

Interest up for biobased technology

After many years of development and scale up, renewable and biobased technologies are coming to the market, attracting the attention of established major producers and technology providers

JOHN BAKER LONDON

It is a sign of the maturity of the green and biobased chemicals sector that major producers and technology providers are making moves to join the entrepreneurs and start-ups that have been driving the technology forward.

Just last month, for instance, Saudi Arabia's huge energy and chemicals major Saudi Aramco made a \$100m move to acquire the *Converge* carbon dioxide to polyols technology developed by US-based Novomer.

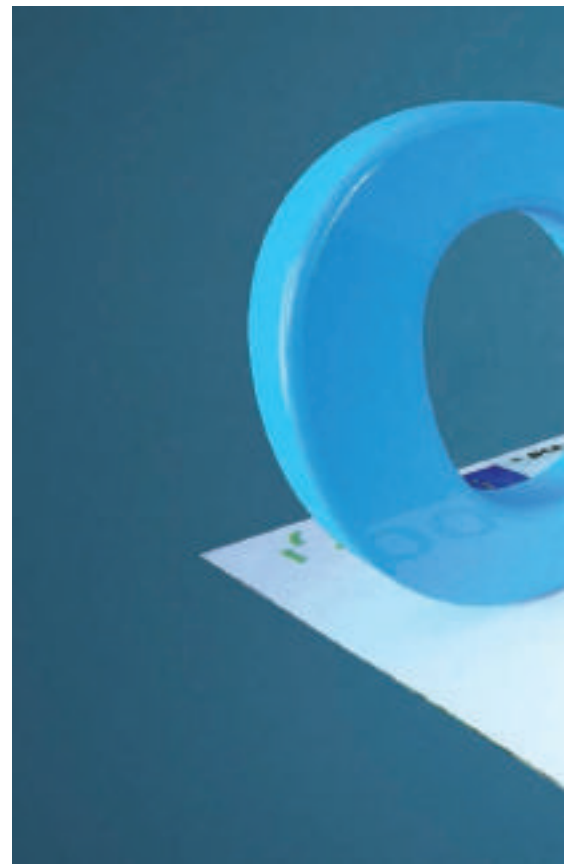
And in other moves this year, France's Technip and Finland's Neste have both signed agreements to co-develop biobased chemicals with partners, the latter with no less than IKEA, to develop a range of biopolymer products.

The Aramco deal, which covers Novomer's polyol business and associated technologies, is strategically motivated and is designed to enhance the Saudi company's drive downstream into specialty chemicals

in the country. It will also enable the development of new technological growth areas in line with Saudi Vision 2030 objectives of economic diversification and job creation, explains Aramco.

The *Converge* technology converts carbon dioxide into high-value end-products with significant performance, cost and carbon footprint improvements, notes Novomer. Saudi Aramco already has a venture investment in Novomer, made in 2013 through its Saudi Aramco Energy Ventures (SAEV) subsidiary to help accelerate the development and commercialisation of the *Converge* technology.

The Novomer technology provides a more sustainable alternative to conventional petroleum-based polyols that are used in coatings, adhesives, sealants and elastomers (CASE), which feature in high-value, high-demand end-products. These include flexible and rigid foams, with applications that cover a broad spectrum from automobile seats to building insulation panels.



Signing the deal, Amin H Nasser, Saudi Aramco president and CEO, said: "Some of Saudi Aramco's most significant achievements in recent years have been in developing new international partnerships in the downstream space. There is compelling industrial logic to the *Converge* polyol technology deal as it enables the conversion of waste CO2 into cleaner, high-value end-products with significant performance, cost and carbon footprint improvements."

By providing access to reliable feedstocks, financial stability and research and development (R&D) investment and focus, Aramco will be able to accelerate the commercialisation of the new polyol materials. This, it hopes, will help spur growth in the production of more sustainable finished and semi-finished products in the petrochemicals conversion sector, including within the small and medium enterprise sector in Saudi Arabia.

Compared to conventional polyols, *Converge* polyols have approximately one-third the carbon footprint. When incorporated into polyurethane formulations, they demonstrate superior material performance including increased strength; increased abrasion, chemical and weather resistance; increased adhesion, hardness and tear-strength; greater load bearing capacity; and reduced heat of combustion.

Saudi Aramco will manufacture and mar-

BIOsuccinic ACID JOHN BAKER LONDON

BIOAMBER PROGRESSES SECOND FACILITY

CANADA'S BIOAMBER, which already operates a commercial-scale biosuccinic acid in Sarnia, Canada, is seeking a \$360m loan guarantee from the US Department of Energy (DoE) to build its second plant, which will be located in the US.

