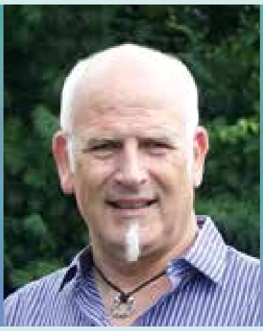
2nd PHA platform World Congress

Speakers Biographies

Abstracts

Wednesday, 22 Sep, 2021 | 08:30-08:45



Welcome

Michael Thielen, Polymedia Publisher

Biography

Dr.-Ing. Michael Thielen, born in 1961 studied mechanical engineering specialized on plastics processing at the Technical University of Aachen (RWTH / IKV), Germany. After his diploma exam (BSc) in 1989 he joined the Research and Development Centre of KRUPP in Essen, Germany. Here he did development and research work mainly in the field of extrusion blow moulding. In 1995 he passed his PhD-exam with a thesis on "Blow Moulding Long Glass Fibre Reinforced Thermoplastics". After 5 years with Krupp Kautex being a project engineer and sales manager for the North American market was Head of Public Relations at SIG Plastics International, Essen until 2003. Then he founded his own PR consultancy firm Polymediaconsult and in 2006 started his own publishing company with the first product being the "bioplastics MAGAZINE". Today he still acts as a PR consultant and publisher of bioplastics MAGAZINE as well as organizer of technical conferences such as the PLA World Congress, PHA World Congress, bio!CAR, bio!PAC or the Bioplastics Business Breakfasts.

Wednesday, 22 Sep, 2021 | 08:45 - 09:15

The PHA-platform, moving up the S-curve

Jan Ravenstijn Biomaterials Consulting

Biography

Jan Ravenstijn studied Organic Chemistry and Chemical Engineering at the Technical University Delft in the Netherlands. During his career he worked 22 years for Dow Chemical and 11 years for DSM in thermoplastics, thermosets and elastomers businesses, both in R&D and in Manufacturing.

Since 2009 he continued his professional career as a global consultant in bio-based materials for large and small companies, bio-refineries, OEMs and investment & consulting companies. He also served as a visiting-professor at the Technical University Eindhoven, University College Dublin and the Tsinghua University in Beijing.

He has written several articles and columns on the bio-based industry for American, Asian and European journals: a bioplastics review report, a book on bioplastics for SMEs and many global market studies (2013 till 2018) as a member of the global expert team from the Nova Institute.

Since May 2016 he serves on the Scientific Advisory Board of the Aachen Maastricht Institute for BioMaterials (AMIBM).

Abstract

As part of the metabolism of living organisms, PHB and a number of its co-polymers already appear in nature longer than mankind. However, it was only since the last decade of the previous century that significant developments were started to make these natural materials at large scale by mimicking nature in an industrial setting. Several billions of dollars or euros have been and are still being spent ever since to develop and to produce these natural materials, mostly by start-up companies with a focus on innovation for a fossil-free and environmental friendly circular economy.

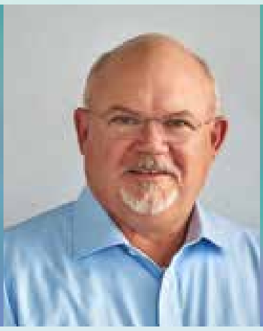
About one hundred different companies around the globe have been or are being active to bring this new PHA-platform materials about, a platform that has been in the embryonic stage of the S-curve for a long time, but is now ready to move to the early-growth stage.

Today we see that almost all sources of renewable carbon can be used as feedstock for the manufacturing of PHA-platform materials. Also most manufacturing process technology unit operations have undergone major technology improvements. Commercialization and expansion of PHBH-materials are making significant leaps forward, but a number of other PHA-materials are following right behind them. With an established manufacturing capacity of about 30 kt/annum in 2020 for the entire platform, many capacity expansions & new constructions under way, and new construction announcements & off-take agreements in place it is anticipated that the manufacturing capacity will be at least an order of magnitude higher by 2025.

Wednesday, 22 Sep, 2021 | 09:15 - 09:40

Moving Past Recycling: Can We Stem the Microplastics Crisis?

Blake Lindsey, RWDC-Industries



Biography

Mr. Lindsey graduated from The University of Arkansas with a business degree 1981 and later attended the University of Arkansas School of Law. He pursued graduate education at The Kellogg School of Business, Northwestern University and Southern Methodist University in Dallas, Texas with a focus on customer driven, lean systems.

Prior to entering the world of biopolymers, Mr. Lindsey spent over twenty years in forest products, initially in sales & marketing then moving to division leadership managing large paper making and converting centers with annual sales in excess of $1 billion. Mr. Lindsey, seeking to explore his personal entrepreneurial goals, joined DaniMer Scientific in 2005 as President while working alongside Dr. Daniel Carraway, Founder & CEO. While at DaniMer, Blake lead this team to introduce the world's first PLA based extrusion coating resin, acquired a PHA portfolio from P&G and developed a number of novel biobased materials for large global brands. Mr. Lindsey left DaniMer in 2015 and joined RWDC Industries in 2017 where he rejoined Dr. Carraway. Blake is the Chief Commercial Officer for RWDC with offices in Athens, Georgia USA and Singapore. At RWDC, Mr. Lindsey is demonstrating the value creation capabilities of mcl- PHA and the highly efficient, high quality PHA production systems of RWDC. Building long term relationships with customers is an approach that Blake believes in and has practiced during his thirty plus years of professional work experience. Blake believes that the customer experience is the key to winning and is a highly focused leader.

Abstract

Many believe simply recycling and reusing traditional plastics will solve our current environmental crisis. However, failed recycling efforts have left a potentially more dangerous and less acknowledged threat: a world consumed by microplastics – small particles that are making their way into our oceans, lakes, food, drinking water, the air we breathe and even our bodies.

Microplastics cannot be efficiently removed from marine ecosystems, and there is increasing awareness of the danger they present. Today, there is insufficient understanding of the danger to people. One significant consequence of microplastics: proliferation of inadvertent human ingestion.

We must stop plastic waste at the source. The commonly accepted 'reduce, reuse and recycle' solution does not go far enough. RWDC is committed to adding a fourth 'R': replace. Equipped with globally accepted replacement materials, we all will make wiser choices in the design and use of everyday items. This mission is critical — for the benefit of our environment and human health. PHA provides manufacturers and consumers with a compelling solution since it is technologically viable and scalable.

