

The Bioeconomy Consultants



## News Review

Issue Sixty-Two

May 2017

**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

As the sun beams down on York, a comparatively warm welcome to May's Biobased Products News Review.

The bioeconomy moves so fast, what with rapid technological advances, ever-shifting policy and growing awareness among the general public for the benefits of the bioeconomy. In that respect, you could say keeping abreast of the world's biobased goings-on is never tiresome, but certainly this month it is *tyre*-some! Terrible puns aside, there have been two separate news stories this month concerning tyres. Tyres are a massive market and widely important product, what with the ever-growing automotive industry (but equally, those of us who cycle to work contribute also), but biobased tyres isn't something you'd often think about. After all, being made of rubber, tyres are inherently biobased to some degree (in most tyres there is up to 30% natural rubber in the compound used), but this does not necessarily mean they are sustainable: a rubber tree has a 7-year growth cycle, and is very environmentally sensitive, making producing rubber on a large scale a significant logistical challenge. This may be about to change however, as researchers at Continental Tire have recently been looking at a species of Russian dandelion which produces latex nearly identical to that of the rubber tree, but being a weed species it is much hardier and has a much shorter growth cycle, meaning it could potentially be a much more economically viable means of producing natural rubber.

But rubber isn't the only component of tyres – the vast majority of tyre compounds are synthetic, and this usually is from petroleum sources. However, this month Amyris, Kuraray, and Dunlop have announced that the latter's newest tyre contains liquid farnesene rubber (LFR) derived from Amyris' biobased farnesene. Not only this, but Dunlop state that the new tyre featuring LFR has set new standards for winter performance and durability, once again highlighting how biobased products can bring unique properties that improve on existing products.

If you aren't tyre-d (I'll get my coat) of biobased news thus far, read on for the latest news.

# Policy

## EU Votes to tighten waste collection policy

Members of the Parliament (MEPs) have unanimously rejected "watered-down" ambitions for resource efficiency across the continent by 2030. The plenary vote has advocated to reinstate the 70% target for municipal waste recycling, strengthening current proposals by 5%.

Meanwhile, a 2030 target for packaging recycling was voted to be 80% - higher than the 75% previously backed by the Commission. And the waste-to-landfill target has been restricted to 5%, replacing a mandatory target of 10% by 2030. MEPs have also voted for a European Union (EU) food waste reduction target of 30% by 2025 and 50% by 2030, compared to 2014.

Today's proposals also strengthen EU provisions on waste prevention and extended producer responsibility (EPR), increase the use of economic instruments such as incineration taxes and deposit-return schemes, and provide more clarity on the decontamination of hazardous components in waste.

The Circular Economy Package will only be finalised once both the European Parliament and the Council of Ministers agree on an identical text. Malta, which holds the rotating EU Presidency, has said it will try to reach a deal with MEPs before 1 July, when its six-month Presidential term ends.

Click [here](#) for more information.

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# Markets

## Amyris strikes China-based deal with Blue California



*Amyris*

Amyris Inc., the industrial bioscience company, has announced that it has expanded the scope of its relationship with Phyto Tech Corp (D/B/A "Blue California"). Blue California is based in Southern California and is a global leader in food, flavour and fragrance ingredients and nutraceuticals.

Amyris No Compromise® ingredients into China have been more than doubling in sales and are expected to continue strong growth in the personal care and nutrition segments. To support this product growth without capital investment, Amyris has entered into an agreement with Blue California whereby its affiliates will provide access to its fermentation manufacturing in China and provide the necessary capital to produce No Compromise ingredients for Amyris. Blue California and its affiliates have an expanding fermentation production base in China with capacity to support the Amyris technology. This partnership also includes Blue California's status as the preferred contract manufacturer for Amyris outside China when and where it is able to meet the current cost structure of Amyris production to maintain Amyris's low cost, high performance product value proposition. In this relationship, Amyris will provide the technology and our partner is providing the capital and capacity for

manufacturing that meets Amyris's demand and Amyris is responsible for delivering the products to its customers and collaboration partners.

With the strong demand for farnesene-based Vitamin E oil with another Amyris partner in China, and the company's opportunity to supply intermediates and ingredients for the large and fast growing Chinese food ingredients market, the revenue opportunity in China is significant. The company expects to generate \$50 million or more in revenue over the next 12-18 months from its sales into China.

Click [here](#) for more information.

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## New Venture Capital fund for Synthetic Biology Projects



*SynBioBeta*

US-based venture capital fund Data Collective has announced that it is partnering with SynBioBeta to launch a new synthetic biology venture fund.

Data Collective will join forces with SynBioBeta founder John Cumbers to launch the DCVC SynBioBeta fund, a pre-seed and seed VC fund to invest in synthetic biology startups. John Cumbers, an expert on the synthetic biology industry, will support the fund to make early-stage synthetic biology investments.

Synthetic biology applications range from the production of biologicals such as insulin or therapeutic antibodies, to the genetic engineering

of microorganisms or plants for the production of biofuels. Undoubtedly, it will impact many areas including agriculture, healthcare, environment, chemicals and materials.

With the newly launched fund, Cumbers and DCVC aim to further advance the progress within this field, which is expected to revolutionize a number of industries.

