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1354th Conference

Biopolymers & Bioplastics 2017

7th International Conference and Exhibition on

Biopolymers and Bioplastics

October 19-20, 2017 San Francisco, USA

Keynote Forum

Day 1

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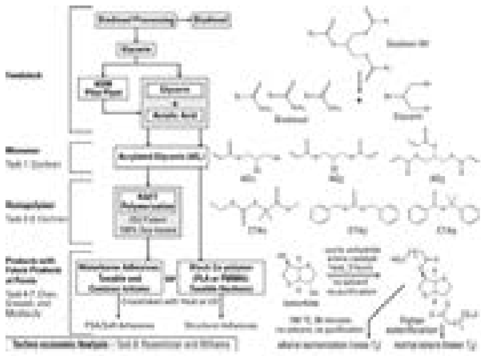
David Grewell

Iowa State University, USA

Biobased adhesive for construction applications

This work presentation will highlight the research at the National Science Foundation (NSF) on Bioplastics and Biocomposites (CB^2) as well as provide a detailed review of a project focused on biobased adhesives. Iowa State University (ISU) is in the process of scaling-up a demonstration of a commercially-viable family of economically competitive, biobased adhesives that comprise thermo-/photo-curable waterborne structural adhesives for wood-based composite materials. Much of the fundamental research into the polymerization – based on an innovative process developed at ISU – has been completed (see Figure) and the chemical pathways are fully understood; the current work focuses on identification and resolution of any remaining hurdles related to scale-up, demonstration of quality assurance, and optimization of the manufacturing process for industry compliance and acceptance.

The work has demonstrated the production of OSB (oriented strand board) produced with biobased adhesives that exhibit performance equal or even superior to currently available OSB boards. The bio-based OSB boards were compression molded with standard wood chips. Various thermal cycles and chemical initiators were studied to optimize the production of the OSB boards as well as their performance. The biobased OSB products exhibited superior tensile strength, three-point bend strength, toughness well as water resistance. They release zero VOCs (volatile organic compounds) and are economically competitive with boards manufactured using commercial adhesives. The team has completed a first draft of an LCA (life cycle assessment) and of a techno-economic model. A comparison of the production of biobased OSBs to commercially available OSBs showed a significant reduction in environmental impacts caused by the biobased product at competitive costs. The team at ISU is able to produce 1000 pounds of adhesive each day in the new pilot plant constructed at ISU's Biocentury Farm.



Biography

Dr. David Grewell received a BS, MS and Ph.D. in Industrial Systems and Welding Engineering from The Ohio State University with minors in biomedical engineering and polymer processing in 1989, 2002 and 2005, respectively. He holds 14 patents, has been given numerous honors and awards and as well as numerous publications, including two books. His interests include joining of plastics, micro-fabrication, laser processing of materials, bioplastics and biofuels. He currently works at Iowa State University as a Professor in the department of Agricultural and Biosystems Engineering. Dr. Grewell is the Director of the NSF Center for Bioplastics and Biocomposites, is the Chair of the Biopolymers & Biocomposites Research Team, a Board Member of the Ultrasonic Industry Association, Society of Plastics Industry and Society of Plastics Engineers. He also has a position at the University of Erlangen in Germany and is Fellow of the Society of Plastics Engineers.

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Christopher J Barrett, J Bioremediat Biodegrad 2017, 8:6 (Suppl)
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Christopher J Barrett

McGill University, Canada

Easing the environmental impact of disposable packaging: New sunlight-degradable bio-sourced polymer materials

Recent advances in Green Materials Science should be of interest to the packaging industry, in the form of providing cost-effective bio-sourced alternatives to artificial plastics. indeed, traditional disposable plastics have now become a global environmental concern due to their overuse, non-degradability, and toxicity. Especially vulnerable are many fragile ecosystems often specifically targeted by eco-tourism, such as high altitude, remote, and Arctic destinations, where there can also be additional barriers to disposal of waste (Kumar et al., 2014). This presentation will highlight recent successes from various Sustainable Materials Science and Engineering efforts towards providing low- or non-impact plastics alternatives (Daley, 2016). These encouraging examples are part of a larger network of local efforts, which could readily be implemented in many environments, partnered with local Universities (Zhong, 2016). A general strategy to develop local production and implementation partnerships will be discussed. Specifically at McGill University in Canada, as a working collaboration between our School of Environment, Center for Green Chemistry, and Materials Engineering Facility, we are developing a bio-inspired, sunlight-degradable plastics alternative (Borchers and Barrett, 2016). Constructed from completely bio-sourced natural starting materials, these new 'soft-bonded' materials can be easily and cheaply fabricated locally, to replace many of the current artificial plastics used for packaging, food transport, preparation, and consumption containers, vessels, and utensils. Containing light-responsive 'structural linking' units, when exposed to sunlight after use they mechanically (not chemically) degrade quickly and completely from the 'inside out', returning the polymer material starting components 'reversibly' back to their initial non-toxic and water-soluble form, out of sight and environmental harm.