Please join Blake Lindsey, RWDC's chief commercial officer, and Dr. Daniel Carraway, RWDC's CEO and co-founder — and one of the leading global authorities on biopolymer solutions — for a discussion on the current state of our microplastics crisis, PHA's potential for moving us beyond traditional recycling methods and the consequences if we don't act now.

Wednesday, 22 Sep, 2021 | 09:40 - 10:05

Market expansion of Kaneka Biodegradable Polymer Green Planet™ through sustainable application developments

Erwin LePoudre, Kaneka

Biography

Dr. Erwin Lepoudre obtained his Ph.D. degree in Physical Chemistry at the Catholic University of Leuven (Belgium) in 2000. After another 2 years of research work at the university, he started his industrial career within Kaneka Belgium N.V. in 2002.

He has initially been responsible for technical service and project management with customers of the Kane Ace® product line, which includes various polymer additives, i.e. impact modifiers, processing aids, and other functional additives based on core-shell rubber technology, to be used in PVC, epoxy resins, engineering plastics, PMMA etc.

Later one, as New Business Development Specialist, he has been responsible to enlarge the use of new technologies of Kaneka Corporation within the European market, such as Sibstar®, an isobutylene based thermoplastic elastomer for packaging applications and Graphinity®, synthetic graphite sheet, for electronic applications.

Within his recent challenge as Business Manager Biopolymers, he is responsible to expand the usage of the biobased and biodegradable PHBH material towards a variety of new applications.

Abstract

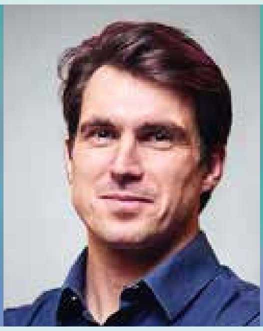
By developing its originated fermentation and macromolecular technologies, Kaneka has developed its Biodegradable Polymer Green PlanetTM (poly((R)-3-hydroxybutyrate-co-(R)-3-hydroxyhexanoate) on industrial scale. Micro-organisms available in nature, such as in soil, ocean and river waters, convert the polymer into water and carbon dioxide. Kaneka Biodegradable Polymer Green Planet™ opens perspectives for designing materials suitable for sustainable application, which are biobased, recyclable, and biodegradable in open environments in case of leakage.

Within this presentation, we will demonstrate innovative applications based on Kaneka Biodegradable Polymer Green Planet™. and discuss how they fit within a circular economy. Case-studies will be given, based on different packaging styles such as films, coated paper and capsules. The different end-of-life options will be reviewed, including the behavior in compost- and anaerobic digestion installations or paper recycling stream.

Wednesday, 22 Sep, 2021 | 10:05 - 10:30

GO!PHA: a collaborative effort to PHA-platform industry growth: status & activities

Rick Passenier, GO!PHA



Biography

Rick Passenier has a Master's degree in Industrial Design Engineering from Delft University of Technology and is founder and director at PACE Business Partners, a globally operating innovation consulting and venture building company specialised in bio-based and circular transformations. Rick has extensive working experience in up- and downstream bio-based markets, including feedstock, product and application development and works with leading players to create sustainable impact worldwide. Additionally Rick is ambassador of the Holland Circular Hotspot and Circular Economy design trainer at CIRCO.

Together with several leading PHA experts, Rick founded the Global Organization for PHA (GO!PHA), in 2019. GO!PHA is a non-profit initiative with ±40 industrial and academic partners, that aims at accelerating the development of the PHA-platform industry by focusing on technology, application and market development, and value chain collaboration.

Abstract

The PHA platform industry is growing rapidly and so are the efforts of GO!PHA. Since its inception in 2019, the developments of the industry and its context have continued to change; from regional and local legislation to production capacity expansions and application development. GO!PHA makes an effort together with its members to drive the PHA-platform by focusing on 3 areas; advocacy, communication and scientific knowledge development. In this presentation Rick Passenier will reflect on the challenges and opportunities of joint activities in all these areas.

Wednesday, 22 Sep, 2021 | 11:10 - 11:35

New Generation Industrial Biotechnology as a basis for PHA Builder

George Chen, Tsinghua University

Biography

Professor George Guo-Qiang CHEN received his BSc and PhD from South China University of Technology in 1985 and Graz University of Technology (Austria) in 1989, respectively. He also conducted research in 1990-1994 as a postdoc at University of Nottingham in UK and University of Alberta in Canada, respectively. He has been focusing his research on microbial materials polyhydroxyalkanoates (PHA) metabolic engineering, synthetic biology and PHA biomaterial application since 1986. After joining Tsinghua University in 1994, he has been actively promoting the microbial Bio- and Material Industries in China. Professor Chen has more than 35 years of R&D experiences on microbial physiology, microbial PHA production and applications, has published over 370 international peer reviewed papers with over 20,000 citations (H-Index 69) as reported in Web of Science. With over 40 issued patents and 50 pending patents, Prof. Chen's technologies have been provided to several companies that succeeded in mass production of microbial polyhydroxyalkanoates (PHA). He has received many awards for his contributions to the microbial manufacturing fields. Beginning from 2015, he becomes the Funding Director of the Center for Synthetic and Systems Biology in Tsinghua University. From 2015-2024, he serves as chair Professor of Synthetic Biology, The University of Manchester/UK.

Abstract

Polyhydroxyalkanotes (PHA) are a family of environmentally friendly biomaterials synthesized by various bacteria. The diversity of PHA reflected by structures and properties has resulted in various applications, making them a promising alternative of petroleum-based plastics, yet their industrialization is challenged owing to the high production cost and instable product quality. Recently the "Next Generation Industrial Biotechnology" (NGIB) has been developed, namely, a long-lasting, open and continuous, energy-saving fermentation process under artificial intelligent control using extremophilic bacteria grown on low-cost mixed substrates and less freshwater, as demonstrated successfully by halophilic Halomonas spp. NGIB overcomes the disadvantages of the current industrial biotechnology (CIB) to reduce the bioproduction cost and process complexity, leading to successful industrial production of PHAs with various structures and properties.

Wednesday, 22 Sep, 2021 | 11:35 - 12:00

Economic considerations of 100 million tons of PHA

Jeff Uhrig, Novomer

Biography

Jeff is President and CEO of Novomer. Jeff most recently served as President and CEO for Sirrus, Inc., the leading developer of methylene malonate technology. At Sirrus, he led a successful sale process to Nippon Shokubai and managed engineering, intellectual property, and commercial activities. Uhrig also served as vice president of corporate development at Elevance Renewable Sciences and was vice president in the clean technology investment banking group at Piper Jaffray & Co.

