He teaches Materials Science at the University of Applied Sciences FH Technikum Wien.

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**Bas Krins***Applied Polymer Innovations BV, Netherlands*

The development of commercial high-end applications of biopolymers

Applied polymer innovations BV (API) is a commercial research institute with lab and pilot plant facilities dedicated to the development of high-end applications of polymers. It has an extensive know-how with respect to the use of biopolymers. Apart from contract-research, API is working together with investors on the development of start-ups. In 2015, the first start-up is realized: Innofil3D BV, a company producing monofilaments for 3D-printing from PLA and other polymers. At the moment, other start-ups are being prepared. One start-up will produce compostable twines for the cultivations of tomatoes, cucumbers and peppers. Another start-up will produce biodegradable trimmer lines. These and other examples will be shown in order to illustrate the fact that biopolymers do offer a lot of commercially attractive opportunities for new applications.

Biography

Bas Krins is Director R&D of Applied Polymer Innovations (API). Previously, he worked at AkzoNobel, Acordis and Diolen. He is a Specialist with respect to the development of high-end applications of Biopolymers.

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