Some of the companies currently at SynBioBeta that are actively thinking about these aspects include Swiss Syngenta, which uses synthetic biology to produce engineered crops or British Isomerase Therapeutics, which engineers natural microbial products to yield new therapeutic compounds. Finally, Oxford Genetics is purely specializing in synthetic biology to develop and optimize biological products for its customers.

There is a lot to expect from the synthetic biology movement as public engagement is increasing and competitions such as iGEM are empowering the next generation of scientists to embark within this exciting field.

Click [here](#) for more information.

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## Bioplastic Market diffusion analysis

The emerging bio-based economy is initiating a shift from fossil-based resources towards renewable resources. The use of biopolymers is seen as being a key component in sustainable product development. Research on biopolymers for bioplastics production mainly focuses on product development, environmental performance and cost-related aspects, and neglects the issue of bioplastic market diffusion. This paper aims at identifying the factors influencing the market diffusion of bioplastic by considering the four biopolymers: polylactic acid (PLA), polyhydroxyalkanoate (PHA), lignin and cashew nut shell liquid (CNSL). Scenario techniques employing effects analysis and cross impact

analysis are applied in the assessment. The effects analysis shows that the price of PLA and PHA is influenced by the process costs, whereas the prices of CNSL and lignin based novel bio-based plastic materials, are influenced by further technological innovations. The sales volume of all four biopolymers largely depends on the price as well as on marketing activities. The cross-impact analysis identifies a range of possible outcomes. While a further price reduction and an increasing sales volume can be assumed likely in the case of PHA and lignin, the scenarios for PLA and CNSL are rather uncertain. The results provide insight into the possible impact of further price and sales volume developments in the bio-based plastic market.

Click [here](#) for more information.

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### **Technavio predicts big growth in Biobased Platform Chemicals market**

According to Technavio bio-based platform chemicals are compounds containing two to six carbons and are derived from renewable resources. They are used as important precursors for producing a variety of chemicals and materials, such as pharmaceuticals, perfumes, solvents, fuels, and polymers. Platform chemicals are two to six carbon-containing compounds derived from fossil fuel resources. They are used as important precursors for producing a variety of chemicals and materials, such as pharmaceuticals, perfumes, solvents, fuels, and polymers.

Technavio's analysts forecast the global bio-based platform chemicals market to grow at a CAGR of 10.88% during the period 2017-2021.

Click [here](#) for more information.

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### **Biopolymer market set to grow - Global Market Insights**

Biopolymer Films Market size was valued at over USD 3 billion in 2015 and will witness gains close to 7% CAGR by 2024.

Positive growth indicators in the food & beverage industry along with increasing food packaging demand for prolonged preservation has substantially driven the overall biopolymer films market size over the past few years. The overall food & beverage business in 2005 was roughly around USD 8 trillion and reached approximately USD 15 trillion in 2015. This inclination was particularly driven by growing population along with increasing restaurant & food joints visits of middle class population in Asia Pacific and Latin America, on account of increasing consumer spending power in these regions.

Besides various advantages offered by the product. High product cost in comparison with synthetic and semi-synthetic films is one of the major pitfall faced by the biopolymer films market share contributors. In addition, relatively low vapor barrier and mechanical properties of the product may hamper industry growth in the coming years. However, technological advancements such as multilayer films and atomic layer deposition has introduced products with promising characteristics. The aforementioned trends along with increasing consumer awareness towards bio-based product usage and government support towards bio-based product usage will create new industry growth prospects over the projected timeframe.

Click [here](#) for more information.

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# Research & Development

## MetGen commercialises enzymatic glucose conversion process



*MetGen*

MetGen has invented a revolutionary chemo-enzymatic pathway that enables streamlined processes towards platform chemicals, for example FDCA.

MetGen's ENZINE® Technology Platform allows the design and production of the necessary enzymes for full bioconversion of glucose. Required enzymatic solutions have not been commercially available – until now. The advantage of this enzymatic reaction stems from the complete conversion of the glucose. In the conventional fructose-based process the conversion between glucose and fructose reaches an equilibrium at less than 50% fructose, therefore requiring an additional and inefficient separation step. It is noteworthy in the case of MetGen's approach that no additional chemicals or co-factors are needed in order to perform the bioconversion.

Furthermore, MetGen has filed a patent on the chemical route to convert the resulting sugars to oxidized forms of 5-HMF. In that respect, the dehydration of the MetGen's bioconversion product is considered to be much more efficient than the dehydration of fructose: This form of sugar is known to have above 90% conversion yields, whereas fructose dehydration has only around 60% yield.

MetGen's MetZyme® enzymatic solutions cover the entire bio-based value chain from feedstock to high-value chemicals and enable the use of cellulosic feedstocks as well as the creation of entirely new bio-based materials. In this context, MetGen's latest innovation also applies to the conversion of all types of cellulosic sugars to more easily chemically convertible sugars. This is believed to represent a major boost to the cost-competitiveness of any biorefinery concept.

MetGen's new innovation therefore allows the possibility of dramatically improving the efficiency and economics of renewable chemicals production including, but not limited to, bioplastics.

On the whole, MetGen's new innovation therefore provides a possibility of dramatically increasing the efficiency and economics of renewable chemicals including, but not limited to, bioplastics. As such, it is therefore potentially a key accelerator of the displacement of fossil fuels as a feedstock by bio-based alternatives.

Click [here](#) for more information.

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## Towards flame-retardant biobased plastics?

