The Bioeconomy Consultants

NNFCC

News Review

Issue Sixty-Four

July 2017

Each month we review the latest news and select key announcements and commentary from across the biobased chemicals and materials sector.

Contents

Foreword

Welcome to July's Biobased Products News Review, brought to you by NNFCC.

Despite their undoubted usefulness, where fossil-based plastics are concerned, you're never far away from environmental controversy.

Currently, the most talked-about plastic-related controversy is microbeads: microbeads are, as the name implies, small plastic beads of less than 0.5mm in diameter. They are often included in cosmetic products to improve texture and performance. The issue lies in their disposal: by their very nature microbeads enter the wastewater stream after use, but they are too small to be filtered out by traditional sewage treatment systems, meaning trillions of them end up in lakes and the ocean each year.

Conventional microbeads are produced from polyethylene or other durable plastics. Given these plastics take hundreds of years to degrade, microbeads are accumulating in oceanic food chains, as they are small enough to be consumed by planktivorous animals. Concerns over this accumulation lead US legislators to introduce the 'Microbead-Free Waters Act' of 2015, under the legislation the phase out of plastic microbeads from personal care products began on the 1st July 2017. Following the US lead, in 2016 the UK Government also announced plans to ban microbeads in cosmetics and personal care products by the end of 2017.

Could biodegradable microbeads provide a solution? Last month researchers at the University of Bath developed a way of producing a biodegradable renewable alternative to durable plastic microbeads in a scalable, continuous manufacturing process. These beads are stable enough to perform their prescribed function in products, but can be broken down by organisms at the sewage treatment works, or in the wider environment.

The Bath researchers aren't the only group looking towards biodegradable microbeads. Danimar and Bio-On are both companies who produce biodegradable microbeads from the bio-based plastic polyhydroxyalkanoate (PHA).

But "biodegradable" is a very open-ended term for a process that often requires very specific conditions, often lending itself little meaning. With this in mind, the Belgium not-for-profit company Vincotte has developed the OK Biodegradable labelling system, which stipulates the conditions under which plastics biodegrade, and since 2015, have provided a process for material producers to have their claims on marine degradation verified according to international standards. Uptake is low outside of Belgium, however, but if bio-based microbead producers (and indeed any bio-based plastic producers) can adopt such a labelling system, then consumers will be better educated, rather than believing that "biodegradable plastics" will simply biodegrade no matter what is done with them.

While the environmental persistence of plastics is not something to be celebrated, market persistence certainly is, and elsewhere, the bioplastics industry is celebrating a birthday of sorts, as it has been 70 years since a small French firm called Organico patented Polyamide 11, but in the modern day it is more commonly known as Rilsan – one of the mainstays of the bio-based polymer sector, with applications ranging as wide as automotive manufacturing to 3D printing. Rilsan is a true success story of the bioeconomy, and demonstrates the massive potential for market longevity of biobased products.

Read on for the latest news.

Policy

Industry Consortium announces Roadmap for Europe's Bioeconomy

To help build a resource-efficient, circular and bio-based economy, the Bio-based Industries Consortium (BIC) has announced its new Strategic and Research Agenda (SIRA). The SIRA identifies the activities needed to speed up the development of sustainable and competitive bio-based industries in Europe. SIRA reflects BIC's ambition to transform Europe into a world leading bioeconomy.

The updated SIRA addresses the technological and innovation challenges facing the bio-based industries, takes a 'multi-value-chain' approach and integrates new feedstocks such as aquatic-based sources, bio-waste (including from food processing) and CO2. It also considers the aims of BIC's newest members, as well as technology and market developments since the first Agenda was adopted in 2013. The SIRA identifies the research and innovation actions needed to deliver tangible and increasingly ambitious environmental, social and economic benefits by 2020 and 2030.

Click here for more information.

JRC publishes EU bioeconomy policy report

The 2016 bioeconomy report is the first JRC science for policy report addressing the bioeconomy across its sectors as well as from angles such as bioeconomy policies, legislation and funding, jobs and growth, and the environment. However, holistic approaches to bioeconomy research and monitoring are still at an early stage. Therefore, this report cannot yet provide a comprehensive description and evaluation of the "state of the bioeconomy"; it rather reflects the current state of 'knowledge' about the bioeconomy.

Results are preliminary and need to be interpreted with caution. Further research is required, especially the development of methods for monitoring and of models for forecasting and the collection and evaluation of relevant data, in order to provide a more complete and precise picture of the bioeconomy in the future.

Despite significant caveats concerning data availability (it is especially limited for the blue economy) and methodologies for monitoring the bioeconomy, the analysis of two indicators presented in this report – employment and turnover – provides important insight into the economic size, impact and development of the EU bioeconomy.

The EU bioeconomy makes up an important part of the total economy in the EU. In 2014, it employed around 18.6 million people and generated approximately EUR 2.2 trillion. This means that the bioeconomy represents around 9 % of all sectors of the economy with regards to employment as well as to turnover.

The economic size of the bioeconomy sectors varies considerably. The agriculture and food and beverages and tobacco sectors together make up about three quarters of the overall bioeconomy for employment and about two thirds of the overall bioeconomy for turnover.