Jeff holds a bachelor of science in chemical engineering from the University of Illinois at Urbana Champaign, and an MBA and Master of Engineering Management with Distinction from the Kellogg School of Management and the McCormick School of Applied Sciences at Northwestern University, respectively.

Abstract

The presentation will be focused on the concept that in order to fully address microplastics and waste issues, PHA must be produced and composted economically. The former will motivate lower cost access to compostable polymers and the latter will motivate composting infrastructure to ensure PHA waste does not end up in landfills or oceans.

Brand owners will need assurances that the cost of production must be lowered to motivate high volume adoption.

Wednesday, 22 Sep, 2021 | 12:00 - 12:30

Cross-border opportunities for the biobased value chain

Stefan Jockenhoevel, AMIBM

Biography

Stefan Jockenhoevel, Univ.-Prof. Dr. med. (*1967) is Director of the Department of Biohybrid & Medical Textiles (BioTex) at RWTH Aachen University and one of the founding fathers and the first Director of the Aachen-Maastricht Institute for Biobased Materials (AMIBM), a cross-border cooperation between RWTH Aachen University (Germany) and Maastricht University (Netherlands). Furthermore he is associated scientist of the DWI Leibniz Institute for Interactive Materials and member of the National Academy of Science and Engineering (acatach), Germany.

He studied medicine at RWTH Aachen University and obtained his PhD in the Department of Physiology with a focus on the development of extracorporeal lung support systems for pediatric applications. Clinically, he was trained in the field of cardiovascular and thoracic surgery and worked clinically at the University Hospitals of Aachen, Zurich and the Heart Centre Lahr and INCCI Luxembourg. He carried out research internships at the USZ Zurich on the topic of cardiovascular tissue engineering and at the ETH Zurich in the field of biobased materials, specifically on the use of fibrin as a scaffold material.

His research focuses on the development of textile-reinforced biohybrid implants for cardiovascular and pulmonary

Abstract

The Aachen-Maastricht-Institute for Biobased Materials (AMIBM) is a unique cross-border collaboration between the Maastricht University and the RWTH Aachen University located at the Brightland Chemelot Campus at Geleen (NL). The mission of the institute is to gain knowledge for ground-breaking conversion of biomass to bio-based materials and into product applications. The AMIBM strives for creating an added value at any step in the value chain

from biomass to application by creating outstanding cross-border teams and with using synergistic core competences and infrastructures from both universities. Therefore, the institute is organized along the value chain from biomass into bio-based building blocks and into polymers. Keeping the polymer physics in mind the researchers of the AMIBM are going into (i) technical and/or (ii) biomedical applications. The research group of Sustainability of Materials evaluates our research from an economic and ecological perspective.

The presentation will introduce the AMIBM institute at its glance and will give an outlook on an EU initiative for an industrial doctorate program to train early stage researchers along the PHA value chain from synthesis and functionalization of the material into products.

Wednesday, 22 Sep, 2021 | 12:30-12:55

The compounding will be the success of the sleeping Giant!

Eligio Martini, MAIP

Biography

Eligio Martini took a degree in Chemical Engineering in the year 1977 at Politecnico di Torino.

In 1980 he joined Maip to follow the technical and commercial development of technical plastic materials.

In particular he focused on Ems and Bayer materials.

He used such experience, some years later, buying an injection moulding Company that was active in the automotive sector.

He's presently the President of Gruppo Maip, made of 6 different Companies co-operating with prestigious technopolymer producers

He has been studying nanocomposites for over 20 years, making experiments on specific processes for the use of nano fillers, carbon nanotubes and recently graphene.

Abstract

The various PHA base materials are "alive and lively" products. Deep know-how is needed in order to better exploit the exceptional properties of this material that, thanks to the compounding, can present to the market an almost infinite number of possible formulations to meet many different requirements. Optimizing with other biopolymers, fillers and different additives through formulation DoE and with a fine tuning of process conditions you can modify the various products according to the customer's requests, e.g. bringing the same formulation to have MFR from 2 to 500. All the various studies are then aimed at evaluating the various formulations according to the disintegration times, showing the superior ability of PHA compared to all the other so-called biodegradable to disintegrate.

With specific attention to the world of the injection molding, some particularly challenging industrial applications – for different reasons- are presented

Wednesday, 22 Sep, 2021 | 14:05-14:30

Effect of PHA-material structure on yarn and filament spinning

Bas Krins, Senbis

Biography

Bas Krins is Technical Director of Senbis Polymer Innovations BV, located in Emmen, The Netherlands.

He has an extensive research career in wetspinning and melt processing of polymers. First at Akzo Nobel, later at Acordis and Diolen. After the bankruptcy of Diolen in 2008 he was one of the founders of an independent commercial research institute, Applied Polymer Innovations BV. This company was later renamed to Senbis. Senbis offers a unique combination of lab facilities and an extensive pilot plant. Together with a team of specialists this institute has a track record with respect to the development of applications based on biopolymers, especially in cases where biodegradability is an advantage for environmental reasons.

Abstract

The results of the investigations into the structure – property relationship of PHA's will be presented. A number of PHA's have been selected and analyzed by NMR and GPC in order to reveal the chemical structure. The crystallization behavior has been evaluated by DSC. The mechanical properties of undrawn objects have been determined by producing injection molded dogbones, and the mechanical properties of drawn objects have been measured based on the production of drawn monofilaments. And finally the rate of biodegradation has been established. During the lecture the relationships between these parameters will be shown. This project is a collaboration with Hanze Hogeschool Groningen and NHL Stenden Emmen (both are technical highschools).

Wednesday, 22 Sep, 2021 | 14:30-14:55

PHB in cosmetic applications

Lenka Mynářová, Hydal/Nafigate

Biography

Lenka Mynarova is the member of the Board of NAFIGATE Corporation. More than 20 years she engages in marketing and brand management. She specialises in the field of marketing of science and research. She participated in the creation and management of more than 200 national, international and global brands in all market segments. She was awarded Manager of the Year 2018 of the Czech Republic for Hydal Project

Abstract

The PHA biopolymer has enormous application potential in a number of areas. Cosmetics and biomedicine is at the top of the biomass cascade and represents the highest level in PHA application areas. Specifically, P3HB has unique properties in this area - especially biocompatibility. This lecture presents specific applications of P3HB in the field of cosmetics and biomedicine. P3HB replaces toxic substances, allergens but also plays the role of active agents, drug carriers and scaffolds. The lecture also includes a presentation of new business models for innovation in circular cosmetics and new communication models.