Natural fibres and bio-based composites are competitive to conventional materials in structural and transportation industry. Natural fibres reinforced polymer matrix composites are familiar/common materials currently. Various properties of these composites have been explored in the already available literature, and has been continuing with new developments. They have a risk of flammability in most of the applications which is undesirable. Fire retardant natural fibre and bio-based composite materials have recently gained researchers' interest. This paper summarizes recent progress regarding flammability of natural fibre and bio-based composites. The mechanism of fire retardancy has

been explained. The factors affecting flammability of such composites and characterization techniques required for evaluating fire retardancy have also been described in detail. The reported effects of fire retardant include practices on the other properties of composites.

Click [here](#) for more information.

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## Improving batteries and superconductors with seaweed



*Flickr*

Researchers have made a seaweed-derived material to help boost the performance of superconductors, lithium-ion batteries and fuel cells.

Traditional carbon materials, such as graphite, have been essential to creating the current energy landscape. But to make the leap to the next generation of lithium-ion batteries and other storage devices, an even better material is needed, preferably one that can be sustainably sourced.

With these factors in mind, the researchers turned to the ocean. Seaweed is an abundant alga that grows easily in salt water. The researchers have previously tried to make porous carbon nanofibers from seaweed extract. Chelating, or binding, metal ions such as cobalt to the alginate molecules resulted in nanofibers with an “egg-box” structure,

with alginate units enveloping the metal ions. This architecture is key to the material’s stability and controllable synthesis.

Testing showed that the seaweed-derived material had a large reversible capacity of 625 milliampere hours per gram (mAhg<sup>-1</sup>), which is considerably more than the 372 mAhg<sup>-1</sup> capacity of traditional graphite anodes for lithium-ion batteries. This could help double the range of electric cars if the cathode material is of equal quality. The egg-box fibres also performed as well as commercial platinum-based catalysts used in fuel-cell technologies and with much better long-term stability. They also showed high capacitance as a superconductor material at 197 Farads per gram, which could be applied in zinc-air batteries and supercapacitors. The researchers published their initial results in ACS Central Science in 2015 and have since developed the materials further.

More work is needed to commercialize the seaweed-based materials, however. Currently more than 20,000 tons of alginate precursor can be extracted from seaweed per year for industrial use. But much more will be required to scale up production.

Click [here](#) for more information.

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## Safety test for cellulose nanomaterials developed

In the commercial development of novel nanoscale materials, a proactive approach toward safe commercialization requires assessment of material safety for manufacturing, in product use and for environmental impacts. The goal of this study was to design an industrially-relevant testing strategy and develop key data on lignin-coated cellulose nanomaterials to evaluate their safety before wide-scale market introduction and subsequent commercialization. The testing plan developed to evaluate BioPlus® lignin-coated fibrils (L-CNF) and BioPlus® lignin-coated crystals



(L-CNC) considered a range of potential uses, and employed a variety of standard and tailored protocols to characterize physico-chemical properties, human health effects and environmental fate and toxicity. For human health studies, acute oral toxicity testing as well as dermal and eye irritation studies were completed. Results reveal no oral, dermal or ocular toxicity following L-CNC and L-CNF exposure at the highest doses tested. Testing conducted to evaluate potential environmental effects included aquatic toxicity testing of bacteria (*Vibrio fisheri*), algae (*Pseudokirchneriella subcapitata*), invertebrates (*Daphnia magna*), and vertebrates (*Danio rerio*). A unique aspect of the study was that in general, testing was performed at environmentally relevant concentrations. Virtually no toxic effects were reported for either L-CNC or L-CNF in these tests, even at artificially high concentrations that could not feasibly occur in the environment. Together with published studies examining the effects of related and conventional substances, these results demonstrate that L-CNC and L-CNF are relatively non-toxic for the broad range of endpoints considered, much like their conventional cellulosic counterparts. These results were anticipated, due to the ubiquity of cellulose in commerce and in the environment, however publication of such negative results is rare, yet critically important to further understanding of the disposition of commercially relevant nanoscale materials.

Click [here](#) for more information.

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# Polymers

## **BASF announces partially biobased copolyamide**



## The Chemical Company

*BASF*

Ultramid® Flex F38 L is an entirely new and partly bio-based copolyamide. Thanks to its softness and transparency even at low temperatures and low humidity, this polyamide is ideally suited for soft packaging. Tear and puncture resistance are also increased in an even softer film. Films made of Ultramid® Flex F are even soft immediately after processing and without conditioning. This offers huge advantages for film processing at low temperatures and low humidity.

A quarter of the raw material used for the monomer is sourced from regionally-grown rapeseed oil. Ultramid® Flex F38 L supports the trend towards more sustainable packaging solutions. For the packaging industry, the new Ultramid® Flex F unlocks entirely new opportunities for launching bio-based products onto the market.

With a CO<sub>2</sub> and O<sub>2</sub> permeability 15 times higher than in conventional polyamide 6, the new Ultramid® Flex F38 L possess considerably changed barrier properties. For example, Ultramid® Flex F is ideally suited for use as cheese ripening bags.

Thanks to its high flexibility and softness, the new Ultramid® can also be used to produce soft vacuum and shrink bags. The product also allows for conventional stretching ratios in deep-drawing processes – without any stress whitening.

In addition to its use in the food industry, the new Ultramid® Flex F is the ideal solution for a wide array of technical films that are characterized by sufficient ductility and tear strength even at lower temperatures.