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Research & Development

Computer system identifies less obvious bioeconomy value chains

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Research on value pathways for organic wastes has been steadily increasing in recent decades. This article explores how automated data analysis approaches can help in analysing large bodies of text to distil and present potential value pathways for secondary (waste) bio-based materials. The study employed multiple methods (literature collection, topic modelling, and co-occurrence analysis) on a collection of abstracts from 53,292 academic articles covering technologies, applications, and products (TAPs) for bio-based wastes. The results of both the topic modelling and co-occurrence analysis are presented as online interactive web pages. The topic modelling presented an overview of research clusters related to secondary organic resources, processes, and disciplines. The co-occurrence analysis helped to understand which TAPs are researched in relation to a broad spectrum of organic wastes. Co-occurrences were evaluated using the Normalized Pointwise Mutual Information measure to locate terms which co-occur more frequently than would be expected by chance. Through the use of detailed lists of organic wastes and TAPs, the co-occurrence method mapped out 7118 unique intersections between 473 specific wastes and 228 TAPs. This technique enables it to find seemingly non-obvious valorisation pathways such as the re-use of oyster shells as catalysts for bio-diesel production and bioplastic production from brewery waste. While a proof-of-concept, this work points the way for using Big Data to suggest novel pathways for implementing the Circular Economy.

Click here for more information.

LCA demonstrates reduced environmental impact of bio-based fillers

This research focused on life cycle assessment (LCA) and techno-economic analysis (TEA) comparisons of polylactic acid (PLA) composites, in order to compare organic to inorganic fillers. Organic fillers included DDGS, flax, hemp, rice husks, and wood, and were compared against inorganic fillers (glass and talc) for PLA-based composites. This study utilized LCAI and TEA methodology to estimate and quantify costs, emissions, and energy intensity (EI) associated with material acquisition, processing, transport, and end-of-life treatment used during plastic composite production. Emission categories analysed include global warming potential (GWP), air acidification (AA), air eutrophication (AE), water eutrophication (WE), ozone layer depletion (OLD), air smog (AS), high carcinogens (HC), and high non-carcinogens (HNC). To achieve a "Cradle-to-Grave" perspective, two models were meshed, the plastic comparator (PC) and EIO-LCA (EIO), to simulate the EI and emissions associated over the entire life cycle. Based on the assumptions used, this research has shown that utilizing land fill end-of-life treatment and glass filler composite was the most environmentally harmful option, and maintained the highest economic impact, for all

impact categories during PLA composite production. Alternatively, both DDGS and wood filler composites paired with recycling end-of-life treatment were shown to be the least environmentally damaging method and incurred the lowest cost of all PLA composites considered. This study also suggests that utilization of organic bio-based fillers produces a lower economic/environmental impact, and EI, compared to utilization of inorganic fillers in PLA composites. Accordingly, this research has demonstrated the impact of LCA/TEA paired analysis when assessing the bioplastic and biocomposite processing, which may be utilized as a precursor for parallel research undertakings.

Click here for more information.

Nordson announces bio-PLA-optimised plasticising system

Nordson

Nordson has announced that a plasticising system optimised for processing polylactic acid (PLA) bioplastics provides greater productivity and better product quality than standard screw and barrel systems, while resisting the corrosive effects of PLA compounds.

The new Xaloy PLA screw and barrel system is based on technology developed in cooperation with producers of PLA resins, and incorporates three key elements, which are screw geometries designed specifically for PLA that increase throughput while minimising shear and controlling melt temperature, mixing segments that deliver a homogenised, and screw and barrel materials that resist the mildly corrosive effects of PLA and the abrasion caused by compound materials.

For all PLA applications, barrels in the new package system are lined with Xaloy X-800 inlay, a nickel-based alloy with tungsten carbide that is more wear resistant than iron, iron chromium, and nickel-cobalt alloys, providing enhanced abrasion and corrosion resistance.

Screws consist of 17-4 ph stainless steel with Xaloy X-183 hardfacing.

Click here for more information.

Large investment for Gas Fermentation in Flanders

ERDF Flanders and Bio Base Europe Pilot Plant (BBEPP) signed an agreement for an investment of €9.36 million within the framework of the IMPACT project. This will be used to build up new research infrastructure specifically for gas fermentation and Down-Stream Processing.

Gas fermentation is an innovative and sustainable technology with enormous potential in terms of carbon footprint reduction. It uses micro-organisms to convert waste gases such as CO2 and syngas into a wide spectrum of chemicals. Bio Base Europe Pilot Plant will build a unique scale-up facility for gas fermentation to become a global reference for gas fermentation and to turn Flanders into a testing ground for this sustainable technology. Down-Stream Processing comprises the isolation and purification of a product after a biotechnological or chemical conversion step. This investment will also enable Bio Base Europe Pilot Plant to enlarge its Down-Stream Processing capacity at high TRL (Technology Readiness Level) level, allowing the pilot facility to use the full potential of its 15m3 fermenters.

Bio Base Europe Pilot Plant offers access to state-of-the-art pilot infrastructure to companies and research organisations active in the biobased economy. As such, the pilot plant enables Flanders to remain a frontrunner in terms of industrial biotechnology and to deliver a significant contribution to the European Innovation Agenda. Therefore, this investment will stimulate economic growth in and far beyond the Flanders region.