Biography

Christopher Barrett received his Ph.D. in Chemistry from Queen's University, Canada in 1997, working on photo-responsive polymers with the late Almeria Natansohn, and Paul Rochon. Barrett then spent 2 years at MIT's Department of Materials Science and Engineering as an NSERC Postdoctoral Fellow, '98-'99, working on self-assembled polymers at bio-surfaces, before joining McGill University in 2000, where he is now Associate Professor of Chemistry, and McGill's School of Environment. He has been a JSPS Fellow at Tokyo Tech, a Fulbright Fellow at UCLA and Berkeley, and has published 100+ papers on light-responsive materials, and bio-inspired polymers, composites, and naturally-sourced materials.

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Yash P Khanna, J Bioremediat Biodegrad 2017, 8:6 (Suppl)
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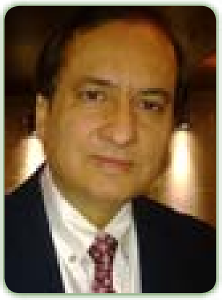

Yash P Khanna

Innoplast Solutions, USA

The future of PHA bioplastic

Polyhydroxyalkanoates (PHA) are a new class of bioplastics that are produced by microbial bacteria as they ferment a variety of organic substrates ranging from naturally occurring oils to food wastes. Depending on the starting feedstock and the bacterial fermentation process, the chemical structure of PHA changes, thereby leading to a large variation in product performance. A number of companies around the globe have recently emerged with their plans targeting "Novel Manufacturing Processes" to "Commercial Applications". The differentiating feature of PHA that sets this class apart from the rest is the "Biodgradability in Waters as well as under Ambient Conditions", thus addressing Sustainability and Land-Ocean pollution issues confronting the society. This presentation will cover the latest on PHA technology and the current state-of-the-commercialization efforts.

Biography

Dr. Yash P. Khanna has over 40 years of highly diversified industrial experience. His career is credited with over 120 research publications, 25 U.S. patents, Society of Plastics Engineer's International "Engineering/Technology" Award (2001) and North American Thermal Analysis Society's Fellowship (1988) and its highest honor, the International Mettler Award (1997). His industrial affiliations include Chief Technology Officer at Applied Minerals (2013-2015), Senior Technology Fellow / Director of Technology at Imerys (2005-2009), a $5B minerals company and Manager of Reinforced Engineering Thermoplastics Program at Rayonier (2001-2004), a $3B forest products company. The great majority of his career was at Honeywell (1975-2001) formerly AlliedSignal, a $40B conglomerate company at its Corporate Research & Technology Center as a Research Group Leader / Senior Principal Scientist. During 1990-2001, he also held positions as Business Unit Liaison to Specialty Films and key technologist for Packaging Resins, where scientific fundamentals formed the basis of new product / process development as well as technology marketing in North America and Europe. These significant business contributions were recognized through 5 Special Recognition awards and 3 business awards ("Growth," "Sale of the Year," and "Save of the Year"). Now at InnoPlast Solutions, Dr. Khanna's technology driven business experience is playing a key role in offering "Value-Driven" conferences and courses.

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Day 2

T Aoyagi, J Bioremediat Biodegrad 2017, 8:6 (Suppl)
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T Aoyagi

Nihon University, Japan

Preparation of functionalized PCL-based materials for biomedical application

So far, aliphatic polyesters, especially, poly(glycolide) (PGA), poly(lactide) (PLA), poly(e-caprolactone) (PCL) and their copolymers have withdrawn much attentions as biodegradable polymeric materials, because of their superior properties, such as mechanical strength, easiness of polymerization and manufacturing, biodegradability, and so on. Among them, there are many PCL-related researches as biodegradable materials have been already used as artificial dura mater clinically. We have reported that surface shape memory materials derived from PCL could contributed to mechano-biological studies using the same materials with modulated elasticity and viscosity by only temperature change. Furthermore, drug permeation control near body temperature could be succeeded by effective melting point modulation. In this study, new PCL network material which has cationic groups is prepared. The cationic moieties would interact to anionic groups easily, for example sialic acid in sugar chains. As other functional materials, we have been studying the methodology to introduce functional materials into the PCL main chains for immobilization of bio-active molecules, So such polymeric materials are expected to interact to living cells or tissues. To achieve such purpose, we newly designed blanched PCL macromonomer which has bromomethyl groups at the all of chain ends. Then, these terminal halomethyl groups reacted to 2, 2'-dimethylaminoethyl methacrylate to afford the objective macromonomer as seen in Figure 1. The corresponding macromonomer solution was cast and UV light was irradiated in the presence of photo-sensitizer. Briefly, 4-blanced PCL were prepared by ring opening polymerization initiated with pentaerythritol. Hydroxy groups at the chain ends reacted bromoacetyl bromide. The reaction with 2,2'-dimethylaminoethyl methacrylate afforded the N-methacryloylethyl, N', N"-dimethylammonio- terminated PCL macromonomers. This cationic PCL macromonomer THF solution were poured into the space of two glass plates with the Tefron spacers. To both sides of the glass plates, UV light was irradiated for cross-linking reaction to obtain membrane-type materials. The surface properties of the cationic PCL cross-linked membrane were evaluated by contact angle measurement of water droplet and anionic compound. As expected, the cationic PCL cross-linked membrane showed larger hydrophilicity and the much greater dye adsorption than the naked PCL. These results suggest that such materials would enhance the living cells interaction and be useful for protein immobilization on the surfaces.