Ultramid® Flex F38 L has a considerably higher melt stability than conventional polyamides, allowing for an outstanding bubble stability and higher blow-up ratio. These processing properties enable users to optimize the entire film structure.

Click [here](#) for more information.

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## FKuR up to 65% biobased in their injection moulding grades

The bioplastics specialist FKuR Kunststoff GmbH of Willich, Germany has extended its product range of cellulose acetate based injection moulding grades. In addition to the current standard grade, C9550, this portfolio now also includes the new grades Biograde® C 5509 CL and C 5508, which are both based on a newly developed combination of raw materials and additives. Along with other benefits, their ASTM D 6866 bio-based content [BCC] has been increased from 50% to over 65%. Both grades can be easily processed with short cycle times on standard injection moulding machines with universal screws, even in multi-cavity moulds. The cellulose used for Biograde® originates from sustainable forestry wood, tropical wood is not used.

The transparent Biograde® C 5509 CL is thermally stabilized resulting in a Vicat A softening temperature of 100 °C and a heat distortion temperature (HDT B) of 80 °C. As a result of its high melt flow index, Biograde® C 5509 CL is suitable for the production of components with thin wall thicknesses and long flow paths. With the appropriate masterbatch, it can also be coloured easily.

If opaque or translucent components are required, FKuR alternatively offers Biograde® C 5508. This translucent cellulose compound has a lower MFR when compared to C 5509 CL and is preferred for smaller and thicker-walled injection-moulded parts.

All Biograde® compounds from FKuR are characterized by their high stiffness, tensile and impact strength as well as a pleasant surface finish. Typical application areas include injection moulded engineering parts, e. g. for the electronics and appliance industry, as well as consumer products such as toothbrushes, ball-point pens or cutlery. All grades are free from harmful plasticizers and suitable for food contact according to EN 10/2011 and FDA as well as for the production of children's toys.

Click [here](#) for more information.

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## API to develop Nanocellulose reinforced plastics



*Wikimedia Commons*

American Process Inc. (API), Will & Co B.V., and P.R.G. B.V. recently signed a Joint Development Agreement to develop, produce and supply ready-to-use thermoplastic compounds reinforced with nanocellulose. While conventional cellulose-based fibres are currently used in plastic compounding for commercial products, high aspect ratio,

crystalline nanocellulose can offer unique features including enhanced mechanical properties.

Nanocellulose is a versatile high-strength, light-weight renewable biomaterial that Thomson Reuters named as one of the top 10 technologies that will change the world by 2025. API has been granted seven patents and has over 100 patents pending in the nanocellulose field.

Click [here](#) for more information.

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### **Bio-On commissions dedicated PHA plant**

A new production plant dedicated solely to special PHA production for advanced niche products has been established by Bio-on. This will compliment other large-scale plants licensed by Bio-on around the world for PHAs output from 5,000 to 10,000 tons per year.

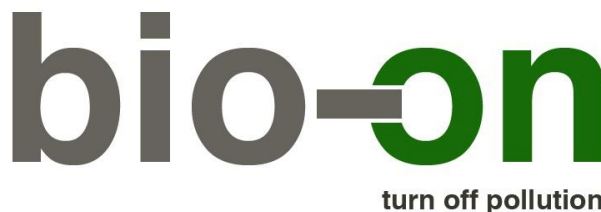
Bio-on Plants is a new company set up by Bio-on to meet the increasing number of requests in PHAs production (polyhydroxyalkanoates) for special uses. Bio-on Plants is an exclusively productive unit for the study and development of PHAs through bacterial fermentation.

The new plant is based in Castel San Pietro Terme in the province of Bologna. The plant has a capacity dedicated to the research into and production of 1,000 tons per year rapidly expandable to 2,000 tons per year. The plant is equipped with the most modern technologies and the most advanced research and development laboratories. New agricultural waste carbon sources for producing biopolymers are continuously tested to increase the range of technologies offered by Bio-on.

Click [here](#) for more information.

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### **New collaboration to produce PHA plastic from glycerol**



*Bio-On*

Bio-on and Greenergy International Limited have signed an agreement to begin a technical collaboration, the first in the United Kingdom, to look at the possibility of producing PHAs bioplastic from Glycerol, a biodiesel production co-product. The two companies will work together to establish the feasibility of building in the United Kingdom a 5-thousand ton per year plant expandable to 10 thousand tons per year.

Greenergy is Europe's largest manufacturer of biodiesel from waste with two production plants in the North East of England, and produces biofuel from waste streams from the food industry, such as used cooking oil. Its technical collaboration with Bio-on will investigate the potential to manufacture PHAs biopolymers from glycerol on an industrial scale in the UK. «We are looking at the potential to integrate the Bio-on technology into our existing biodiesel processes and thereby add value to our existing activities» explains Paul Bateson, Chief Operating Officer at Greenergy.

The revolutionary PHAs bioplastics (polyhydroxyalkanoates) developed by Bio-on are made from renewable plant sources with no competition with food supply chains. They guarantee the same thermo-mechanical properties as conventional plastics with the advantage of being 100% eco-sustainable and naturally biodegradable at ambient temperature.

The new collaboration between Bio-on and Greenergy International Limited is an important milestone for creating a global platform for bioplastic production in the future.

Click [here](#) for more information.

