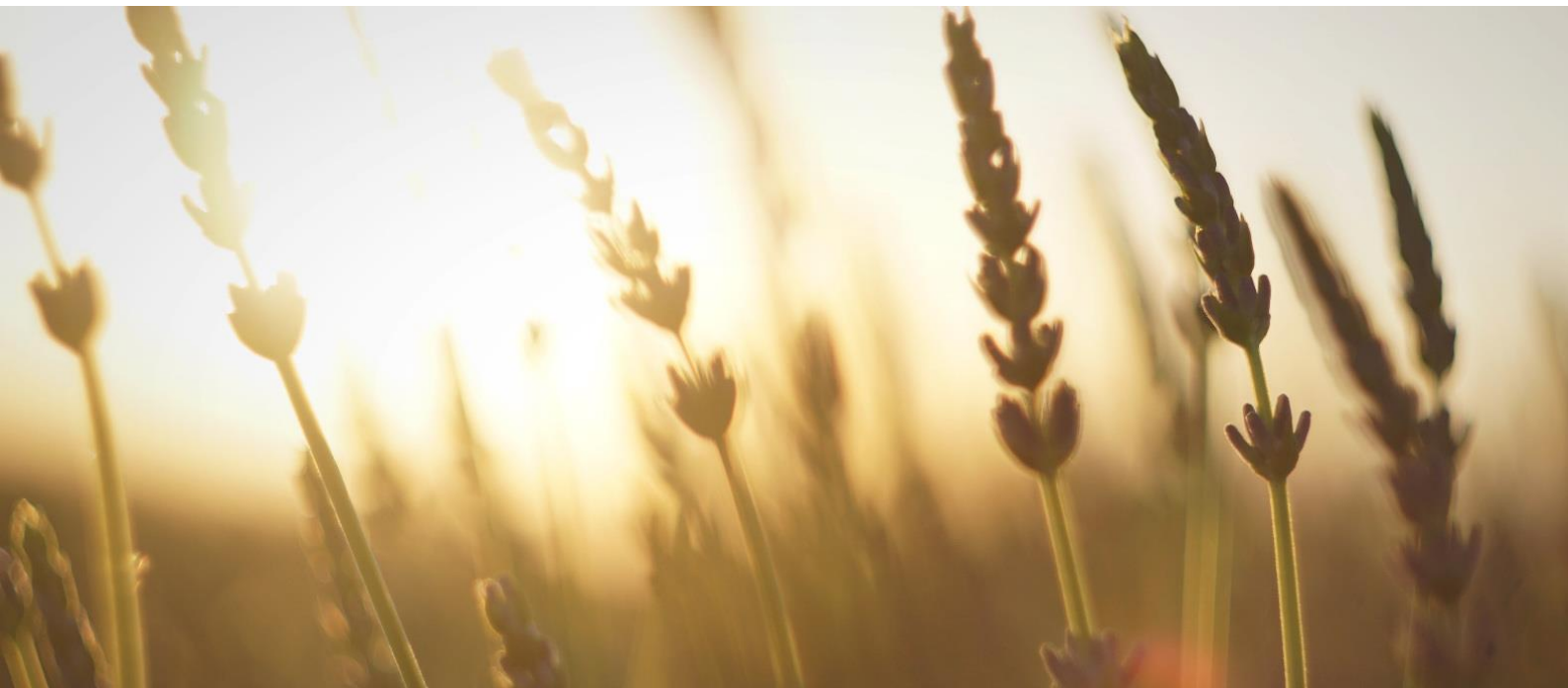


News Review



Issue Eighty-One

December 2018

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

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Foreword

Welcome to the final Biobased Products News Review of the year.