Wednesday, 22 Sep, 2021 | 14:55-15:20

Designing PHA-materials for 3D-printing applications

Ruud Rouleaux, Helian Polymers/colorFabb

Biography

Ruud Rouleaux, 46 years old, living in Venlo, The Netherlands and father of 3 young sons.

He holds a BSc in plastics engineering and has fulfilled several roles in the polymer industry for the last 23 years.

Currently as owner and CEO of both ColorFabb and Helian Polymers, his main focus areas are materials design and

application development for both 3D Printing materials and Biopolymers.

Since 2007 he has been working with Tianan Biopolymers from Ningbo China and has successfully

launched several PHA based material innovations in FFF 3D Printing and Injection Molding.

Abstract

The last few years a variety of PHA producers and brand-owners have successfully developed and launched commercially available PHA building blocks with a broad variety mechanical and thermal properties.

This allows new blends and compounded formulations of PHA that resemble classical petrochemical polymers. However, material design iterations can in some cases by quite time consuming and inefficient before a successful formulations can be rolled out.

In order to speed up this process colorFabb has started a cooperation with the University of Niederrhein developing a Machine Learning AI model to map the correlations of various PHA blends.

Over the last 18 months we have tested over 70 formulations are now scaling up from labscale to pilotscale, focusing on producing and scaling up new PHA formulations specifically for 3D Printing (AM) and Injection Molding (IM).

Wednesday, 22 Sep, 2021 | 15:55-16:20

The effect of legislation on innovative PHA-material design for a circular economy

Anindya Mukherjee, GO!PHA

Biography

Anindya Mukherjee is a Global Business Executive with 20 years enterprise leadership success for high-growth organizations. He has steered 6 technology start-up spin-offs and M&As, managed more than $14M P&L and $10M venture capital investments, and oversaw staff of 30+ direct and indirect reports across Europe and North America. Since 2009, Anindya serves as Management Consultant at i2i Consulting. He successfully grew the business and technology practice from the ground up, serving diverse industries. Anindya is a 30-year veteran of the plastics industry, and has helped commercialize various Biobased products including bioplastics, food and nutraceuticals in the last 15 years. He co-founded the non-profit Global Organization for PHA to promote its use. His most recent initiative, PHAXTEC™, focusses on large scale production and proliferation of PHA's, a natural and biodegradable material. Anindya has a bachelors in Chemical Engineering, a Masters in Polymer Science and an MBA from Vanderbilt University, Nashville, Tennessee.

Abstract

With over 9 million tons of plastics flowing into our oceans every year and recycling rates at around 9% worldwide, policymakers have begun to notice the problems of plastics pollution. Therefore, over 128 countries/states have or are enacting some kind of plastics ban. These bans are not necessarily improving the plastics pollution problem we face. The use of sustainable and natural materials like PHA, on the other hand, is being seriously affected. The effect of these legislations are not even or similar across the world, different regions have taken different routes with different consequences for PHA and for the problems they're trying to solve. This uneven approach in legislations have caused several producers to rethink their long term strategies. This in turn has affected brand owners' and OEMs' efforts in proliferating the use of PHA and their approach to the consumer. This presentation will discuss the bans that are in place or expected to come in various regions and their underlying drivers. It will discuss the effect these bans are having on PHA and other biopolymer commercialization efforts. It will further highlight the efforts of GO!PHA and our members in favor of PHA and other biopolymers."

Wednesday, 22 Sep, 2021 | 16:20-16:55

Biodegradation : one concept, many nuances

Bruno DeWilde, OWS

Biography

Bruno De Wilde is the Laboratory Manager of Organic Waste Systems (OWS) in Ghent, Belgium for whom he has worked for more than 30 years already.

In this capacity, he manages biodegradation, composting and digestion tests and consultancy services as well as waste analyses and inspection activities, supervising a team of 85+ people. Bruno De Wilde has authored or co-authored about 30 scientific articles. Besides he is an active participant of several ISO and CEN working groups in this field and each year gives about 10 presentations on this topic at international conferences and company workshops. He also works as an expert on biodegradable plastics for the European Commission.

He took his MSc in Agricultural Engineering at the State University of Ghent in 1983, spent another year in the Laboratory of Microbial Ecology and then worked in an R&D project on making energy from biomass though biogasification in Indonesia for 4 years prior to joining Organic Waste Systems.

Abstract

- Impact of environment on biodegradation.
- Compostability : more than just biodegradability.
- When is biodegradation a real benefit?
- Bio-beginning vs bio-end of life.

Wednesday, 22 Sep, 2021 | 16:55-17:20

For which end-products is biodegradation a justified need?

Pauline Ruiz, nova Institute

Biography

Pauline Ruiz is trained as a chemist and holds a master's degree in polymer engineering from the European Engineering School of Chemistry, Polymers and Materials Science (ECPM) in Strasbourg (France). Beside her education, she acquired experience in project management as well as in research and development in various fields including the coating and rubber industries. She joined the nova-Institute in 2020 in the sustainability department. Her work focuses on bio- and CO2-based polymers and on life-cycle and sustainability assessments of chemicals, materials and processes.

Abstract

The German BioSinn project found products and applications for which biodegradation at the end-of-life is a real option. 25 fact sheets answer technical and regulatory questions for each application.

In the project "BioSinn – Products for which biodegradation makes sense", experts from the nova-Institute in Hürth near Cologne investigated whether there are applications and products for which biodegradation is a sensible or even the best end-of-life option. The selection criteria were that collecting the products (or their remaining parts), separating them from other organic waste or material recycling is not possible, economically not feasible or does not take place in practice. criteria were that the input of microplastics into the environment can be avoided through the use of biodegradable materials or that indirect positive effects, a relevant secondary benefit, can be achieved through the use of biodegradable materials.

Thursday, 23 Sept., 2021 | 08:40-09:05

The use of PHA in the textile industry

Ruben Geerinck / Lien Van der Schueren, Centexbel

Biographies

Dr. **Lien Van der Schueren** holds a master in Materials Engineering and obtained her PhD in Materials Engineering on the subject of chromic textile materials at Ghent University. She is working for 9 years as research engineer at Centexbel (Belgian Textile Research Centre) where she is responsible for several European and private research projects in the field of extrusion of thermoplastic polymers. Within this, she is mainly focusing on the use of sustainable, bio-based materials for textile applications.