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## Chemicals

### **Modular Genetics' surfactants awarded BioPreferred and Palm Oil-Free status**

Modular Genetics, Inc. (Modular) is a sustainable chemistry company utilizing advanced technology in synthetic biology to produce specialty chemicals that are cost competitive, provide superior performance and are environmentally friendly.

Surfactants are the chemicals that give bubbly products such as shampoos their cleaning power. Traditionally, surfactants have been manufactured using chemical methods that rely on petroleum or palm oil, with serious negative environmental impacts. Modular has developed "green" technologies that use a biobased approach to produce surfactants without using oil--no petroleum and no palm oil. Modular is honoured to report that the surfactants it produces using this technology have been awarded important certifications from both the United States Department of Agriculture ("USDA") and the Go Palm Oil Free organization attesting Modular's achievement of sustainability goals. Specifically, Modular's AminoSurf-ETM surfactants have earned both the USDA 100% BioPreferred® certification and the GPOF Palm Oil Free certification, and are the only surfactants that have been awarded both certifications.

The BioPreferred program in particular was created "to spur economic development, create

new jobs, and provide new markets for farm commodities" and Congress needs to re-authorize the 2018 Farm Bill with robust funding, so American companies, like Modular Genetics, will produce their innovative products domestically. Modular is excited to have been recognized by this important program. Similarly, Modular appreciates the recognition provided by the GPOF Palm Oil Free certification.

Click [here](#) for more information.

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### **Cray Valley releases adhesive resin derived from Amyris' Biofene**



*Cray Valley*

Amyris Inc., the industrial bioscience company, is pleased to announce Cray Valley's launch of new tackifying resins produced with the company's biologically derived Biofene® branded farnesene. The disruptive nature of Amyris's farnesene has enabled Cray Valley to create new tackifying resins that are based on monomers from sustainable biomaterials. As a result, these farnesene-based resins are not subject to the cost and supply instabilities of petroleum-based monomers or the typical natural variabilities that affect the quality of pinene and limonene monomers.

Cray Valley's Wingtack family of tackifying resins have been manufactured with piperylene (a volatile hydrocarbon that is a by-product of ethylene production) as a primary source. Utilizing new technology has enabled Cray Valley to use farnesene as a sustainably-sourced 30% replacement for piperylene and add Wingtack® EXTRA F30 to its product line of tackifiers while

maintaining solid performance, particularly for use in hot melt and hot melt pressure sensitive adhesives. Cray Valley will showcase this new technology and its product line at the Adhesive and Sealant Council (ASC) Conference and Expo April 3-5, 2017 in Atlanta.

Since tackifier resins typically are derived from trees or citrus fruit sources, or petroleum based feedstocks, this will tend to have a long-term impact on natural resources. However, Amyris's sustainably-produced farnesene, which forms the basis for a wide range of products — including tackifiers — supports solid product performance with the added benefit of utilizing a sustainable resource that is better for the planet.

Amyris's sugar cane-derived Biofene forms the basis for a wide range of products varying from specialty products such as cosmetics, perfumes, detergents and industrial lubricants, to transportation fuels such as diesel and jet fuel. As a tailor made pure hydrocarbon it provides numerous advantages when compared to petroleum-based oils and chemicals and is renewable, contributing to a sustainable future.

Click [here](#) for more information.

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## **Enerkem's biorefinery reaches all operational targets**



*Enerkem*

Enerkem Inc., a world leading waste-to-biofuels and chemicals producer, announced today that its first full-scale commercial facility, located in Edmonton, Alberta, has met all operational milestones set by its senior lender Integrated Asset Management (IAM).

In less than five minutes, Enerkem's technology turns household waste into 99.9 per cent pure liquid chemicals and biofuels. Since the start of production, the Enerkem Alberta Biofuels facility has been meeting the highest quality standards set by the International Methanol Producers and Consumers Association (IMPCA) for the production and sale of methanol. Last year, Enerkem's biorefinery also became the first ISCC certified plant (International Sustainability and Carbon Certification) in the world to convert municipal solid waste into biomethanol.

This pioneering facility has been financed by private sources and received funding support from Sustainable Development Technology Canada (SDTC), Alberta Innovates and Alberta Energy.

Click [here](#) for more information.

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## **Jungbunzlauer to produce acetyl-tributyl-citrate from Green Biologics' butanol**

Green Biologics, Inc., the U.S. subsidiary of Green Biologics Ltd., a U.K. industrial biotechnology and renewable chemicals company, announced today an exclusive collaboration with Jungbunzlauer Ladenburg GmbH, the German operating unit of Jungbunzlauer Suisse AG in Basel, Switzerland. In February 2017, Jungbunzlauer received its first shipment of 100 percent renewable BioPure™ n-butanol from Green Biologics' production facility in Little Falls, Minnesota. Jungbunzlauer aims to produce bio-based CITROFOL® BI (tributyl citrate) and bio-based CITROFOL® BII (acetyl tributyl citrate) for its customers with commercial shipments beginning next month.

Green Biologics announced the start-up of its first commercial production facility for renewable n-butanol and acetone in December 2016, with its first bulk export shipment to Jungbunzlauer in mid-January.



Green Biologics is a member of the American Chemistry Council (ACC) and is building its new green solvents facility to meet Responsible Care™ standards. The company's n-butanol and acetone have received 100 percent bio-based, USDA BioPreferred® status.