Frequently, we laud biobased plastics for being sustainable alternatives to petroleum-based plastics, and in the process acting as carbon sinks, helping industries to indirectly deal with emissions. It is well-known, however, that this is not the only advantage biobased plastics offer: they can also offer novel properties that petroleum-based plastics do not. One particular example would be chitosan, produced from chitinous shells found in seafood waste, which is not only biocompatible, making it useful for medical procedures, but also exhibits antibacterial and antimicrobial properties, the advantages of which are obvious. However, developing a new polymer can take many years of R&D, as a cost-effective production method needs to be developed, even if the chemical knowledge of the intended properties is already there. This may be about to change thanks to a new technology announced this month by Teysha Technologies Ltd, a bioplastic startup based in London. They claim that their technology, which produces polymers from biomass, allows its products' properties to be "tuned". Material properties including flexibility, thermal properties, and degradability can be controlled in the process. The former two allow for biobased polymers to be developed to fit a great range of mechanical purposes, and the latter allows the plastics to be disposed of in a safe and sustainable way. If this technology can be successfully scaled up, then there is no telling the number of applications for which biobased plastics could be developed.

On the complete other end of the biobased products spectrum, we have an announcement from Gingko Bioworks and Glycosyn LLC, that they have reached a deal to scale of production of human milk oligosaccharides (hMOS). These are chemicals naturally present in human milk, and this scale-up is initially for the production of hMOS for formula milk, for babies who are not breastfed. It is hoped that this process will allow for formula milk to attain the same nutritional status as breast milk, as currently there is only one hMOS available at a commercial scale, and formula milk contains only analogues. The other, longer-term prospect of this scale-up is for the produced hMOS to be used for research. While it may sound unsettling for this product to also be for adults, scientists have speculated on the potential health benefits for adults of these chemicals in the past, but have not had a large enough supply for testing. Thanks to Gingko and Glycosyn, this may well be about to change.

Read on for the latest news.

Policy

An end to the term "biodegradable"?



Flickr

Following soundings with the UK packaging sector, non-government organisations and litter charities, the Foodservice Packaging Association is calling for an end to the description 'biodegradable' in reference to packaging.

Using the term biodegradable has led many to believe that, no matter where disposed, so called biodegradable packaging will disappear to nothing within a very short period. This is misleading for the public, many of whom erroneously believe it is acceptable to litter biodegradable packaging. This in turn is leading to confusion about compostables which require appropriate end of life treatment and are certainly not acceptable as land or marine litter. This latter point has been communicated clearly by the compostable packaging sector.

A recent Westminster Hall debate highlighted the confusion with some of the MPs taking part freely interchanging the terms biodegradable and compostable as if they were the same. Therefore, the Foodservice Packaging Association are asking

the packaging sector and its customers to end the confusion and reduce littering by ceasing the use of biodegradable as a description.

Six months ago, the FPA formed a working group including waste management and anaerobic digestion (AD) experts with the task of helping to develop the much needed UK compostable packaging infrastructure and to analyse research and evidence to ensure all claims made by such packaging are factually accurate. The FPA's code of practice requires all claims made by members to be supported by evidence as a condition of membership.

Click [here](#) for more information.

Markets

Italy-Russia agreement a boost for Bio-On

A highly important agreement for technological and commercial relations between Italy and Russia was signed in Moscow in the presence of Russian Federation President Vladimir Putin and Italy's Prime Minister Giuseppe Conte.

The agreement is worth 17.6 million Euro for Italian company Bio-on: 5.6 million for licensing the technology to produce 100% natural and biodegradable PHAs bioplastic, and 12 million for supplying high-tech fermenters design plants to the TAIF JSC group.

This agreement will see the Russian Federation's first PHAs production plant (in Republic of Tatarstan) with Bio-on technology. The TAIF JSC group will invest 90 million Euro in the production hub. The hub is expected to be operational by 2020.

The agreement is worth a total of 17.6 million Euro (as anticipated in the presentation of the half-year results). In particular, 5.6 million goes on licensing Bio-on's exclusive technology to produce PHAs from sugar beet by-products; 12 million goes on the supply of plant components built according to Bio-on's proprietary technology. The industrial group TAIF JSC, operating in the traditional petrochemical sector, will invest a further 90 million Euro in building a 10 thousand tons/year production site expandable to 20 thousand tons/year in the future. The plant, the design of which will begin next month, will be operational in 2020.

With this project, the TAIF JSC group intends to open up new sectors of development for the revolutionary "green" plastic designed by Bio-on, both in segments traditionally served by oil-based plastics and in high added value advanced sectors.

Click [here](#) for more information.