The company says that the proposed US facility will be over six times the size of the

Sarnia plant - with capacity for 60,000 tonnes/year of biobased succinic acid, 70,000 tonnes/year of biobased 1,4-butanediol (BDO) and 24,000 tonnes/year of biobased tetrahydrofuran (THF).

"Our first commercial plant in Sarnia is ramping up to full capacity and performance is

on track," notes Jean-Francois Huc, BioAmber's CEO.

"Securing funding for our second facility would be the cornerstone of our next phase of growth, where we will have expanded our product line to include bio-BDO and bio-THF and in so doing, become a world leader in renewable chemicals," he adds. ■



Carbon dioxide is beginning to be seen as a valuable raw material for the chemical industry

REUTERS/SHUTTERSTOCK

ket *Converge* and associated products through its subsidiary, Aramco Performance Materials (APM). Saudi Aramco is planning for full-scale production facilities in Saudi Arabia to support the manufacture of specialty and intermediate chemical products to supply a wide variety of industries.

Saudi Aramco's carbon capture, utilisation and storage (CCUS) technology deployment and R&D activities are part of a holistic approach to complement Saudi Arabia's broader energy efficiency and greenhouse gas (GHG) management framework. In July 2015, Saudi Aramco launched Saudi Arabia's first carbon capture and storage pilot project at the 'Uthmaniyah field and Hawiyah facilities.

Currently the largest such project in the Middle East, it will inject 800,000 tonnes of CO₂ every year. Saudi Aramco has also pioneered research on capturing CO₂ from mobile sources, developing a prototype vehicle that can capture up to 25% CO₂ in real driving conditions.

IKEA SIGNS WITH NESTE

Another major global group showing commitment to biobased materials is Sweden's IKEA, retailer of furniture and household goods. The company recently announced a partnership with Finland's Neste to deliver renewable, biobased plastics for use in its production chain.

The two companies are also inviting other companies to join their initiative, as they seek to take a leadership position in renewable, biobased materials.

The partnership includes production of plastics and other materials utilising Neste's renewable solutions in polymer production. The partnership combines IKEA's commitment to reduce its dependence on virgin fossil-based materials and Neste's expertise in renewable solutions.

The companies aim to produce plastics and other materials that are used today, but

instead replacing virgin fossil feedstock with renewable or recycled waste and residue raw materials. The companies will work with a number of partners in the supply chain. Partners will be provided with an opportunity to address the growing market for biobased products while utilising their existing production assets.

"We are very pleased to form a partnership with IKEA", says Tuomas Hyyrylainen, senior vice president, strategy and new ventures at Neste. "IKEA's commitment to initiate a change in the industry is an extremely important step in redefining how materials will be made and how raw materials are used in the near future.

"IKEA and Neste, together with partners, can enable the production of biobased plastics that are produced from waste and residues of the customers' preference and choice, can be produced with the existing production assets, are fully compatible with customers' needs, and are recyclable in the current plastics pool. We are proud to work with IKEA on the initiative."

For its part, says Lena Pripp-Kovac, sustainability manager at IKEA, we want "to contribute to a transformational change in the industry and to the development of plastics made from recycled or renewable sources. In line with our goals, we are moving away from virgin fossil-based plastic materials in favour of plastic produced from more sustainable recycled or renewable sources such as waste and residues, not using palm oil and its derivatives as feedstock."

Neste and IKEA's target is to produce the first proof of concept during 2017. Furthermore, the companies expect to widen their cooperation towards new, novel technologies and other opportunities.

IKEA's long-term ambition is for the plastic material used in their home furnishing products to be renewable or recycled materi-

FERMENTATION JOHN BAKER LONDON

MICROORGANISM PARTNERSHIP

US-BASED START-UPS Ginkgo Bioworks and Genomatica have forged an alliance to share technology and intellectual property and collaborate in the development of the biobased specialty chemicals market.

The companies described the alliance as a "deep collaboration", which aims to accelerate the mainstream chemical industry to biological process technology.

"This alliance should be a welcome and familiar approach to anyone in the chemical industry," said Genomatica executive chairman Carlos Cabrera. "The potential of biology to impact our industry is substantial and rapidly evolving."

Mainstream chemical producers will now be able to license-in technology to manufacture widely used chemicals with cost-effective and sustainable whole-pro-

cess solutions that include engineered microorganisms, complete process designs and technology transfer support, say the two companies.