Click [here](#) for more information.

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## **Rennovia begins 1,6-hexanediol production**

Rennovia Inc., a privately held company that develops novel catalysts and processes for the cost-advantaged production of chemical products from renewable feedstocks, announced today that it has now successfully commissioned, and is operating, all core pilot plant operations for its sugars to 1,6-hexanediol (1,6-HDO) process.

1,6-HDO is a speciality chemical widely used today in a variety of formulated products, including coatings, adhesives, and elastomers. Renovia's novel production process employs its proprietary catalyst technology and is projected to provide 1,6-HDO with drop-in performance properties. This bio-based product is anticipated to have greatly reduced greenhouse gas and environmental impacts versus petroleum-based 1,6-HDO. In addition, Renovia's 1,6-HDO is a platform intermediate to several commodity chemicals with over \$20 billion market value, including hexamethylenediamine (HMD), adipic acid, and caprolactam.

The completion of key piloting activities and the development of a 1,6-HDO commercial design package are anticipated by the end of this year. Renovia is in active discussions with a number of potential strategic partners to support the commercialization of 1,6-HDO and downstream products. Archer Daniel Midlands Company (ADM), a current investor in the company, has expressed strong interest in supporting Renovia's commercialization of these products through feedstock supply and co-investment value chain partnering.

Click [here](#) for more information.

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# Consumer Products

## **Dunlop's new top tyre contains biobased rubber additive**



*Pixabay*

Amyris Inc., the industrial bioscience company, has announced that Sumitomo Rubber Industries Ltd. has adopted liquid farnesene rubber (LFR) as a performance enhancing additive for use in the production of its latest Dunlop-branded Winter Maxx 02 tires. LFR is a liquid rubber developed by Kuraray Co. Ltd using Amyris's biologically derived



Biofene® branded farnesene. The Winter Maxx 02 represents the brand's best tire to date for on-ice and snow-braking performance and for durability. LFR's breakthrough performance enhancement will be available across Dunlop's entire Winter Maxx 02 portfolio of 91 sizes.

The unique qualities of farnesene material, which is only available at commercial scale from Amyris, is propelling product innovation and rapidly growing demand from the company's customers. This has helped support Amyris's ability to post significant revenue growth for 2016 with expectations that product revenues will continue to significantly expand.

Click [here](#) for more information.

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### **Volcano coffee pods 100% biobased and compostable**

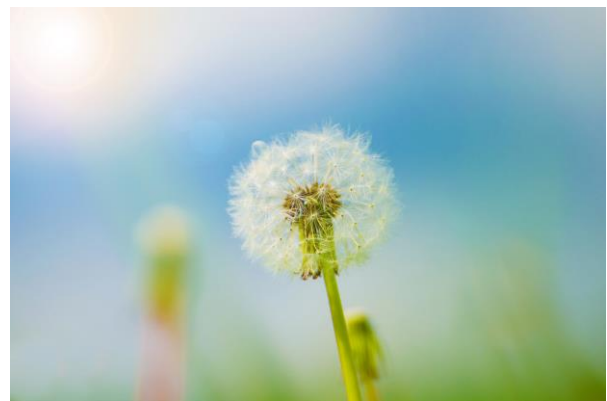
Coffee pods have many advantages, including convenience and consistency. However, they have one major drawback: their environmental impact, and that's something that Volcano have been working to counter. Plastic pods take 500 years to degrade, while aluminium pods aren't much better, taking around 150 years. Most recyclable pods are a mix of plastic and aluminium, combined with the dregs of the coffee, which means that most recycling plants won't accept them unless they are first completely disassembled and washed. Too few people have time to do that.

None of this sits well with Volcano's core belief of sustainability, which is why they use pods which are not only 100% biodegradable, but are also fully bio-based compostable as well.

Click [here](#) for more information.

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### **Tyres from Dandelion Rubber**



*Public Domain Pictures*

Most people view dandelions as a nuisance. But Continental Tire is embracing the flowering weed as a key component to the future of tires. In conjunction with The Fraunhofer Institute for Molecular Biology and Applied Ecology, Julius Kuehn-Institute, and EKUSA, Continental Tire has produced, and tested, the first tires where the tread is made 100 percent out of dandelion natural rubber. Plans are in place to begin manufacturing consumer road tires made from dandelion-derived rubber in five to 10 years.

Between 10 and 30 percent of a car tire includes natural rubber, while truck tires can include proportionally higher amounts. Today, natural rubber is still obtained almost exclusively from the rubber tree (*Hevea brasiliensis*) which can only be cultivated in what is referred to as the "rubber belt" around the equator. Global demand for natural rubber is set to rise in the next few years and at the same time, the changing world makes it challenging to meet this demand.

The growth cycle of a rubber tree is roughly seven years before it can start producing latex that can be used in rubber production. This latex is key as it has unique performance attributes that can't be replicated in synthetic rubber making natural rubber a must for tire production. Therefore, market demand is outpacing production capacities, a situation that, in the past, has led to unpredictable price volatility.

The team at Continental Tire looked to the dandelion as an alternative source of natural rubber - and a specific Russian species. This is the only dandelion that can be used as an alternative source for natural rubber production. The roots of this dandelion species contain the natural rubber latex meaning supply will be steadier and easier to control leading to greater price stability. This crop is also much less sensitive to weather than the rubber tree.