BioAmber assets bought by LCY Chemical

Taiwan-based LCY Chemical Corp. has purchased the assets of bankrupt sustainable chemicals company BioAmber Inc., which was headquartered in Montreal.

The purchase was made by LCY's green sciences division, LCY Biotechnology, and includes BioAmber's shuttered plant Sarnia, Ont., which opened in 2015 and cost \$140 million to build, including \$52 million in federal and provincial funding.

According to PricewaterhouseCoopers, the court-appointed monitor for proceedings under the Companies Creditors' Arrangement Act, the Sarnia plant has been sold to LCY for US\$4.34 million as part of a court-supervised liquidation of the company.

BioAmber filed for court production in May, saying at the time it was "faced with a liquidity crisis" as well as "the inability to raise capital on public markets as a result of its recent delisting from the New York Stock Exchange and the Toronto Stock Exchange."

BioAmber used corn syrup to make succinic acid, a building block chemical used in products ranging from plastics to cosmetics and food additives. When it was operational, the BioAmber's Sarnia plant employed approximately 60 workers.

It attracted \$52 million in federal and provincial funding to help it build its \$140-million plant in Sarnia.

Click [here](#) for more information.



Research & Development

Kraig begins scale-up of Dragon Silk



Pixabay

Kraig Biocraft Laboratories, Inc., the leading developer of spider silk based fibres, has announced that it has begun the scale up of its recently announced second generation Dragon Silk.

Consistent with the Company's history of creating performance driven recombinant spider silk, this new material was specially designed at Kraig Labs' Michigan research headquarters for application in protective textiles, where increased strength and decreased flexibility are expected to provide improved protection.

Scale up of Dragon Silk 2.0 is well underway, with the production team already raising tens of thousands of the new transgenic silkworms at the Company's US based pilot production facility. Over the next 30 days, Kraig Labs anticipates scaling up production volumes of this new silkworm strain into the millions, as it prepares to create the first silk threads and fabrics made of this next generation recombinant spider silk.

Further, the Company is laying the groundwork to partner with experts in multicomponent thread design and spinning, to develop new specialty

threads blending the performance spider silk with other traditional materials. This work is expected to develop threads and fabrics focused specifically on products for the performance wear and other closely linked market segments.

Future scale up of Dragon Silk 2.0, as well as the Company's other lines of recombinant spider silk silkworms, is expected to be transferred to the Company's subsidiary Prodigy Textiles and its operations in Vietnam, while the Company's US facility remains focused on the development of next generation materials.

Click [here](#) for more information.

Review of transition from petrochemicals to biobased chemicals

In the current context of transitioning to more sustainable chemical processes, the upgrading of biobased platform molecules (i.e., the chemical transformation of widely available low molecular weight entities from biomass) is attracting significant attention, in particular when combined with enabling continuous flow conditions. The success of this combination is largely due to the ability to explore new process conditions and the perspective of facilitating seamless scalability while maintaining a small overall footprint. This review considers representative continuous flow processes which utilize a selection of currently popular platform molecules that target industrially relevant building blocks, including commodity chemicals, specialty and fine chemicals, and fuels and fuel additives.

Click [here](#) for more information.

Polymers

"Tuneable" biobased plastics

Teysha Technologies Ltd, a London-based bioplastics startup, claims to have developed a breakthrough technology to develop organic-based plastic substitutes.

In a statement to PNE, the company said its "plug-and-play" process takes monomers and co-monomers from bio-based feedstock, such as starches and agricultural waste, to produce biopolymers that can be used in a large variety of applications.

Particularly, what makes the Teysha technology stand out is that it allows the company to "precisely tune the physical, mechanical and chemical properties" of its polymers.

The "tunability" of the technology will allow for the manufacture of a wide variety of final products, from medical implants and vehicle moulding to food packaging and even cladding for building construction.

Teysha claims that its technology can produce bio-polycarbonate materials that are rigid or flexible, or that offer different thermal properties.

The process uses polyhydroxyl natural products as monomeric building blocks and carbonates as the linkages to produce the polycarbonates.

Crucially, the company asserts that it can control the biodegradation of its polymers – i.e. either within weeks or years.

Teysha maintains that its materials are fully compatible with existing production methods and that they "slot easily" into current manufacturing facilities.