Click here for more information.

Origin materials receives backing from Canada

Bioindustrial Innovation Canada (BIC) is pleased to announce that it has made a COMM SCI investment in Origin Materials, Sacramento, California, through BIC's Sustainable Chemistry Alliance (SCA) investment fund, as part of an investment round that will see Origin construct its first commercial scale demonstration facility in Sarnia by late 2018.

Origin has developed unique and proprietary technology which allows it to transform multiple bio-based feedstocks into a broad range of chemical intermediates with large existing market demand. The company has successfully demonstrated the technology in its Sacramento pilot plant but chose Sarnia for its first commercial scale demonstration due to the unique nature of the biocluster which has been growing in the Sarnia region in recent years.

This cluster allows Origin to not only locally source feedstocks but have a ready market in the biochemical value chain. Origin is supported by partnerships with several global consumer products companies that will benefit from bio-based packaging created from the Company's bio-intermediates.

Click here for more information.

Polymers

70 years of Rilsan

Arkema

"A proven legacy. An exciting future." is the theme for Arkema's celebration of the 70th anniversary of the invention of its flagship Rilsan® polyamide 11 series of high performance polymers.

The 70th birthday celebration will be marked by a series of customer events across the globe during which Arkema will present the spectacular history and the exciting future of one of the world's most famous specialty polymer families.

Today, Rilsan® PA11 is known globally for being one of the world's highest performing specialty polymers.

The first commercial batch was made in 1947 in a re-purposed spinning mill called 'La Dame Blanche' in Serquigny, France. These historic first steps were taken during very difficult times. The desperate conditions of post-World War II forced the original inventors to work under extremely adverse conditions.

The celebration officially kicked off at Arkema's Serquigny, France production facility and research centre on June 10th.

The celebration will continue with several customer events across the globe, mainly in China and USA.

Click here for more information.

PEF consortium receives subsidy

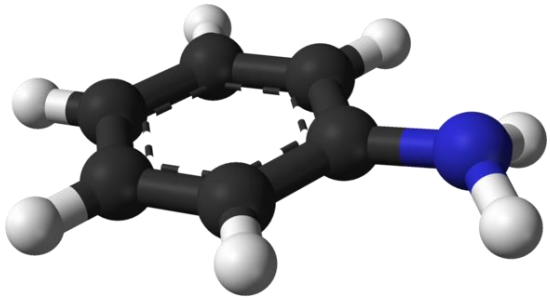
The European Joint Undertaking on Bio-Based Industries (BBI), consisting of representatives from the European Union and the bio-based industry, granted 25 million Euro to "PEFerence", a consortium of eleven companies. The grant supports the establishment of an innovative value chain for bio-based raw materials as well as chemicals and materials based on polyethylenefuranoate (PEF). It includes the intended construction of a 50,000 tons FDCA reference plant, the main chemical building block for the production of PEF. Synvina will be coordinating the "PEFerence" project.

BBI acknowledges the engagement of "PEFerence" for more eco-friendly materials and end products, resulting in substantial benefits for the environment and society. Based on renewable feedstock, products made of PEF will significantly help to replace fossil-based packaging materials and to reduce greenhouse gas emissions, following BBI's assessment. PEF is an innovative polyester suitable for applications such as bottles, films and polyurethanes.

PEF bottles can be recycled and used again as raw material for bottles, as well as for packaging and textiles. Additionally, PEF offers superior product properties in comparison to conventional polyethylene terephthalate (PET) and provides major advantages for end consumers. Improved barrier properties for gases allow to redefine packaging solutions based on PEF. It also offers a higher mechanical strength; thus, thinner PEF packaging can be produced and fewer resources are required. PEF is suitable to produce bottles for carbonated and non-carbonated beverages, foil pouches as well as personal and home care products.

Click here for more information.

Biobased aniline could lead to plastics breakthrough



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Covestro has scored a research breakthrough for the use of plant-based raw materials in plastics production: aniline, an important basic chemical, can now be derived from biomass. The materials manufacturer achieved this by collaborating with partners on the development of a completely new process, initially in the laboratory. Until now, only fossil raw materials had been used for the production of aniline, which plays an important role in the chemical industry and is used as starting material for numerous products.

Following its success in the lab, Covestro plans to further develop the new process together with partners from industry and research. The first step is to upscale the process in a pilot plant with the ultimate goal of enabling the production of bio-based aniline on an industrial scale. That would be an unprecedented achievement in the chemical industry.

About five million metric tons of aniline are produced annually worldwide; the total volume has been increasing by an average of about five percent every year. With a production capacity of about one million metric tons, Covestro is among the leading producers. The company requires aniline as a precursor for rigid polyurethane foam, a highly efficient insulating material used in buildings and refrigeration systems.

The industry currently derives aniline from benzene, a petroleum-based raw material. But industrial sugar, which is already derived on large scale from, for example, feed corn, straw and wood, can be used instead. The newly developed process uses a microorganism as a catalyst to first convert the industrial sugar into an aniline precursor. The aniline is then derived by means of chemical catalysis in a second step.