MSc **Ruben Geerinck** has a masters degree in textile engineering. He is working as a research scientist at Centexbel. His work mainly focuses on formulation and bioadditives development for biopolymers, to improve processability, polymer properties and (home) compostability.

Abstract

From the textile side, there is strong drive for materials that allow melt spinning of environmentally sustainable, cost effective, bio-based and biodegradable fibres and filaments.

The family of PHA materials, with its wide range of properties, offers potentially good candidate materials for technical textiles, and can be used in applications like agrotextiles, geotextiles, hygiene and cleaning, clothing etc. A key advantage is that PHA biodegrades fairly easy, i.e. under mild conditions.

The material processing and resulting properties depend on the specific PHA polymer formulation. Although fairly well processable for foil extrusion and injection moulding, the melt spinning of PHAs poses some challenges such as low melt strength, fast crystallisation and degradation at temperature close to the processing temperature.

From Centexbel side we are working on the one hand on the use of PHA as additive for other bio-based polymers such as PLA or PBS with the goal to improve for example the biodegradability and/or the mechanical properties. On the other hand, focus is on the processing of neat PHA, mainly to monofilaments.

Thursday, 23 Sept., 2021 | 09:05 - 09:30

PHA for denitrification purposes

Jesse Hui, Tianan Biologic Material

Biography

Huang Hui received her bachelor degree in English literature from the China University of Mining and Technology in 2011. She joined Tianan Biopolymer in 2012 mainly responsible for the overseas market and logistics of PHA materials. Since 2019, she has taken also in charge of the oversea sales of Bioserica fiber produced by Tianan's subsidiary corporation, Bioserica Fiber Co., Ltd.

Abstract

Tianan Biopolymer has a commercial facility of producing PHA that has been running since 2004. It can be assured of consistent quality and continuous supply. Some new non-plastic applications of PHA have been developed: water treatment and fiber.

For water treatment application, insoluble in water, PHA can release the carbon source as required and achieve efficient de-nitrification.

For fiber application, Tianan set up a subsidiary company named Bioserica Fiber Co., ltd, producing fiber based on the compounding of PHBV and PLA. Bioserica fiber shows excellent natural antibacterial and antivirus property.

Thursday, 23 Sept., 2021 | 09:30 - 09:55

Possibility of amorphous PHA and current development

Sun-Jong Kim, CheilJedang

Biography

Ph.D in Packaging science(Biopolymers, synthesis of PBSET and blending PLA), Yonsei university(Korea).

Conducted as a senior researcher of Yonsei University for biodegradable materials (PLA, byproducts, PBAT, PBSET, PBSSE , etc).

Working in AnPhat group for PBAT, PBS, and biodegradable resin(compound, blend) as a team leader of R&D.

Working in HPM global for biodegradable material and retort pouch as a team leader of R&D.

Abstract

Our generation had a serious problem of plastic waste management due to littering by mankind. Over the world, many scientists and companies have tried to solve a plastic waste management under 3R concepts such as "reduce", "reuse", "recycle", and development or invent biomaterials including biodegradable ones also. For a few decades, EPR system and biomaterial standards had been made by individual countries or union such as EU which has willingness of sustainable society. So now, we can see various policies of many countries to handle plastic waste problems and probable biodegradable materials through efforts of researchers.

And well-known biodegradable polymers such as PLA, PBAT, PBS, etc which could be biodegraded in certain specific conditions absolutely and still they are good solutions for waste management.

CJ is also the one of biodegradable materials solution Company as a PHA maker. During past years, we've made a lot of efforts to improve our PHA technology for a commercialization.

Now first of all, we are closed to mass production of an amorphous-PHA (aPHA) which has biodegradation labels of TUV for industrial, home, and marine grade also. Especially, aPHA can be used as a modifier for PLA or other scPHA to control specific mechanical properties.

Currently, we have tried a bi-orientated film application for a food packaging area. We will share some results of mechanical properties of bi-axially oriented film which mainly had PLA component with PHA as a modifier. It showed Also we are constructing a plant in Indonesia as a capability of 5,000 MT/year within the end of this year.

Thursday, 23 Sept., 2021 | 09:55 - 10:20

Industrial applications for PHA materials

William Bardosh, TerraVerdae Bioworks

Biography

William Bardosh, founder, President and C.E.O of TerraVerdae Bioworks has over 25 years of experience in management, business/alliance development, technology development and sales/marketing in the fields of renewable energy, biotechnology bioinformatics and biopharmaceuticals with startups, global technology firms, venture and investment organizations. Prior to establishing TerraVerdae, Mr. Bardosh has held senior positions with Garbrook Knowledge Management, The Jackson Laboratory, IBM Life Sciences, DSM Biologics and Applied Biosystems/Perkin Elmer (Life technologies).

Abstract

TerraVerdae Bioworks (TVB) is a performance biomaterials company that develops and manufactures sustainably sourced biodegradable PHA polymers and resins. The company leverages its intellectual property and multidisciplinary in-house expertise in bioprocessing and biopolymer technology to design and market PHA products for films, coatings, packaging, adhesives, and specialty materials that provide sustainable technical solutions for our customers. Success in building industrial partnerships and collaborations is leading to scaled-up commercial production that capitalizes on market opportunities and meets the product demand of our customers.

TerraVerdae's polymer development laboratory is located in Edmonton, Canada; market introductions of our products are underway globally - in North America, Europe and Asia.

Thursday, 23 Sept., 2021 | 10:55 - 11:20

The latest P3HB4HB developments for medical applications

Liusong Hue, MedPHA Corp. Ltd.

Biography

Dr Yu worked in Austria in 1990's after earning his PhD from university of Vienna /Austria in 1993. After completing his MBA in USA from 2000, he worked for former Sandoz /Clariant in Basel of Switzerland until 2007, then moved to Beijing of China working for a multinational US firm from 2008-2017 in charge of Asia Pacific region.

Dr Yu switched his focus from 2018 on investment of technology start up, and grounded Zhuhai MedPHA Co. Ltd in 2019 with a few partners using the platform technology invented by George Chen (Guoqian) of QingHua University School of life science.