Click [here](#) for more information.



Teysha

Covestro develops adhesive with biobased polyols

Covestro Deutschland AG has developed polyurethane dispersion adhesives (PUD) with a biobased content of more than 50 percent in cooperation with the adhesive manufacturers Jowat SE and Henkel AG & Co. KGaA. Technically, they could replace conventional adhesives in the wood, furniture and automotive sectors without much customization. The Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT also demonstrated the contribution of the new products to climate protection.

Solvent-free, water-based polyurethane dispersions (PUD) are used as adhesives in many products. They consist of a urethane and a polyester polyol component. In the project, the researchers were able to produce the polyester polyols based on renewable raw materials: succinic acid, sebacic acid, 1,3-propanediol and 1,4-butanediol were suitable as monomers. The PUD adhesives produced in this way had a total biogenic carbon content of more than 50 percent. In the application areas wood, furniture and automotive, they showed technical characteristics close to the market standard. There is still a need for optimization for bio-based shoe adhesives.

Click [here](#) for more information.

Teijin Aramid to produce biobased fibres in Netherlands

The Japanese company, Teijin Aramid, and the Dutch BioBTX are working on a synthetic fibre made entirely of sustainable materials. The initiative that is about to start is financially supported by the provinces of Drenthe and Groningen and by Chemport Europe. Teijin Aramid has production facilities in Emmen and Delfzijl. The initiative contributes to making the industry greener. It also strengthens the position of the Northern Netherlands chemical cluster, also known as Chemport Europe.

Teijin Aramid produces super strong fibres in the Netherlands under the brand name Twaron®. In the Netherlands, the company has facilities in, among others, Delfzijl and Emmen. Their fibres are used worldwide in products that need to be made stronger, lighter and more durable. For example, in car tires, light freight containers, and protective clothing. To produce Twaron® fossil resources are used for which there are currently no sustainable alternatives.

To develop a green feedstock Teijin Aramid works together with the company BioBTX in Groningen. This company developed a sustainable technology that can transform renewable resources, such as biomass and residual products, into chemical resources, mainly benzene, toluene, and xylene (BTX). With the BioBTX technology, it is possible to produce these so-called aromatics in a sustainable manner and, thus, largely reduce CO₂ emissions. BioBTX recently opened a pilot plant to produce aromatics on the Zernike Campus in Groningen. Based on these aromatics the chemical company Syncom will produce specific building blocks. The polymer and fibres will be made in the Research Center at Teijin Aramid in Arnhem, based on the processes in Delfzijl and Emmen.

Click [here](#) for more information.

Chemicals

Partnership to produce human milk compounds



Wikimedia Commons

Ginkgo Bioworks, the organism company, and Glycosyn LLC, a biotech company developing components of human milk, have announced a \$14MM deal to optimize and scale the production of human milk oligosaccharides (hMOS) for a suite of products that offer health benefits by fostering a healthy gut microbial ecology. Combining Glycosyn's experience in hMOS with Ginkgo's world-class organism engineering platform will drive new advances in and awareness of the widespread health benefits and applications of hMOS.

While major progress has been made in understanding the potential of hMOS, research to-date has been limited by the inability to access multiple hMOS at large scale and high purity. Although only one hMOS— 2'-fucosyllactose (2'-FL)—is available at commercial scale today, Glycosyn has developed a unique portfolio that can produce 15 additional hMOS at lab scale. With Ginkgo's automated, high-throughput foundry, Glycosyn will now be able to more effectively optimize and enhance these existing hMOS-producing strains to scale up production, as well as develop dozens of new hMOS products.

Augmenting Glycosyn's existing operations and strain development with Ginkgo's infrastructure for bioengineering will significantly increase the pace and scope of research into hMOS properties, unlocking new applications.

Over 200 unique hMOS are found in human breast milk, where they provide many important health and nutritional benefits for infants. Glycosyn has developed a portfolio of microbial strains that can readily produce hMOS for use in infant formula and other nutritional or health applications. While infant formula containing one of these crucial sugars is commercially available today, the broader potential of hMOS has remained largely untapped. hMOS provide a wide array of health benefits; from maintaining a healthy gut microbiome, to improving immune function, to preventing infection. Early research indicates hMOS could have even larger implications for treating diseases of the gut including inflammatory bowel disease (IBD), which includes ulcerative colitis and Crohn's disease, irritable bowel syndrome (IBS), as well as repairing the damage done to the gut ecosystem by antibiotic therapies.