Covestro is already using renewable raw materials in a number of different products. A hardener for coatings that the company developed is one example: up to 70 percent of its carbon content is derived from plants. And CO2 is also increasingly being used an alternative raw material. Used in place of petroleum, CO2 accounts for up to 20 percent of the raw materials used in a precursor for flexible polyurethane foam that Covestro began producing in 2016. The company is also researching and developing many more products based on CO2.

Click here for more information.

Lenzing releases new line of viscose fibres

Lenzing

Textile consumption is expected to double by 2025, and the industry is anxiously looking for more sustainable solutions with minimal eco-footprint. Achieving low environmental impact requires developing eco-friendly raw materials and a sustainable manufacturing process.

EcoVero™ fibres are made from wood, a natural and renewable raw material. The wood comes from sustainable forestry plantations that are certified by industry-leading associations such as FSC®. Lenzing has a comprehensive wood sourcing policy that goes above and beyond the call of duty to ensure that the most sustainable wood sources are used for viscose production.

Lenzing enforces strict environmental standards during viscose production and has invested millions over the years to achieve eco-friendly production process. For example, Lenzing's viscose production sites where EcoVero™ fibres are produced comply with the stringent guidelines of the EU Eco Label, a world-leading environmental manufacturing standard.

With EcoVero™ fibres, Lenzing launches one of the most environmentally friendly viscose fibres. A special manufacturing system enables them to identify EcoVero™ fibres in the final product, long after the textile processing and conversion steps. Thus, retailers and brands are fully assured that they are indeed incorporating the eco-friendly viscose, and not a generic market viscose.

Click here for more information.

Grasim achieves BioPreferred status

Aditya Birla

Grasim Industries Ltd, a flagship company of Aditya Birla Group, has earned the U.S. Department of Agriculture (USDA) Certified Biobased Product label for its products- Birla Viscose, Birla Modal and Birla Excel.

Third-party verification for a product's biobased content is administered through the USDA BioPreferred Program. One of the goals of the BioPreferred Program is to increase the development, purchase and use of biobased products.

The USDA Certified Biobased Product label displays a product's biobased content. Utilizing renewable, biobased materials displaces the need for non-renewable petroleum based chemicals. Biobased products, through petroleum displacement, have played an increasingly important role in reducing greenhouse gas emissions that exacerbate global climate change. Biobased products are cost-comparative, readily available, and perform as well as or better than their conventional counterparts.

Click here for more information.

New European Bioplastics Board unveiled

European Bioplastics (EUBP), the association representing the interests of the bioplastics industry in Europe, has elected a new Board on 21 June 2017 to serve a two-year term. In a clear vote of confidence, the General Assembly of EUBP affirmed the strategic direction set by the previous Board and re-elected François de Bie (Total Corbion PLA) as Chairman of the Board for a third term. Mariagiovanna Vetere (NatureWorks) and Henri Colens (Braskem) have been designated as Vice Chairpersons.

Michael von Ketteler (BASF SE), Peter Brunk (BIOTEC), and Stefano Facco (Novamont) have also been re-elected as Members of the Board. Erwin Lepoudre (Kaneka) was elected as new Member of the Board. Peter Brunk will serve as treasurer.

Click here for more information.

Chemicals

Natureworks releases bio-based platform chemicals

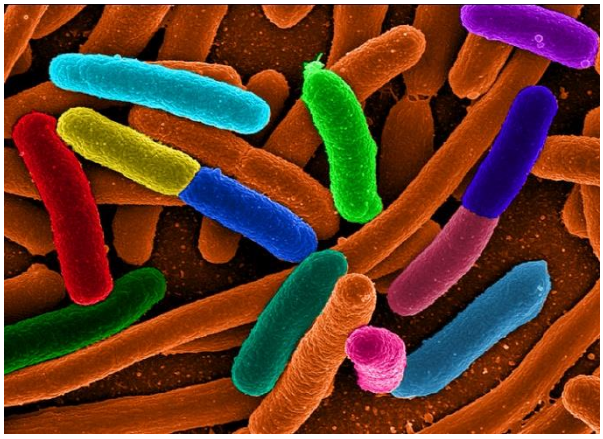
NatureWorks, an advanced materials company offering a broad portfolio of renewably sourced polymers and chemicals, has formed a Performance Chemicals Division to supply lactides, polyols, binder resins, and chemical intermediates to companies that manufacture innovative C.A.S.E. (coatings, adhesives, sealants, and elastomers), toners, and fine chemicals.

Vercet™ is a new tuneable platform of lactide-based chemistries from the NatureWorks Performance Chemicals Division. The customizable properties of Vercet polyols provide excellent hardness, solvent resistance, and low colour in polyurethanes. As components in polyester resins, Vercet lactides can be used to create low volatile organic compound (VOC), solvent-borne alkyd resins for wood, and metal coatings that have excellent adhesion and impact resistance. Solvent-borne coatings and hotmelt adhesives utilizing Vercet intermediate resins offer a tuneable work life, more end-of-life options, excellent adhesion, as well as low dispensing temperatures for food packaging, paper, fibre board, and wood applications. Vercet lactide-based products will have direct and indirect food contact approval as well as inherent health and environmental safety advantages when compared to traditional chemical building blocks.

