

AGRO & CHEMISTRY

ABOUT BIOBASED BUSINESS IN A CIRCULAR WORLD



VDL: TOWARDS CIRCULAR
BUSINESS MODELS

RENEWABLES IN
HOME CARE

PEFERENCE: VALUE CHAINS
FOR FDCA AND PEF

BIOMEDICAL MATERIALS:
FUNCTIONALITIES COUNT



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EFIB 2017 to **report on the latest
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FOOTBALL ENTERS THE BIO-ECONOMY

TOM VAN AKEN:
MARKETS ARE GETTING READY



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CIRCL

Circl, the Circular Pavilion was opened with a festive ceremony on 5 September 2017. Of course Agro&Chemie was at the event. We also had an earlier 'sneak preview', before the summer holidays. At the time, fitting out was still in full swing. Just six months later the unique project is as good as ready. Only a few rooms still need to be completed, but the concept is there.

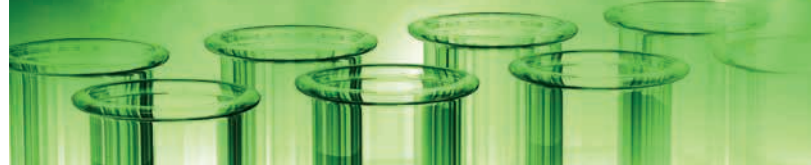
ABN AMRO, the initiator, has stuck its neck out with Circl, which is located in the Zuidas district in Amsterdam. After all, it is investing in an economy that still needs to happen. Circular models are on the rise, but they do not wipe out the 'old' linear economy.

When you take a look at the (near) future, the circular economy is inevitable. Not only because the Dutch government intends being an international leader in the circular economy, but also because circular business models make (more and more) sense economically and ecologically. That definitely applies to the building sector which creates a large share (approximately 40 percent) of the total CO₂ emissions in our country, and with 250 million tonnes is responsible for half of the use of materials in our country as well.

The building industry is highly suitable for circular revenue models. These are capital-intensive goods which, moreover, remain in place. That means that the separate parts are relatively easy to 'harvest'. A company like New Horizon, involved in the construction of Circl, is involved in this. Actually it is a form of value recovery, one of the five revenue models which ABN AMRO describes in its report 'Toekomstbestendig vastgoed bouwen' (A Future-Proof Built Environment). Apart from the reuse of non-renewable raw materials such as metals, there is a place for renewable materials, the 'usual suspects' like wood, hemp and flax, but also for bio-composites. These materials not only have a better CO₂ footprint, they can also contribute to a more comfortable interior climate.

Product as a service is likewise a business model on the rise. Thus Mitsubishi supplies Circl with a lift. The manufacturer continues to own the lift, while ABN AMRO pays for the use. This is on condition that Mitsubishi takes on the maintenance. The underlying idea is that the lift builder obtains extra income through the maintenance. The performance of the lift is assessed and not the number of services. It is therefore important for Mitsubishi to keep the lift working as well as possible, to minimise the maintenance costs and keep the end value as high as possible. Below the line, Mitsubishi is left with the same and the customer pays less. Seems a great business model to me.

ECO-BIO 2018: ABOUT INDUSTRIAL BIOTECH AND BIO-BASED SOLUTIONS



From 4 until 7 march 2018, ECO-BIO 2018 will provide a forum for participants from academia and industry, from government and NGOs. In Dublin the participants will review progress in industrial biotechnology and creating bio-based solutions.

In Dublin participants can interact with high-level speakers: more than 20 plenary and keynote speakers include: Maria Reis, Nova University of Lisbon, Portugal, Patricia Osseweijer, TU Delft, The Netherlands and Rob van Leen, DSM, The Netherlands.

There also will be forum discussions on different topics as 'Natural materials and fibres' and 'Renewable products: Drivers and success factors'. There's also a possibility to present your latest research. The abstract deadline is 23 October 2017.