Click [here](#) for more information.

Emissions-to-methanol plant constructed in Germany

Carbon Recycling International (CRI) and other members of the MefCO₂ research consortium have now delivered their key systems to Niederaussem, Germany, for installation. The project, which is partially funded under the EU Horizon 2020 SPIRE Research Programme, applies CRI's Emissions-to-Liquids (ETL) technology to production of methanol from CO₂ emissions captured from a thermal power plant and hydrogen produced by electrolysis. The project will demonstrate the capability of the ETL system to operate with fluctuating supply of electricity from wind and solar sources and heterogeneous CO₂ sources.

CRI's ETL system, comprised of a gas compressor, reactor and storage system, was delivered to the MefCO₂ site at RWE's Niederaussem power plant in late October. The equipment is currently being integrated with other subsystems. After commissioning, which is expected to be completed in January 2019, the system will be able to produce 1 ton of methanol per day.

CRI's ETL equipment in Niederaussem is comprised of two portable modules, which will be transported off-site upon completion of the MefCO₂ project in 2019. The next deployment of the ETL system will be at a steel mill in the north of Sweden, where the versatility of the ETL technology will again be on display, as CO₂ and H₂ will be derived from blast-oven furnace gases.

Click [here](#) for more information.

Croda releases new biobased surfactants

CRODA

Croda

Croda International Plc has announced the official launch and certification of its ECO range of bio-based surfactants, ingredients designed to meet increasing market demand for sustainable, high-performance ingredient options.

The new 100 percent bio-based and 100 percent renewable range of non-ionic surfactants is the widest commercially available and is certified to meet the criteria of the USDA BioPreferred® program. The new ECO range is the result of a

significant investment made by Croda in its Atlas Point manufacturing site in New Castle, Delaware to construct an ethylene oxide plant using naturally derived feedstocks. The first of its type in the United States, the completed plant supports the evolution of Croda's product line, reinventing many of its active emulsifying agents to meet the increasing demand for more sustainable products without sacrificing performance.

Sold under an ECO brand prefix across Croda's market sectors, these ingredients will lead to the creation of both new and re-imagined products, including: cosmetics and hair care products for the personal care industry; lubricants and coatings in the automotive industry; air- and surface-care products in the cleaning industry; as well as drilling fluids in the oil industry. The range offers a wide variety of benefits including emulsification, detergency and cleansing, and solubilisation, while delivering mild and stable formulations.

With the ECO range, Croda has further evolved the market leading products, creating a step change by offering bio-based and renewable options that reduce the reliance on fossil fuels and lower the carbon footprint of these ingredients versus their petroleum-based alternatives. By simply replacing a petroleum-derived ingredient with its renewable variant, a significant improvement in bio-based content and renewability can be achieved without a sacrifice in product performance.

Click [here](#) for more information.

Braskem joins European Biobased Industries Consortium



European Biobased Industries Consortium

Chemicals company Braskem has announced it has joined European network Bio-based Industries Consortium (BIC) as a full member.

BIC represents the private sector in the Bio-based Industries Joint Undertaking (BBI JU), a public-private partnership (PPP) with the EU worth €3.7 billion. By joining BIC, Braskem has become part of a wider network committed to bringing bio-based products to market.

Established as a pillar of the European Commission Bioeconomy Strategy, BBI JU operates under EU research and innovation programme Horizon 2020. It supports the development and production of bio-based products in Europe via biorefining research and demonstration projects, including large-scale commercialisation, through investment in innovative manufacturing facilities and processes.

Click [here](#) for more information.

Consumer Products

Co-op announces nationwide release of compostable food bags



Wikimedia Commons

More than 1,000 Co-op food stores are at the forefront of the retailer's moves to ditch single-use plastics, with new compostable carriers set for roll-out.

The community retailer is rolling out its new compostable carrier bags to over 1,000 communities in a move estimated to replace around 60M single-use plastic bags UK-wide.