Ginkgo also announced recently the launch of its next generation foundry, Bioworks2. With twice the size and at least six times expected increase in capacity, Bioworks2 represents a step change in what is possible for organism design. ■

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Sweden's IKEA is working with Finland's Neste to develop renewable, biobased materials to make its products



» al. The company is starting with their home furnishing plastic products, representing about 40% of the total plastic volume used in the IKEA range.

TECHNIP EXPANDS PARTNERSHIPS

Also seeking to build its presence in the biobased technology arena is France's Technip. It signed two deals mid-year in 2016, one with METabolic EXplorer (Metex) to

assess the feasibility of offering a combined technology package consisting of the companies' respective 1,3-propanediol (PDO) and polytrimethylene terephthalate (PTT) technologies, and one with BTG Bioliquids to design and build pyrolysis plants for biomass-to-oil production.

The agreement with Metex will include a technical and commercial review with a goal of bringing the bundled technology package

to the market for licensing. PTT is used for the production of high quality textile fibres, packaging films and engineered plastics.

The growth potential of the PTT market, says Technip, is currently hampered by limited quantities of PDO, a feedstock used to produce PTT. Metex has developed a patented, efficient technology to produce PDO through the fermentation of crude glycerins from either vegetable oils (first generation) or recycled oils (second generation).

Technip's operating centre in Frankfurt, Germany – Technip Zimmer Process Technology – licenses the PTT technology, which was developed in the 1990s and commercialised in the early 2000s. Technip's centre in Lyon, France, which has provided engineering services for Metex's PDO technology, will support the new evaluation effort.

By combining these complementary technologies, Metex and Technip Zimmer seek to offer a complete industrial solution for the production of biosourced PTT to the market.

Benjamin Gonzalez, founder and CEO of Metex, said: "I am glad about this partnership with Technip Zimmer, which will accelerate the deployment of the PDO technology for the PTT applications, with a market mainly located in Asia. This partnership with a company as strong as Technip is a real opportunity to open up this PTT market, which is currently limited by the lack of PDO, by offering an innovative and sustainable solution while creating value for our shareholders. It is also one more confirmation of the competitiveness and the maturity of our bioprocess as well as a confirmation of the growth potential of the PTT textile fibre."

Andreas Bormann, managing director of »

BIOPLASTICS JOHN BAKER LONDON

BIO-BDO PLANT COMES ONSTREAM IN ITALY

ITALIAN BIOBASED chemicals producer Novamont has recently opened the world's first commercial-scale facility for production of biobased butanediol (BDO). Novamont's Mater-Biotech plant will produce 30,000 tonnes/year of BDO, up 70% from the initial estimate of 18,000 tonnes/year.

The plant, which is in Bottrighe in northeast Italy, is expected to reach full production rates in 2017. The BDO will be made from renewable sources, using Novamont's technology combined with biobased process technology developed by US-based Genomatica, known as GENO BDO.

BDO produced by the plant will be in part used for Novamont's Mater-Bi bioplas-

tics, which then are used for biodegradable, compostable products such as fruit bags and coffee cups. Novamont predicts that biobased BDO will have 56% of the greenhouse gas emissions of conventional BDO.

Novamont says it spent €100m to build the plant and is employing 70 people on site. The company hopes the plant will be a further starting point to integrate feedstock supplies and product manufacturing in the region. ■



The new Mater-Biotech bio-BDO plant is now onstream at Bottrighe, with a capacity of 30,000 tonnes/year

» Technip Zimmer Process Technology, added: “By bundling PDO and PTT technologies, our goal is to offer a competitive product to a market that is in constant search for diversified, high quality polymers with a solid growth potential. By combining Technip’s strong technology and engineering capabilities with Metex’s technical expertise, we look forward to providing our customers with a complete technology and engineering package, a single point of interface and the highest quality standards.”

Technip’s second agreement is an exclusive cooperation agreement with BTG Bioliquids (BTL) to provide engineering, procurement and construction (EPC) services for its modular pyrolysis plants. The plants will be based on BTL’s Fast Pyrolysis Oil (FPO) technology, which converts biomass to oil through a rapid pyrolysis process.

The agreement combines Technip’s global strength in technology, engineering, procurement and construction with BTL’s experience in the design and commercial operation of one of the world’s first FPO production facilities. Using clean wood as feedstock, a facility has been in operation since 2015 in the Netherlands. Uses of FPO include heat, power, transport fuels and potential biobased chemicals.

Technip and BTL will also collaborate in the development of commercial uses for FPO as renewable fuel and petrochemical feedstock. The agreement will be managed by Technip’s operating centre in Zoetermeer, the Netherlands, which has significant technology and EPC experience.