Abstract

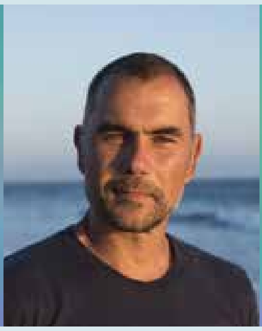
The latest P34HB Development for medical applications"

This presentation will introduce the latest development of P34HB and its selected applications. Particular attention will be given to medical grade P34HB, with molecular weight ranging from 20000 -300000 Dalton. some developments in tissue engineering & regeneration will be illustrated, but emphasis will be given to PHA based micro spheres for controlled drug release, stem cell therapy, interventional embolization etc.

Thursday, 23 Sept., 2021 | 11:20 - 11:45

Ocean Plastic reduction and PHA

Marcus Eriksen, 5Gyres



Biography

Marcus Eriksen is the Executive Director and co-founder of Leap Lab, a center for Art, Science and Self-reliance.

He is also the co-founder of the 5 Gyres Institute, researching the global distribution and ecological impacts of plastic pollution, which has included expeditions he's led sailing around the world - publishing the first global estimate of all plastic of all sizes floating in the world's oceans in 2015.

Today, Marcus divides his time to contribute to both organizations, leading expeditions, publishing research, and engaging the public, policymakers and private sector on overcoming the challenges we face this century. When not working on this, he and his family spend their time enjoying the farm at Leap Lab.

He holds a BS degree from the University of New Orleans and a PhD from the University of Southern California, Los Angeles

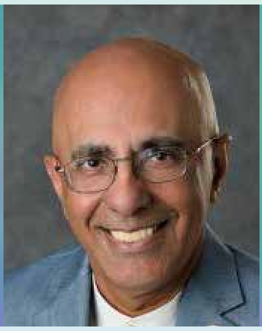
Abstract

There has been confusion over the best biomaterials to introduce to the market, but now PHA is proving to be a strong contender to revolutionize packaging because of its degradability. One lingering challenge that erodes market confidence is the lack of vetted science around the real-world degradation rates of PHA based on product type, shape, thickness, and in a variety of environments. When we understand the real-world degradation properties and communicate a clear understanding of our findings to the public and private sector, this will drive increased market confidence that PHA has the performance characteristics desired if lost to the environment. The presentation will address the results of a degradation study done three years ago and a follow-up study that is going on today.

Thursday, 23 Sept., 2021 | 11:45 - 12:10

Kinetic model to estimate lifetime in ocean environments for biodegradable polymers using PHBV and cellulose as models

Ramani Narayan, Michigan State University



Biography

Ramani Narayan, is University Distinguished Professor at Michigan State University in the Department of Chemical Engineering & Materials Science

He has 140 refereed publications, 26 issued patents, edited three books – all in the area of bio-based and biodegradable polymeric materials.

He served and serves in so many different functions, such as the Scientific Chair of the Biodegradable Products Institute (BPI), Director to Society of Plastic Engineers (SPE) Bioplastics special interest group (BioSIG) or on the Board of Directors of ASTM International, to name just a few.

He has won several awards an is a successful entrepreneur having been responsible for commercializing several technologies.

Abstract

ASTM and ISO standard test methods to measure biodegradability of plastics in aqueous/ocean environments already exists. The time required to convert 90% + of the polymer carbon to CO2 by microbial metabolism is determined and graphically illustrated by plotting percent biodegradability (mass of polymer carbon converted to CO2/ theoretical total mass of polymer carbon converted to CO2 as a percentage) vs time (in days).

The standard lab biodegradability tests are conducted at one specified temperature. A temperature of 300C is specified for ASTM D6691 which is test method for measuring biodegradability using pre-grown population of at least ten aerobic marine microorganisms of known genera or the indigenous population existing in natural seawater. However, surface ocean temperatures range from -1.8°C to 33.4°C, with a global average of 3.9°C. Therefore, the rate of biodegradation at these lower temperatures will be very slow and the biodegradable polymer will exist in the ocean environment much longer than observed in lab studies done at 300C. This has raised questions on the role of biodegradability to address ocean plastic pollution. Expanded and often time exaggerated claims of complete ocean biodegradability in few months and even shorter times is made.

In this presentation, we will describe the use of fundamental reaction kinetics to arrive at the order of the reaction, the rate constant k, and show compliance with the Arrhenius empirical equation relating temperature to the rate constant. Incorporating the reparametrized Arrhenius equation into the rate law gives us the global equation to estimate lifetime of plastics in the oceans using nonlinear regression analysis.

Thursday, 23 Sept., 2021 | 12:10 - 12:35

Historic opportunity of PHA with surging demand of biodegradable polymers in China

Teng Li, Bluepha

Biography

LI Teng is the co-founder and CEO of Bluepha.

Before establishing Bluepha, he got his Ph.D. degree and Bachelor degree in life sciences from Tsinghua University.

During his study in Tsinghua University, his research interests are industrial microbiology and biomaterial. He has consistent interest in commercialization of new biotechnologies developed in labs.

He got iGEM Gold Medal as team leader of Tsinghua iGEM team, and worked as Tsinghua iGEM team advisor for years.

He is the member of Tsinghua-Berkeley Global Technology Entrepreneurship Program. In 2015, he and his partners established Bluepha during his Ph.D. study.

Abstract

Bluepha is a Chinese biotech company as a spin-off from the Tsinghua University. The company produces P(3HB-co-4HB) polymer based on the Next Generation Industrial Biotechnology. It has a market development plant in operation and currently constructs its first large scale industrial plant. New Chinese legislation in favor of biodegradable polymers encourages a fast scale-up of capacity along with new application developments

Thursday, 23 Sept., 2021 | 13:50 - 14:15

T.B.D.

Phil Van Trump, Danimer Scientific

Biography

As chief technology officer, Phil Van Trump manages research & development, product development, regulatory affairs, and intellectual property for Danimer Scientific. Prior to this role, which he stepped into in 2014, Van Trump worked in a variety of positions within the company, performing bench-scale to pilot-level research as well as playing an integral role in the procurement of equipment and laboratory personnel to advance the company's objectives. His undergraduate background in molecular biology and microbiology (BSc University of Central Florida) is supplemented by an MBA from Emory University. In addition to his education, he brought to Danimer Scientific over a decade of industry experience. Van Trump's proficiency in management and scientific insight are a rare combination and are put to use daily as he leads an innovative team of scientists and support personnel in creation of sustainable biopolymer solutions.