The bags are initially available in Co-op food stores in communities where they are accepted by the Local Authority in the household food waste collections.

Shoppers - who forget their bag-for-life - can use the compostable bags to carry shopping home, the carriers then have a secondary use as food waste caddy liners. The bags can be turned into

peat-free compost along with the household food waste, and are approved for home composting.

The compostable carriers are priced at 5p, the same price as the conventional single-use plastic bags that will be removed.

The roll-out follows live consumer testing in 22 stores in the Greater Manchester earlier this autumn. The move is part of Co-op's new hard-hitting ethical strategy called "The Future of Food – a recipe for sustainability" which sets out how the Co-op will tackle plastic pollution as well as food waste, healthy eating, saving energy and trading fairly.

The Co-op's pledge on plastic will see all its own-brand packaging become easy to recycle by 2023. All own-brand black and dark plastic packaging, including black ready meal trays, will be eliminated by 2020. The initiative to ditch single-use plastics will see it increase recyclable packaging and materials. Almost three out of four products that the Co-op makes are now widely recyclable, which accounts for 95% of its products when measured by weight.

The Co-op's strategy has been developed to meet the UN's sustainable development goals to end poverty, protect the planet and ensure prosperity for all by 2030.

Click [here](#) for more information.

Covestro to make sport flooring from CO₂



PxHere

For the first time, synthetic sports floorings can be produced with carbon dioxide – which means less crude oil is needed as a raw material. The world's first subfloor of this kind has now been opened in the hockey facility of a renowned sports club in Krefeld in western Germany. The particularly sustainable new material comes from the materials manufacturer Covestro, which has developed a ground-breaking process for CO₂ utilization to market maturity. This can save up to one-fifth of crude oil in production – an innovative contribution to resource preservation and recycling management.

The CO₂ for the subfloor is contained in a binder – or more precisely, in one of its components, a so-called polyol. So far, the new CO₂-based material called cardyon® has been used to produce soft polyurethane foam for mattresses and upholstered furniture, which is already being marketed. The further development for use in sports is now the next step in the expansion of the range of applications.

The use of CO₂ as a raw material for plastics is made possible by a particularly environmentally friendly technology that Covestro has developed together with its partners. CO₂ is used as a supplier of the important element carbon – instead of petroleum-based raw materials. Up to

20 percent of traditional fossil raw materials can thus be replaced by carbon dioxide. Covestro produces the new CO₂-based polyols at its Dormagen site near Cologne. The carbon dioxide comes from a neighbouring chemical company, which produces it as a by-product.

Click [here](#) for more information.

Bio-On to work with Unilever on personal care products

Unilever and Bio-on have announced the start of a strategic partnership to develop, produce, and sell personal hygiene and care products that guarantee a smaller or no environmental impact. Using patented bio-technologies for natural, biodegradable microplastics production, Unilever and Bio-on are taking an important step towards building a more sustainable economy and more responsible consumption in the personal care sector.

This collaboration is designed to meet the demands of consumers, who are increasingly concerned about sustainability and making purchasing choices that respect the environment, whilst making the most of the skills and excellence at both companies.

Unilever's knowledge and large-scale presence on the personal care market with noted brands such as Mentadent, Dove, Zendium, Glysolid, and Sunsilk, teams up with the exclusive know-how of Bio-on, the Italian company listed on the AIM segment of Borsa Italiana and specialised in biotechnologies applied to widely used materials, to create completely natural products and solutions.

Click [here](#) for more information.

Kellogg to pursue sustainable packaging

The Kellogg Company has announced that it is expanding its Global Sustainability Commitments to include a goal of working towards 100 percent reusable, recyclable or compostable packaging by the end of 2025. This aspiration builds on Kellogg's current sustainable packaging commitment, as part of its Sustainability 2020 goals, to continue to ensure 100 percent of all timber-based packaging is either recycled or certified as sustainably sourced.

According to the Ellen MacArthur Foundation (EMF), of the 311 million tonnes of plastic produced each year, only 14 percent of plastic packaging is collected for recycling globally and just 5 percent of it is retained for secondary use.