Figure 1 Preparation of cationic PCL-based macromonomer

Biography

Dr. Takao Aoyagi is Professor of Department of Materials and Applied Chemistry of Nihon University in Tokyo, Japan. He received his Ph.D. at Tokyo Institute of Technology in 1993. After finishied Graduate School of Science and Engineering of Waseda University, he belonged to a Japanese chemical company (Lion Corporation, 1986-1987) and private institute (Sagami Chemical Research Center, 1987-1995). He became an assistant professor at Institute of Biomedical Engineering in 1995 and associated professor in 2001, Tokyo Women's Medical University. In 2002, he was promoted to full professor of Department of Nanostructure and Advanced Materials of Kagoshima University. In 2009, he moved to the Biomaterials Center and Coordinating Director of Nanotech-driven Materials Research for Biotechnology, National Institute for Materials Science (NIMS) in Tsukuba, Japan. His present research field is design of smart biomaterials for biomedical applications.

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Ana Paula Testa Pezzin, J Bioremediat Biodegrad 2017, 8:6 (Suppl)
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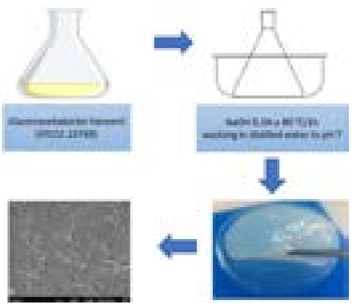
Ana Paula Testa Pezzin

University of Joinville Region (UNIVILLE), Brazil

Recent advances in bacterial nanocellulose for different applications

SThe last years of advances in research have demonstrated the importance and potential of biopolymers for a variety of applications, particularly for biopolymers produced by microorganisms, including bacterial nanocellulose (BNC). These polymers can be biosynthesized by bacteria of some genera, but the most efficient producers of cellulose belong to the genus Gluconacetobacter, that secrets an abundant 3-D network of cellulose fibrils. There are two main methods for producing BNC: static culture, which results in the accumulation of a thick, leather-like white BNC pellicle at the air-liquid interface, and stirred culture, in which cellulose is synthesized in a dispersed manner in the culture medium, forming irregular pellets. BNC can also be synthesized from a variety of substrates such as glucose, sucrose, fructose, glycerol, mannitol, among others. In this way it is possible to modify and control the physical properties of the cellulose during its biosynthesis. Factors such as yield, morphology, structure, and physical properties may be affected by the method of production and culture medium used. The thickness, color and transparency of the membrane can be controlled by means of the culture time of the bacterium. The BNC appears as a competitive alternative, having as main characteristics: high crystallinity, high tensile strength, elasticity, durability, hydrophilic potential (retention capacity and water absorption - about 98% to 99% of its volume is composed of liquids). In the food industry, it is used in the production of coconut cream, ice cream, snacks, sweets, stabilizers for emulsions and foams. In the cosmetics industry BCN is used as moisturizers and astringents. BNC is also used as an additive of high quality papers, membranes for high quality audio devices, electronic papers (e-papers), diaphragms for eletroacustic transducers, liquid crystal displays, OLED support, ultrafiltration membranes (water purification) and membranes for mineral oil recovery. In the biomedical area BCN is suitable for tissue regeneration, drug delivery systems, vascular grafts, scaffolds for tissue engineering, artificial blood vessels and microvessels, artificial vascular implant, dental implants, artificial skin, dressing for wounds and burns, allowing the transfer of medications to the wound while serving as an effective physical barrier against external infection. In the materials area NCB whiskers can also be used as reinforcement in nanocomposites.



Biography

Ana Paula Testa Pezzin. Graduated in Chemistry, Master in Chemical Engineering and PhD in Mechanical Engineering from the State University of Campinas. She did postdoctoral studies at the Université Pierre et Marie Curie in Paris / France. She has been a leader in the POLYMERIC MATERIALS GROUP since 2001, working in research lines: Polymeric biomaterials for medical and dental applications; Composites, biocomposites, nanocomposites and bionanocomposites; Modification of biopolymers for different applications and synthesis and characterization of biopolymers by microbial culture. Currently, she is a Professor and Researcher at the University of Joinville Region (UNIVILLE), being a level 2 productivity fellow at CNPq.

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