Since NatureWorks uses biobased feedstocks to produce its lactide monomer, the company does not have the price volatility and supply chain pinch points of traditional coating and adhesive components. This helps procurement, finance, and manufacturing personnel at Vercet customer locations better manage product cost.

Click here for more information.

Use of E. coli to synthesis TPA from paraxylene



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Terephthalic acid (TPA) is an important industrial chemical currently produced by energy intensive and potentially hazardous p-xylene (pX) oxidation process. This paper reports on the development of a metabolically engineered Escherichia coli system for biological transformation of pX into TPA. The engineered E. coli strain harbours a synthetic TPA pathway optimized through manipulation of expression levels of upstream and downstream modules. The upstream pathway converts pX to p-toluic acid (pTA) and the downstream pathway transforms pTA to TPA. In a two-phase partitioning fermentation, the engineered strain converts 8.8 g pX into 13.3 g TPA, which corresponds to a conversion yield of 96.7 mol%. These results suggest that the E. coli system presented here might be a promising alternative for the large-scale biotechnological production of TPA and lays the foundations for the future development of sustainable approaches for TPA production.

Click here for more information.

HELM AG to market Greenyug's biobased ethyl acetate

HELM AG and Greenyug, LLC have announced an off-take agreement for the purchase and sale of bio-based Ethyl Acetate produced at Greenyug's planned Ethyl Acetate facility in Columbus, Nebraska.

This agreement will make significant amounts of bio-based Ethyl Acetate available first time to the market. The Prairie Catalytic production facility will be located next to Archer Daniels Midland Company's Corn Processing Plant in Columbus, Nebraska. The ADM facility in Columbus will supply the project with bioethanol feedstock and other services. Construction of the facility is anticipated to start during 2017 with production set to begin about a year later. Greenyug and HELM are pleased to announce that HELM will take over exclusive responsibility for the worldwide sales and marketing of Ethyl Acetate from the Prairie Catalytic facility.

Greenyug developed its patented technology at its Santa Barbara, California Research Facility and continued the scale-up at its fully integrated demonstration plant in India. Greenyug has developed a proprietary platform to add value to bioethanol by upgrading it into a variety of bio-based chemicals with broad market appeal. Greenyug Ethyl Acetate, the first of such products, is a widely marketed specialty solvent used extensively in products such as paints, coatings, pharmaceuticals, adhesives and a variety of consumer goods. Ethyl Acetate has a global market of more than $4 Billion. The market for Ethyl Acetate is growing faster than GDP because of its desirable properties. Greenyug Ethyl Acetate will be the first commercially available in industrial quantities to be entirely sourced from renewable feedstock.

Click here for more information.

Rivertop's renewable sodium glucarate achieves REACH registration

Rivertop

Rivertop Renewables has announced that its innovative chemical, sodium glucarate, has achieved registration under the European Chemical Agency's (ECHA) Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation. REACH registration opens the door for the commercial deployment of products derived from sodium glucarate in markets across Europe, including WATERLINE® CI and HEADWATERS® corrosion inhibitor and Rivertop's RIOSE® detergent builder.

The registration confirms the health and safety characteristics of sodium glucarate for manufacturers, customers, regulators and NGOs in Europe. Sodium glucarate, based on glucaric acid, only recently became available in commercial quantities thanks to Rivertop's breakthrough oxidation technology that can efficiently transform simple plant sugars into a variety of renewable chemicals with impressive cost and performance characteristics.

Following the REACH registration, two European customers of Rivertop are beginning trials of the company's Waterline® CI, a high-performing alternative to phosphorous-based corrosion inhibitors in the water treatment industry.

The registration will also make Rivertop's Riose® detergent builder available to European formulators. Riose® is a sugar-derived chelant that meets high performance standards and enables a lower total cost of formulation for dishwasher and laundry detergents. Sodium glucarate is also a key ingredient in Rivertop's Headwaters® corrosion inhibitor, which protects vehicles and highway infrastructure from corrosion caused by salt brine used to de-ice winter roads.

Rivertop plans to develop additional applications for sodium glucarate in food and canning operations, marine corrosion, and rust removal.

Click here for more information.

Emery releases low-temperature plasticiser

Emery Oleochemicals, a global specialty chemical manufacturer and supplier, is pleased to announce the availability of its new low temperature plasticizer. EDENOL® DOZ was developed in response to market demand for more readily available azelaic acid-derived plasticizers specifically designed for PVC and synthetic rubber applications.

Emery Oleochemicals is the pioneer in the commercial development of azelaic acid over 60 years ago. Emery's integrated manufacturing processes and readily-available feedstock of azelaic acid through its proprietary ozonolysis process ensures a secure supply of EDENOL® DOZ.

In most applications, EDENOL® DOZ can replace plasticizers that are based on dioctyl sebacate. Vinyl films, sheeting and coated fabrics made with EDENOL® DOZ plasticizer show exceptional softness and excellent surface properties. The broad resin applications of EDENOL® DOZ include PVC, NBR, NBR/PVC, CR, CM and CSM. EDENOL® DOZ also complies with indirect food contact directives (FDA).