Click [here](#) for more information.

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### **Covestro, BASF, and Audi develop biobased clearcoat for cars**

In the automotive industry, manufacturers and suppliers are working constantly to reduce energy consumption and CO2 emissions in production. A project team consisting of employees of the car maker Audi, BASF's Coatings division and materials company Covestro has now passed a new milestone: for the first time, a clearcoat containing a biobased hardener was applied to test bodies of the Audi Q2 under near-series conditions at the Audi plant in Ingolstadt, Germany.

BASF developed the clearcoat using the biobased hardener Desmodur® eco N 7300 from Covestro. A total of 70 percent of the hardener's carbon content is sourced from renewable raw materials. This innovation reduces the consumption of fossil resources. The clearcoat forms the top layer of the coating system, lending it scratch resistance, a glossy appearance and protection against sunlight and other weather effects.

In addition, process steps are eliminated during biobased raw material production for this hardener, and thus leading to an additional reduction of CO2 emissions.

Click [here](#) for more information.

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### **BioPreferred certified plant nutrients from Anuvia**



*Anuvia*

Anuvia Plant Nutrients' GreenTRX for turf has received certification as a BioPreferred Product from the United States Department of Agriculture.

The USDA designation indicates that GreenTRX 16-1-2-17S-3Fe has a biobased content of 87 percent.

The certification verifies that 87 percent of the carbon in GreenTRX comes from a biological source. This certification will allow Anuvia to use the USDA BioPreferred logo on product packaging and it will give the company preferential treatment as a supplier to federal agencies.

The goal of the BioPreferred program, created by the 2002 Farm Bill and reauthorized and expanded as part of the Agricultural Act of 2014 (the 2014 Farm Bill), is to increase the purchase and use of biobased products. Ultimately, the USDA hopes the program will spur economic development, create new jobs and provide new markets for farm commodities.

Click [here](#) for more information.

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### **Sunscreen containing bio-based propanediol**

DuPont Tate & Lyle Bio Products showcased a new broad spectrum daily facial moisturizer formulation at their 10-Year Anniversary event held today in Loudon, Ten. The moisturizer uses

innovative techniques to maximize sun protection and enhance aesthetics.

Zemea® propanediol, produced by DuPont Tate & Lyle Bio Products, is the key component to deliver this performance. The water-in-oil emulsion combines both water-soluble organic sunscreen actives and inorganic sunscreen actives. Zemea® propanediol acts as a solvent to keep the powdered water-soluble organic actives in solution while evaporation of water occurs as the cream is applied to the skin. Keeping the actives in solution maximizes their performance, allowing them to effectively protect against UVA and UVB. Additional benefits of Zemea® propanediol include lack of skin irritation, improved humectancy, and excellent sensory characteristics, all ideal for producing an aesthetically pleasing facial moisturizer.

The new Zemea® propanediol containing formulation underwent in-vivo SPF testing including a 40-minute water resistance test. Critical wavelength and broad spectrum testing also was completed. The final recipe achieved an SPF three-times the level of sunscreen active used and provides broad spectrum protection, water resistance, and an SPF 25+. Although this is a daily facial moisturizer, the techniques are directly applicable in developing a sunscreen for beachwear.

Click [here](#) for more information.

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### DuPont Tate & Lyle release labelling scheme for bio-based products

Today's consumers are increasingly interested in knowing the ethical and environmental impact of the products they purchase. Recognizing this growing trend, DuPont Tate & Lyle Bio Products is launching a new hangtag program for its Susterra® brand, the building block that delivers high performance across a variety of polyurethane applications.

The first in the series of hangtags was unveiled today to key manufacturing customers from around the world attending a 10-year anniversary celebration event at the company's global headquarters and manufacturing facility in Loudon, Tenn. Other hangtags in the series will become available as new product innovations are introduced.

Highlighted on this hangtag are the three main advantages of Susterra® propanediol - 100 percent renewably sourced; manufactured in a sustainable manner; and backed by the innovative industrial biotechnology of DuPont Tate & Lyle.

Two versions of this hangtag will be available - in English and one for use in the Asia Pacific region that includes English, simplified Chinese, traditional Chinese and Korean.

Click [here](#) for more information.

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### CORDURA teams up with Dupont Tate & Lyle for bio-based clothing



CORDURA

INVISTA's CORDURA® brand and DuPont Tate & Lyle Bio Products announce a collaboration to deliver a new chapter in innovative sustainable textile solutions for performance fabrics. Now, designers of apparel, footwear and gear will have access to leading durable performance fabrics that incorporate sustainable materials.

Both companies, who share a common heritage by tracing their roots to DuPont, a global science

company, are marking major milestones. The CORDURA® brand is celebrating 50 durable years of continuous advancements that have helped shape the world of military, workwear and outdoor products. DuPont Tate & Lyle Bio Products is celebrating a decade of offering high performing ingredients from a sustainable and renewable source based on leveraging the tools of modern biotechnology.

DuPont Tate & Lyle's Susterra® propanediol durable coatings and waterproof, breathable membranes are manufactured through a proprietary fermentation process using plant-derived glucose. In addition to being renewably sourced, Susterra® is manufactured using a sustainable process that produces 50% less greenhouse gas emissions and consumes 42% less non-renewable energy than equivalent petroleum-based diols. At the manufacturing facility's full capacity, that is equivalent to taking 40,000 passenger cars off the road and turning off one million 100W incandescent lightbulbs for one full year.