BIO-AROMATICS JOHN BAKER LONDON

BIO-PX DEMO PLANT UNDERWAY

US-BASED ANELLOTECH has begun commissioning a development and testing facility to produce renewable paraxylene (PX) and other aromatics. The 25m tall unit is designed to confirm the viability and suitability of its Bio-TCat process for scale up and to generate data needed to design commercial plants.

Bio-TCat is described as a thermal catalytic biomass conversion technology for the cost-competitive production of aromatics, including PX and benzene, from non-food biomass. Commercial plants could be built by the end of this decade, the company said.

David Sudolsky, president and CEO, said that there was currently no commercial production of renewable-based PX.

“Despite strong industry demand, there is no commercially available, renewable-based paraxylene, a critical missing component required to make 100% biobased polyethylene terephthalate [PET] products on the market today, nor other biobased aromatics needed for bio-nylon, [bio]-polystyrene [PS], [bio]-acrylonitrile butadiene styrene [ABS], or [bio]-linear alkyl benzene,” he added.

Anellotech’s competitive advantage derives from the use

of a simple process – performing all process reactions in one fluid bed reactor where biomass is thermally broken down and then catalytically converted into aromatics. As a result, the biobased aromatics can be sold profitably against their identical, petroleum-derived counterparts.

Anellotech also disclosed recently it received a \$1.5m equity investment from a new, confidential strategic investor. The new investor joins existing partners Axens, IFP Energies nouvelles (IFPEN), Johnson Matthey, Suntory and Toyota Tsusho. ■

The centre is part of Technip Stone & Webster Process Technology, which looks after Technip’s expanding portfolio of onshore process technologies in petrochemicals, refining, hydrogen and syngas, polymers and gas monetisation.

Stan Knez, president, Technip Stone & Webster Process Technology, stated: “This partnership with BTL will enable Technip to take its development further in a market which is of strategic importance to many of our clients. It will also allow us to better re-

spond to future ‘green’ projects, linking biomass with the petrochemical and refining industries.”

Gerhard Muggen, managing director of BTL, added: “This agreement will allow our technology company to launch its global roll-out. The strong combination of Technip and BTL will now start to offer turnkey pyrolysis plants and services to industrial companies seeking to develop new bio-sourced applications and anticipate the transition to a biobased economy.” ■

BIOPLASTICIZERS JOSEPH CHANG BUENOS AIRES

BRAZIL’S ELEKEIROZ CLOSE TO JOINT VENTURE START-UP

BRAZIL’S ELEKEIROZ is aiming for a late 2017/early 2018 start-up for the first phase of its joint venture bioplasticizers project, president and CEO Marcos De Marchi said at the APLA annual meeting in Buenos Aires last month.

The first phase involves the construction of 16,000 tonnes/year of capacity in two lines at Elekeiroz’s Varzea Paulista site around 50km from Sao Paulo, De Marchi told ICIS.

After that, Elekeiroz and its 50:50 joint venture partner Nexoleum will move Nexoleum’s existing 8,000 tonne/year plant near Sao Paulo to the Elekeiroz site for total joint capacity of 24,000 tonnes/year. This second phase could take about a year, he added.

The bioplasticizers will be epoxidised soybean oil (ESBO) transes-



Elekeiroz’s De Marchi: investing in biobased plasticizers in Brazil

terified with an alcohol to give it higher quality properties, said De Marchi. Nexoleum’s plant already produces ESBO transesterified with methanol, while the new plant will also use other alcohols, he added.

The technology is being licensed

from US-based Battelle Memorial Institute for use in Latin America.

“ESBO itself is a poor quality plasticizer but after transesterification there is a big improvement in properties. This way we’ll have a completely biobased plasticizer

with high quality,” said De Marchi.

“ESBO has grown since about five years ago and is very important today in Brazil and Argentina where soybean is widely available. But it has reached a limitation on quality. This [transesterified ESBO] solves the limitation of quality,” he added.

While De Marchi would not disclose which alcohols other than methanol would be used, Elekeiroz produces oxo-alcohols n-butanol (NBA), isobutanol (IBA), 2-ethylhexanol (2-EH), isononanol (INA) and 2-propylheptanol (2-PH).

Elekeiroz is moving heavily towards non-phthalate plasticizers, having increased its exposure from 5% “some years ago” to 32% today, said De Marchi. “This project will prepare us to move further in this direction.” ■

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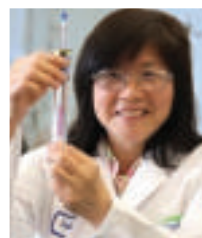
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