Abstract

Thursday, 23 Sept., 2021 | 14:15 - 14:40

Feedstock considerations for world-scale PHA production: Methane as viable option

Maximilian Lackner, Circe

Biography

Dr. Lackner has earned his PhD in 2003 and his habilitation in 2009 from Vienna University of Technology, Austria. He is docent at Vienna University of Technology, Austria, Johannes Kepler University, Austria, Xidian University, China, and the University of Applied Sciences Technikum Wien, Austria, and has worked for over 10 years in the polymer industry in Austria and China in senior leadership positions. Having authored over 200 scientific articles, Dr. Lackner has founded the "International Journal of Biobased Plastics". He has carried out research with PHA for the last 7 years, on process and application development, amongst others as sorption material, non-woven, blend-partner and for additive manufacturing. Due to slow growth rates of PHB from CO2 by cyanobacteria, Dr. Lackner has turned his research interest to PHA from methane using methanotrophic bacteria. Circe Biotechnology is developing fermentation processes for scaleable PHA production using proprietary strains and bioreactors.

Abstract

The PHA platform is versatile and expected to be in a position to technically replace up to 90% of fossil-based polymers. Biodegradability also in difficult environments, coupled with resource conservation and a lower environmental footprint are key advantages. It is well-known that production costs are a limiting factor in many applications of PHA. Therefore, the ideal feedstock needs to be of low cost and ample availability. Traditionally, starch or sugar are used. Although these are biobased, there is a concern about sustainability, particularly once significant production volumes are reached. The competition with food can not only create a negative image in the general public, but also drive up prices of nutrition and contribute to climate change by increased land use change [1]. PHB from traditional, agricultural feedstock requires 3.24 tons of starch (=18 tons of potatoes (0.81ha) or 7.04 tons of wheat (1.88ha)) or 2.86 tons of sugar (=22 tons of sugar cane (0.3ha) or 17.84 tons of sugar beet (0.31 ha)) per ton of PHB, plus 2300-12900 m^3 of water [2]. For 1 million tons of PHA, the required area of agricultural land equates to 3,000 to 18,800 km^2 (1 crop per year). This is the equivalent of the island of Mallorca to twice the island of Cyprus. Moving towards 100 million tons of PHA, one can immediately see the constraints in scaling up. The methanotrophic bacterium methylocystis sp. GB 25 DSM 7674 was shown to produce 0.54 g PHB/g CH4, which is 40% carbon efficiency [3]. 2.6 billion m^3 of methane hence could be converted into 1 million tons of PHB. With the global production of natural gas standing at 4000 billion m^3/year, and biogas being on the order of 100 billion m^3/year, with a potential in excess of 1000 billion m^3/year [4], it is evident that 100 million tons of PHA are within reach by methane as feedstock, both from fossil and from renewable resources.

In this work, laboratory experiments with the methanotrophic strains methylosinus trichosporium, methylocystis hirsuta and methylococcus capsulatus are reported [5], [6]. A 20 l bioreactor was used for the experiments. PHB could be isolated and characterized. A scenario to reach the level of polyolefin production of 100 million tons per year for PHA is outlined. The feedstock, coupled with an efficient bioprocess, is elaborated as critical success factor for scale-up.

Thursday, 23 Sept., 2021 | 14:40 - 15:05

Customized PHA during biosynthesis

Manfred Zinn, ISBP

Biography

Dr. Manfred Zinn is professor at the Institute of Life Technologies, HES-SO Valais-Wallis, where he also leads the research group Biotechnology and Sustainable Chemistry. Manfred's research is focused on bioprocess engineering using process analytical tools (PAT) and on tailored biosynthesis of scl- and mcl PHAs. Manfred is teaching at Bachelor and Master's level at HES-SO Valais-Wallis and at EPFL. Since January 2018 he is Specialty Chief Editor of the Frontiers' section "Bioprocess Engineering". He is the co-organizer of the International Symposium on Biodegradable Polymers (ISBP) in Crans-Montana, Switzerland, in 2022.

Abstract

The material properties of short-chain-length (scl-) and medium-chain-length (mcl-) polyhydroxyalkanoates (PHAs) can be tailored during the biosynthesis by different approaches, namely 1) the choice or design of a suitable production strain, 2) selection of particular precursor substrates, and 3) the appropriate growth and PHA production conditions.

For many years the dominating strains for biosynthesis in case of scl-PHAs were Cupriavidus necator, Bacillus spp and Nocardia spp. and for mcl-PHA different Pseudomonas putida strains. With the evolution of novel techniques in genetic engineering (e.g., CRISPR/Cas9), new options with respect to metabolic engineering (pathway design, acceptance of other precursor molecules by targeted modification of the polymerase) became a reality.

Consequently, the biosynthesis of suitable precursors by the PHA producing strain is now also a financially interesting option since their expensive, chemical synthesis can be avoided. Recently, there is a trend towards mixed culture systems, where one strain produces the precursor molecule(s) for the PHA polymerizing strain. However, these systems need to be assessed in more detail to become industrially viable. In addition, the synthesis of copolymeric PHAs can be a true challenge because along with the cellular activity, also the metabolites may change significantly. That's why the control of the growth conditions plays a crucial role and is also determines the final material properties copolymeric PHAs. Different techniques will be explained during the presentation.

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Thursday, 23 Sept., 2021 | 15:40 - 16:05

Enhancing the Properties of PHAs via Nucleation: Translating 40 years of Polyolefin Innovation to PHAs

Scott Trenor / Paul A. Kearns, Milliken

Biography

Scott Trenor has over 18 years of experience in research and development in the polymer industry. His functional experience includes discovery, development and commercialization of novel polymers and polymer additives as well as in technology scouting, acquisition, and licensing.

Following earning his Ph.D. in Marcomolecular Science and Engineering from Virginia Polytechnic Institute and State University (Virginia Tech) in 2004, Scott joined Kraton Polymers as a R&D Chemist. At Kraton, he refined and improved the Cariflex™ IR and Cariflex™ IR Latex product portfolio to allow for streamlined production and expansion of the business from approximately $60 million in 2009 to over $170 million in 2016. He coinvented and developed the NEXAR® family of ion exchange membranes for the water transport, filtration and separation technology markets. This technology was awarded the 2011 US EPA's Presidential Green Chemistry Challenge Award in Greener Reaction Conditions.