Click [here](#) for more information.

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## Patents

### **Bio-Based Acrylate and Methacrylate Resins**

The disclosure relates generally to a bio-based acrylate and methacrylate resins comprising isosorbide acrylate/methacrylate or rosin acrylate/methacrylate.

Most polyester-based resins are prepared from monomers obtained from petroleum or are man-made materials ("conventional monomers"). With an increased focus on impact on environment and

health, there is an interest and/or a need to find suitable replacements to reduce health risk and negative environmental impact associated with carrier and toner production and use.

Bio-based monomers in polymeric materials reduce dependency on fossil fuels and render the polymeric materials more sustainable. Recently, the USDA proposed that all toner/ink have a bio content of at least 10%.

Toner resins using bio-based monomers were described, see, for example, U.S. Pat. No. 8,580,472. Nevertheless, there remains a need to use same successfully and to increase the bio-content of toner, and to incorporate bio-content into carriers, the other element of two-component developers comprising toner particles and carriers, while maintaining or improving favourable toner, carrier and developer properties.

Click [here](#) for more information.

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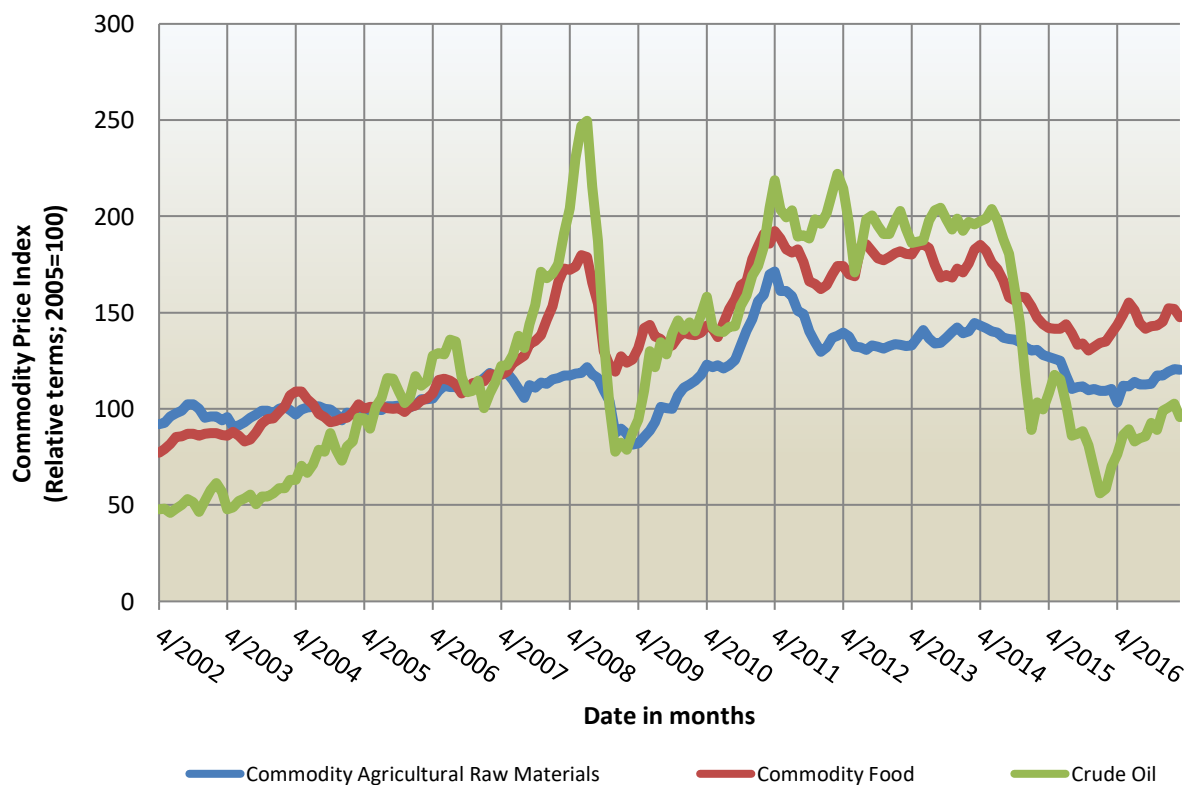
# Price Information

**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\$ (Mar 12)	Price, US\$ (Mar 17)	Price Change
Crude oil (petroleum, barrel)	117.79 (↑)	50.91 (↓)	-57%
Maize (corn, metric ton)	280.66 (↑)	158.97 (↓)	-43%
Sugar (pound)	0.2379 (↑)	0.1806 (↓)	-24%
Rapeseed oil (metric ton)	1,288.75 (↓)	839.92 (↓)	-35%
Soybean oil (metric ton)	1,196.53 (↑)	723.4 (↓)	-40%
Ethanol (gallon)	2.29 (↑)	1.55 (↑)	-32%

For details on indexes please see [www.indexmundi.com/commodities](http://www.indexmundi.com/commodities); Ethanol prices from Govt of Nebraska at [www.neo.ne.gov/](http://www.neo.ne.gov/)

## Raw materials 15-year Price Indices



For details on the nature of these commodities please see [www.indexmundi.com/commodities](http://www.indexmundi.com/commodities)

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