Click here for more information.

S2G begins work on first standalone biorefinery

S2G BioChem (S2G), a developer of natural biotechnology conversion processes, has announced that it has started work on the company's first standalone biorefinery demonstration plant that it intends to build in Sarnia, Ontario.

The commercial-scale facility will refine local, sustainable forestry and agricultural residues using S2G's patented process to produce the lowest-cost and highest-value food ingredient xylitol available on the market today while co-producing value-add bioglycols for a new generation of consumer, industrial and packaging and products.

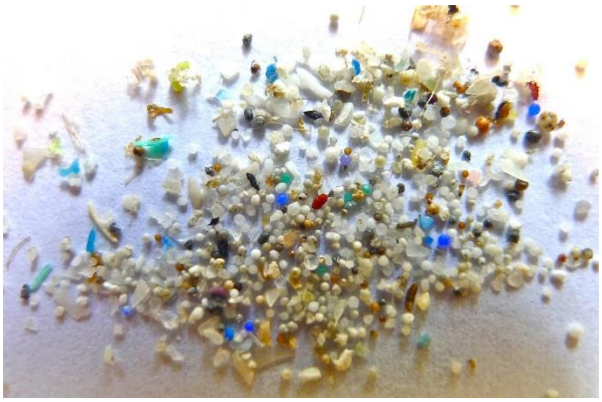
The S2G facility is considered a major advance in biorefinery development in Canada. It will have the capacity to produce over 2,000 MT/year of high-value xylitol and coproducts utilizing a range of feedstocks from forestry and agricultural residues. Basic engineering for the facility is underway and construction is expected to begin in 2018. The build-out and operation of the facility is projected to create 13 permanent jobs with more required during construction and testing.

S2G's conversion technology uses sustainably-sourced renewable plant materials to concurrently produce two bio-based products - xylitol and bioglycols. The ability to co-produce these products results in the lowest production costs for xylitol and bioglycols available today. Xylitol is a natural, low-calorie sweetener, offering high sweetness, excellent flavour, oral health benefits and 1/5 the glycemic index of table sugar, enabling healthier snacks and food products. Bioglycols (EG & PG) are sustainable drop-in replacements for petrochemicals that can be used to make countless everyday products such as packaging, lotions, liquid detergents, de-icing fluids and antifreeze.

Click here for more information.

Consumer Products

Biodegradable microbeads from cellulose



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Scientists and engineers from the University of Bath have developed biodegradable cellulose microbeads from a sustainable source that could potentially replace harmful plastic ones that contribute to ocean pollution.

As a result of recent campaigning by environmental groups, the UK Government has pledged to ban plastic microbeads in 2017.

Now a research team, from the University's Centre for Sustainable Chemical Technologies (CSCT), has developed a way of producing a biodegradable renewable alternative to plastic microbeads in a scalable, continuous manufacturing process.

The beads are made from cellulose, which is the material that forms the tough fibres found in wood and plants. In this process, scientists dissolve the cellulose to reform it into tiny beads by forming droplets that are then "set". These microbeads are robust enough to remain stable in a bodywash, but can be broken down by

organisms at the sewage treatment works, or even in the environment in a short period of time.

The researchers anticipate they could use cellulose from a range of "waste" sources, including from the paper making industry as a renewable source of raw material.

The physical properties of the beads can be tweaked by changing the structure of the cellulose, for example making the beads harder. A team, led by Dr Scott and including Professor Davide Mattia (Chemical Engineering) and Professor Karen Edler (Chemistry) has also just been awarded funding of just over £1 million by the Engineering & Physical Sciences Research Council to develop porous beads, capsules and microsponges.

Click here for more information.

New sports bottle made from Evonik bio-based plastic

The LUDAVI drink bottle is the ideal new companion for all sports fans. Made of the transparent TROGAMID® Terrabiopolymer by Evonik Industries, it stands out for its trendy look and high-quality material that makes it virtually indestructible.

Sungo left nothing up to chance in the material selection and called on the experts from the High-Performance Polymers Business Line of Evonik. The specialty chemical company from Germany is the perfect partner when it comes to mechanically stable plastics that are resistant to heat and chemicals as well as environmentally friendly.

TROGAMID® Terra by Evonik was ultimately the material of choice for the new LUDAVI drink bottle. The plastic is lightweight and abrasion-proof as well as resistant to heat and chemicals. That makes LUDAVI equally suitable to hold hot tea, carbonated sodas, and spritzers and helps the product withstand the mechanical stresses a drink bottle typically encounters in its life cycle. Evonik kept its focus on environmental properties from the start of the development: TROGAMID® Terra is a transparent microcrystalline polyamide made with more than 50 percent renewable raw materials such as palm kernel and coconut oil.

With its green lifestyle approach, Sungo has created optimal conditions for establishing LUDAVI as a popular product in sports departments, which combines all desirable properties of a drink bottle and appeals to health-conscious, environmentally aware, and fashion-minded shoppers alike.

Click here for more information.

New eco-efficient textiles for use in clothing

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Leading apparel, footwear and gear brands are demanding innovative eco-efficient solutions. INVISTA's CORDURA® brand in partnership with DuPont Tate & Lyle Bio Products brings the first in a series of eco-innovations, driving the future use of new sustainable textiles.