Since joining Milliken & Co in 2008, Scott led development and commercialization of novel additives for polyolefins. He coinvented and commercialized the DeltaMax Performance Modifiers which enables increased recycled PP incorporation in durable goods. Scott is currently the Global Technology Lead for Milliken's Plastic Additives sustainability efforts. He drives R&D efforts in sustainability-enabling technologies and serves on working committees of the Association of Plastics

Paul A. Kearns is a chemical engineer by training and a marketer in practice.

After serving in the U.S. Navy nuclear submarine force, Paul began a career in packaging that started in paper, evolved into plastics and is now centered on materials.

In his current role, Paul is helping Milliken's Plastic Additives business create a sustainable future for plastics by bringing additive solutions to the market that improve the performance of recycled plastic materials and bioplastics.

As a true believer in the power of collaboration, Paul serves on working committees of the Association of Plastics Recyclers, the Plastics Industry Association, the Alliance to End Plastic Waste, and GO!PHA.

Recyclers, The Recycling Partnership, RecyClass, and the Alliance to End Plastic Waste

Abstract

By combining science with design and insights, Milliken tackles the issues and concerns of today. Every day, our community of innovators is invigorated by the challenge of finding creative ways to enhance people's lives and make the world around us easier, safer, more sustainable, and more beautiful. Since our first published recycling policy in the early 1900s, we've been finding innovative and environmentally friendly ways to increase the use of materials and diverting them from landfills.

Milliken's broad portfolio of advanced solutions are aiding efforts by plastic resin producers, processors and brand owners to generate the desired end products more sustainably. Recently, we have begun focusing on the needs of PHA producers and converters. In this session, we will share our initial progress on translating over 40 years of experience in nucleation and clarification to the PHA family to enable more efficient use, production and scaling of this unique biopolymer.

Thursday, 23 Sept., 2021 | 16:05 - 16:30

Synthetic Biology strategies for the biosynthesis of new-to-nature PHA-based polymers containing xeno-atoms

Pablo Ivan Nikel, Novonordisk Foundation

Biography

Pablo is a Senior Researcher at DTU Biosustain and head of the Systems Environmental Microbiology group. He received a M.Sc. in Biotechnology (2004) and a Ph.D. in Biotechnology and Molecular Biology (2009) in Buenos Aires, Argentina. During graduate school, his research focused on repurposing two-component signal transduction systems for metabolic engineering. After receiving training in quantitative physiology in USA (Rice University, supported by ASM), Pablo moved to Europe in 2011 as a post-doctoral fellow in Prof. de Lorenzo's laboratory in Madrid, funded by the European Molecular Biology Organization (EMBO) and the Marie Skłodowska-Curie Actions (MSCA) of the European Commission. During this post-doctoral training, he came across the fascinating world of environmental bacteria, particularly Pseudomonas putida. Inspired by the virtually countless bioengineering possibilities offered by this bacterium, he is now leading the Systems Environmental Microbiology Group at DTU Biosustain. The goal of the team is to rewrite P. putida's core biochemistry, implementing synthetic metabolism for novel compounds with a focus on new-to-nature chemicals. The ultimate ambition of this research programme is to expand the boundaries of microbial biochemistry—thereby accessing compounds that are exclusively produced via traditional chemistry nowadays.

Abstract

Fluorine is a widespread element used in the synthesis of molecules used in medicine, agriculture and materials. Addition of fluorine to organic structures represents a unique strategy for tuning their molecular properties, yet this atom is rarely found in Nature and approaches to engineer fluorometabolites into the chemistry of living cells are scarce. To overcome this state of affairs, we have designed synthetic metabolism in the platform bacterium Pseudomonas putida for incorporation of this halogen into metabolic intermediates and products. Expanding the chemical landscape of cell factories by providing fluorinated building-blocks was further exploited for the accumulation of fluoropolymers in vivo. To this end, synthetic modules were implanted in P. putida cell factories to capture fluorinated monomers into polyhydroxyalkanoates (PHA)-based polyesters. Different cultivation strategies and physicochemical characterization of the polymers will be discussed at the light of the bio-based production of new-to-Nature PHAs.

Thursday, 23 Sept., 2021 | 16:30 - 17:05

Can a bio-based downstream process reduce cost and improve the polymer properties?

Edvard Hall, Bioextrax

Biography

Edvard Hall is a lawyer and entrepreneur with an L.L.M from Lund University and a MSc International Political Economy from the London School of Economics. He has been the CEO of Bioextrax since 2017 and is on the board of several R&D based companies. Bioextrax is a company based on research from the Department of Biotechnology at Lund University. The company was founded in 2014 after a novel and biobased method for the extraction of PHAs from the PHA producing bacteria was discovered and patented. Bioextrax founder and CTO Mohammad H.A. Ibrahim will join Edvard Hall during the presentation. Mohammad has a PhD in Molecular Microbiology and Biotechnology from Münster University, Germany, focused on PHA production, and has done industry funded post-doctoral research at Lund University (Sweden), University of Hawaii (HI, USA), and Rensselaer Polytechnic Institute (NY, USA). He has more than 18 years of experience in microbial production of polymers and enzymes.

Abstract

As Polyhydroxyalkanoates (PHAs) are accumulated by microorganisms as intracellular carbon and energy reserves, a method for the extraction (recovery) of the granules is required. Such method should be economically and environmentally sustainable, scalable and produce high quality polymers. While much effort has been devoted at reducing the costs for the upstream (accumulation) of PHAs by investigating new substrates and strains, PHA recovery and purification is a severely under-researched area. This is unfortunate, considering that extraction and purification are amongst the most important aspects of PHA production in terms of economic weight and in terms of the life-cycle assessment of PHA production.

Today, PHA extraction methods used can be divided into two main methods:

1. Solvents utilized to solubilize the granules form inside the cells and

2. Additives/chemicals used to disrupt the cell walls and releasing the PHA granules.

Solvents provide high extraction yields and high polymer quality, but environmentally problematic and expensive. Cellular lysis, on the other hand, are generally less hazardous, but negatively affect the polymer properties.

As part of the search for more sustainable alternatives for PHA extraction that could decrease both the environmental and economic impact of the current approaches, Bioextrax has developed a 100% bio-based technology for PHA extraction. The new technology avoids the use of chemicals and produces natively shaped PHA granules with intact molecular weight and high purity.

This presentation will make comparative assessment among different extraction methods by considering the recovery, purity, molecular weight, costs and environmental sustainability.