For more information, the full program and registration, see the website: <https://www.elsevier.com/events/conferences/eco-bio>

Green-chem launched in Ghent

Ghent University has launched the GREEN-CHEM network. The network is founded because the university believes the future of chemistry is green, but this requires a global collaboration and knowledge sharing model between academia and industry.

The goal of the network is to think about the possibilities of green chemistry and how international green chemistry experts from academia and industry can internationally work together towards a more sustainable future.

'We are facing several global challenges, such as overpopulation, increased consumption and global warming. In this respect, the development of a more sustainable and green chemistry is crucial', says prof. Chris Stevens as acting chair. 'To enhance and speed up this process, it is essential for universities and industry to collaborate globally, share knowledge, and create new know-how.'

Companies and universities are already working together in various projects with green chemistry as the main subject, according to Dirk Carrez, executive director of the Bio-based Industries Consortium (BIC). The consortium already resulted in numerous new cooperations, such as Leaf Resources and Novozymes that are joining forces in the conversion of biomass to functional sugars.

Superbio close to goal

After only twelve months of operation the Superbio-project is already exceeding expectations, with 20 new value chains already developed. Superbio is a Horizon-2020-project that aims to develop 30 new disruptive biobased value chains together with EU SMEs and to provide professional innovation services to SMEs funded by the project.

The newly established value chains in Superbio are as diverse as can be expected in the biobased economy: biogas production, food, horticultural and agricultural waste valorisation, bioplastics production, and production of high-value compounds such as crop-protection products, fragrances or food additives are some of many sectors of innovation attracted by the project. SuperBIO is a truly Europe-wide project, attracting SMEs from Belgium, Finland, France, Israel, Italy, Portugal, UK, Spain, The Netherlands, Norway and Turkey. With its innovation support services, Superbio fills a need for EU SMEs and gives them a head start to get closer to the market.



Flamini: football enters the bio-economy

What insiders knew for years, was that former Arsenal-footballplayer Mathieu Flamini had ventured into the bio-economy as a co-founder of GFBiochemicals. At the EFIB2017, Flamini spoke about his involvement in this company.



'I have been interested from a young age on in environmental matters', Flamini said. 'So when the chance arrived to co-invest in a company that could make a difference, I did (together with his partner Pasquale Granata, ed.). Our company aims to mass produce levulinic acid, using a cost-effective, direct route. Levulinic acid has been labelled by the US Department of Energy as one of the twelve biochemicals of the future. However, if we can not produce this chemical and its derivatives in a cost-competitive way, there won't be a market.'

Flamini also mentioned the acquisition of Segetis in 2016, by which GFBiochemicals

has moved into down stream processing. In the R&D-stage, GFBiochemicals has selected three derivatives – gamma valerolactone, methyl butanediol en methyl-tetrahydrofuran – that can be used as environmentally friendly solvents and/or intermediate products for nylons, among other things. Gamma valerolactone (GVL), for example, can be used as a solvent, but also as an intermediate coupling for monomers for large-scale industrial polymers.

AVANTIUM: MARKETS ARE GETTING READY

'The industry, meaning brand owners, and young consumers are getting ready for renewable product concepts. This is good news as the last 10 years not many products in this domain have been launched.'



Tom van Aken, CEO of Avantium, looked back at the last 10 years at the EFIB-conference in Brussel. EFIB celebrates its 10th year: a decade in which it has grown from a small-scale event to a one of the major international meeting points for the European bio-economy.

According to Van Aken, the last ten years have been characterized by a relatively slow, but steady progress. True, not many products have made it to the market, yet, but brand owners and consumers are ready for product concepts that are more sustainable than existing ones, Van Aken stated. 'Have we reduced our dependency on fossil resources or reduced climate change in the last 10 years? No. Admittedly, current oil price levels make it a very challenging task. However, the interest of the industry and consumers and growing awareness regarding climate change indicate that the tide is turning.'