Tiong Liong, the first authorized mill for footwear and gear as part of the CORDURA® + Susterra® brand collaboration, is dedicated to developing

product innovations with eco-efficiency in mind. Some of the first composite textiles utilizing the Susterra® propanediol thermoplastic polyurethane membranes incorporate CORDURA® EcoMade fabrics made with recycled polyester yarns as well as Tiong Liong's own Ariaprene™ foam. Ariaprene™ foam uses a certified Bluesign® system water-based lamination process that is designed for non-skin irritation and does not off-gas harmful pollutants throughout the product lifecycle. Durable, solvent-free, renewable, and recycled are the key descriptors that describe the exciting new developments coming from Tiong Long's CORDURA® + Susterra® developments.

Everest, the first apparel fabric mill brought into this collaboration, has the ability to incorporate bio-based membranes and coatings based on Susterra® propanediol from DuPont Tate & Lyle into a variety of CORDURA® brand fabrics. At Techtextil, Everest is highlighting how CORDURA® Naturalle™ fabrics incorporated with a polyurethane bio-based membrane contain more than 25 percent renewable sourced materials by weight are engineered to help keep your body dry and comfortable in all kinds of weather. The Susterra® propanediol based membrane demonstrates good hydrolysis resistance, excellent low temperature flexibility and elasticity thus allowing the membranes to be incorporated with stretch fabrics for added mobility.

Click here for more information.

Braskem's bio-based plastic to be used for mattress foam

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Braskem, the largest thermoplastics resins producer in the Americas and the leading producer of biopolymers in the world, along with Sealed Air Corporation, an innovative packaging, cleaning and hygiene solutions company, and Naturepedic, the leading manufacturer of certified organic mattresses and bedding products for the whole family in the U.S., are pleased to announce their partnership to create a new-to-world formula for renewable polyethylene foam.

Braskem's I'm GreenTM Polyethylene (PE) is a bio-based resin made from ethanol, a renewable and sustainable resource produced from Brazilian sugarcane, and a drop-in substitute for conventional oil-based polyethylene. Cultivation of sugarcane utilizes CO2 and releases O2, which means the material has a negative carbon footprint. The use of Braskem's Green polyethylene in the production of one ton of Sealed Air's foam equates to 3.09 tons of CO2 captured from the atmosphere from a cradle to Braskem gate life cycle perspective.

The first application of the renewable polyethylene foam will be in Naturepedic's mattresses. Naturepedic was responsible for introducing Sealed Air to Braskem while searching for an alternative to polyethylene made from petroleum for its crib mattresses.

Having pioneered the use of bio-based materials in the mattress industry, Naturepedic never uses

polyurethane foam or associated flame retardants in any of its products and has now been able to eliminate virtually all petroleum-based materials from its products. Using polyethylene foam made from non-GMO sugarcane sourced from existing plantations also provides the company with a lightweight alternative to latex or steel coils.

Click here for more information.

Consumers show preference for 100% bio-based brands

To reduce human dependency on fossil fuels, increasing attempts are being made to substitute synthetic materials in products with bio-based materials. Global brands attempt to differentiate themselves by adding bio-based materials to their products. However, little is known about consumers' reactions regarding brands that use bio-based materials. Two experimental studies in six European countries on bio-based products were used to test whether consumers responded differently to brands that use materials that are fully bio-based (i.e., 100% bio-based) compared to brands that use materials that are partially bio-based. The results provide evidence that only brands with attributes that were 100% bio-based consistently resulted in enhanced purchase intentions. Instead, introducing partially bio-based attributes does not always result in a better evaluation of the brand compared to brands that do not contain any bio-based attributes. Additionally, the authors show how these effects occur (i.e., via brand attitude and brand emotions) and under which conditions these effects are enforced (i.e., environmentally conscious consumers and private labels). Finally, these effects are seen for multiple products, brands and countries. The study offers theoretical and practical implications and presents avenues for future research.

Click here for more information.

Events

Chemistry and Industrial Biotechnology Showcase 2017
20th-21st November, York

Showcasing how UK chemistry and industrial biotechnology sectors are helping to enable growth in key UK supply chains through innovation.

This two-day conference and exhibition hosted by the Knowledge Transfer Network is a major event to bring together industry, researchers, investors and government agencies to showcase how the UK chemistry and industrial biotechnology sectors are helping to enable growth in key UK supply chains through innovation.

Click here for more information.

EFIB 2017
9th-11th November, Brussels

The 10th European Forum for Industrial Biotechnology and the Bioeconomy (EFIB) returns to Brussels October 2017 and will attract industry executives committed to a shift towards renewable, biologically-based manufacturing. EFIB is organised by EuropaBio, Europe's largest and most influential biotechnology industry group and Smithers Rapra, global leader in rubber, plastics, polymer and composites information products.

Click here for more information.

European Biosolids & Organic Resources Conference 20th - 21st November, Leeds

Now in its third decade this event provides practitioners with an annual update on legislatory changes; new technologies; best practice and site-experiences with existing technologies and an insight into relevant research in the science and engineering of biosolids and organic resources. The conference is attended by recognised experts from around the world both, as speakers and delegates.