Kellogg has already made steps toward "greening" its own facilities. In April 2018, the company announced the transition to compostable and paper food service products in all of its plants and offices globally by the end of 2018, fully eliminating all remaining single-use foam and plastic serviceware, plastic straws and plastic water bottles.

Kellogg has also been actively working with its suppliers to identify packaging designs that minimize waste while ensuring the quality and safety of its foods. For example, in Europe, the company has launched a project to move its cereal pouches to a recycle-ready material by late 2019, which will remove an estimated 480 tonnes of non-recyclable packaging from its supply chain each year.

Click [here](#) for more information.

Patents

Polymer blends with controllable biodegradation rates

Biodegradable compositions of polybutylene-succinate (PBS) or polybutylene-succinate-adipate (PBS A) with biobased 3-hydroxybutyrate copolymers are described. In certain embodiments, the copolymer increases the biodegradation rate of the PBS or PBSA. Methods of making the compositions of the invention are also described. The invention also includes articles, films and laminates comprising the compositions.

Click [here](#) for more information.

Biobased hydroxy-urethanes as reactive diluents

Provided herein is a method of preparing a biobased hydroxy-urethane. The method includes reacting a cyclic carbonate with a diamine in the absence of an isocyanate. Also described provided herein are biobased hydroxy-urethane materials prepared by the method, coating compositions including the biobased hydroxy-urethane materials, and methods of coating a substrate using the biobased hydroxy-urethane materials.

Click [here](#) for more information.

Events

IBioIC Annual Conference Glasgow, 30th-31st January 2019

IBioIC's Annual Conference is the leading general IB conference in the UK. The conference celebrates the success of the biotechnology industry in Scotland and provides delegates with the networking opportunities needed to drive new collaborations.

IBioIC's Annual Conference 2019, Industrial Biotechnology for a Sustainable Future, will take place on Wednesday 30th and Thursday 31st January 2019 in the Technology Innovation Centre, Glasgow.

Click [here](#) for more information.

The European Biopolymer Summit 2019 Ghent, 13th-14th February 2019

The European Biopolymers Summit 2019 will bring together senior executives and experts working in the biopolymers sector, from manufacturers, chemical companies and consultants to discuss the latest developments and future prospects for the industry.

The two-day event will take place in Ghent, Belgium, over 13-14 February 2018 and will cover topics such as: current environmental projects and regulations within the biopolymer industry; assessing the feedstock landscape for biopolymers' production; biopolymers in the circular economy; introducing new technologies in processing new bio-based materials; assessing the bio-based new content; and more.

Click [here](#) for more information.

Gasification 2019 Brussels, 13th-14th March 2019

The conference will showcase the latest developments in the sector and provide key insights from senior executives in the industry to discuss the latest commercial and technical developments, challenges and research breakthroughs throughout the entire gasification market.

Click [here](#) for more information.

World Bio Markets 2019 Amsterdam, 1st-3rd April 2019

Come and connect with the bio-based producers with revolutionary chemical properties for your industry, and gain insights into practical, commercially viable, actionable organisational change from other brands who have been through it with success.

For the wider industry, come and connect with the most exciting bio-based producers, ranging from well-backed start-ups to truly global chemical giants to help your businesses grow or regions succeed – and the brands carrying these products to consumers.

Click [here](#) for more information.

Plant Based Summit 2019

Lyon, 22nd-24th May 2019

In May 2019, Plant Based Summit will launch its 5th edition in Lyon, with an even sharpened positioning on the innovation, the co-development and its operational implementation for the necessary deployment of bio-based products. It will be the opportunity for the participants to contribute to the evolution of plant-based, green and sustainable chemistry!

The 2019 congress is still focused on stimulating biobased product development through a market driven approach. You gain access to more than 700 professionals from all the biobased chemical industry value chain.

At Plant Based Summit, each stakeholder in the biobased economy is able to share, find the best solutions to fit its own specific place and development stage, enabling it to make the decisive leap forward, thus contributing to empower the biobased economy.

Click [here](#) for more information.

EUBCE 2019

Lisbon, 27th-30th May 2019

The EUBCE is the leading platform for the collection, exchange and dissemination of scientific and industrial know-how in the field of biomass.