The programme covers the latest innovations and updates of existing technologies. Presentations from respected industry experts and newcomers follow the development of technologies and legislation from inception to full-scale installations.

Click here for more information.

European Bioplastics Conference 28th - 29th November, Berlin

Today, there is a bioplastic alternative to almost every conventional plastic material and corresponding application. While offering the same qualities and functionalities as their conventional counterparts, bioplastics strive to be even better by providing innovative solutions with improved properties and performances as well as the unique ability to reduce emissions and our dependency on fossil resources. The 12th edition of the annual European Bioplastics Conference will showcase just how biopolymers are Making the Difference in driving innovations forward for more sustainability, resource efficiency, and functionality.

Every year the European Bioplastics Conference features a well-researched conference programme and impressive speaker line-up attracting more than 300 senior bioplastics decision makers from across the bioplastics value chain, policy bodies, NGOs, and brand owners.

Click here for more information.

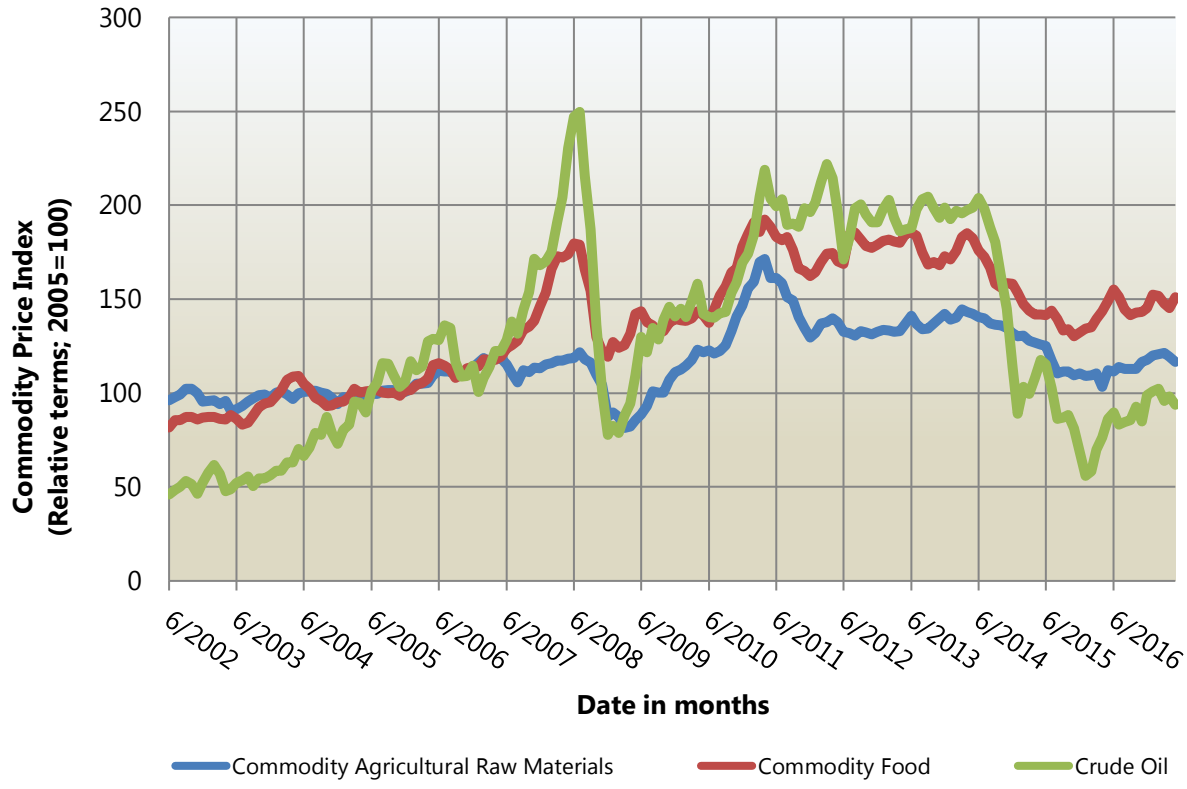
Price Information

Spot Prices of feedstocks as of today and five years ago, and percentile price change. Arrows indicate rise (↑), constant (–) or fall (↓) from previous month.

Item	Price, US$ (May 2012)	Price, US$ (May 2017)	% Price Change
Crude oil (petroleum, barrel)	104.16 (↓)	49.91 (↓)	-52
Maize (corn, metric ton)	268.79 (↓)	158.59 (↑)	-41
Sugar (pound)	0.2027 (↓)	0.1569 (↓)	-23
Rapeseed oil (metric ton)	1,236.62 (↓)	833.47 (↑)	-33
Soybean oil (metric ton)	1,134.58 (↓)	714.07 (↑)	-37
Ethanol (gallon)	2.22 (↓)	1.62 (↓)	-27

For details on spot prices please see www.indexmundi.com/commodities; Ethanol prices from Govt of Nebraska at www.neo.ne.gov/;

Raw materials 15-year Price Indices



For details on the nature of these commodities please see www.indexmundi.com/commodities

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