The EUBCE combines one of the largest biomass science and technology conferences with a high-quality industry exhibition, attracting biomass professionals from around the globe.

Click [here](#) for more information.

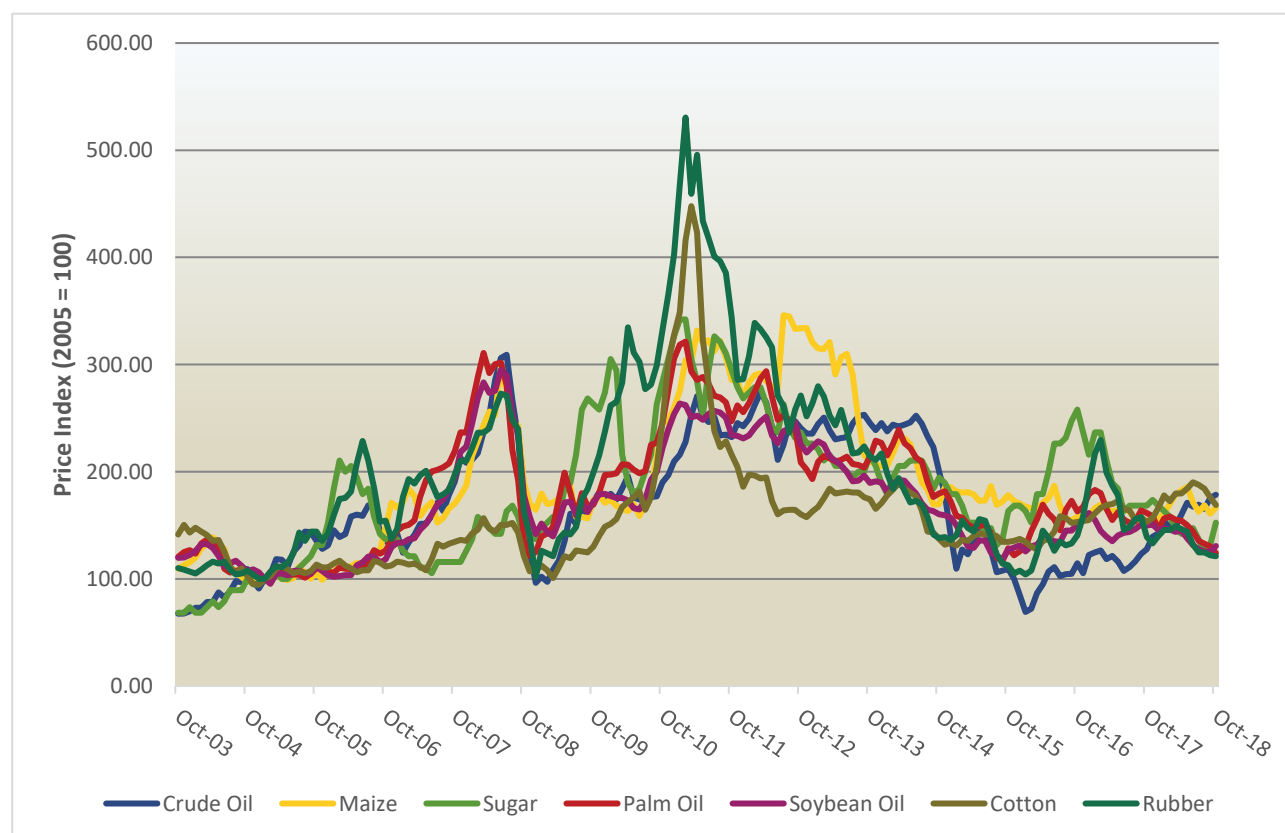
Price Information

Spot Prices of feedstocks as of today and five years ago, and percentile price change.

Item	Price, US\$ (Oct 13)	Price, US\$ (Oct 18)	Price Change
Crude oil (petroleum, barrel)	105.43	76.73	-27%
Maize (corn, metric ton)	201.73	160.26	-21%
Sugar (pound)	0.41	0.29	-29%
Palm oil (metric ton)	859	499.15	-42%
Soybean oil (metric ton)	987	680.72	-31%
Cotton (kilogram)	1.97	1.91	-3%

For details on indexes 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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