17TH - 18TH OF OCTOBER

Biofuels International 2017, Edinburgh

The 10th anniversary edition of the leading Biofuels International conference & expo, for the first time held in partnership with Bioenergy Insight conference & expo, will focus on the latest developments in biofuels policy, international biofuels trading, sustainability, solutions for first generation producers, progress in advanced biofuels and information on feedstock pricing and trends. It's a must attend industry event with many great networking opportunities.

With over 200 attendees over 2 days of high level presentations and discussions it is an excellent opportunity to engage with the market and to highlight your company's products and services.

8TH - 9TH OF NOVEMBER

European Biomass to Power Conference, Aarhus

At the European Biomass to Power Conference, presentations the focus is on transportation & storage challenges, overcoming biomass supply and other risks and supply chain development & innovation. With presentations by Michael Corten, CEO, Belgian Eco Energy (BEE) and a Senior Representative from VTG Rail Europe on the topic "Optimising biomass power supply chain, what are the solutions?"

23RD OF NOVEMBER

Biobased Delta Business Development Day, Terneuzen

Yearly event, this edition is organized by Biobased Delta and Flanders Biobased Valley, with ample opportunities for networking, interesting speakers, a product expo and workshops.

6TH - 7TH OF DECEMBER

Biocomposites Conference Cologne, Cologne

This year's conference and exhibition will be the largest industry meeting on biocomposites worldwide. The first preliminary programme featuring 17 speakers is now online.

We would like to acknowledge COPERION GmbH (DE) for sponsoring the renowned Innovation Award Biocomposite of the Year 2017. This award will be granted to the young, innovative bio-based materials industry to identify suitable applications and markets for bio-based products. The focus of the award is on new developments within these areas, which have been launched in 2017 or will be launched in 2018.

CROP PROTECTION PROMISING MARKET



Crop protection is a promising market for more sustainable products, according to Dinand van Wijk, director of Cultus Agro Advies. This company will run the Cultus Crop Research centre opened earlier this year at the Brightlands Campus Greenport Venlo.

Cultus Agro Advies (CAA) forms part of the Vitelia cooperative and provides advice to the members of the cooperative: the core activity of the company. Van Wijk: 'We also invest in research and innovation to keep the tree nursery sector and agricultural and horticultural sectors competitive.' Some of that research is now taking place at Cultus Crop Research, a research station which is no less than 1,700 m². This is where the colleagues of Van Wijk will investigate matters such as high-protein crops, components and more sustainable forms of crop protection.

'I have noticed that the demand and volumes are the largest in the latter market. It is not surprising that major producers like Bayer, BASF and Syngenta are involved in the research. These multinationals present us with research issues, which we then work on at our research centre, albeit on a small scale. We also rent ground from farmers and nurserymen where we can scale up our tests.'

Nettles

One striking example of a crop protection project revolves around marigolds (tagetes). This plant contains an active substance (thiophene) against certain nematodes, (roundworms) which can harm plants. One way the nematodes do this is by using plants as an incubator for their offspring. 'Marigolds come in a great many varieties, so the aim is to identify the most effective variant.' The nettle is another plant on CAA's radar, because it contains active components against thrips (editor's note: parasitic insects) and aphids. 'A mixture of nettles, water and sugar is a household recipe against aphids. We are looking for a means which can help farmers and nurserymen. There is considerable interest from the primary sector for more natural crop protection products, whereby "natural" does not have to mean they do not contain any toxins.'



The new chemical industry is coming off the ground

The Northern Netherlands offers fertile soil for the chemical industry of the future. We are at the cutting edge in the transition to biobased chemical industry based on renewable resources like **grain varieties, sugar beets, potatoes, and grass and wood**. New products are being developed at the interface of agribusiness and chemical industry. These products meet the wish of producers and consumers to live and work responsibly. That's how we create a world of opportunities for the Northern Netherlands.

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FROM STRAIGHT PRODUCER TO SUPPLY CHAIN PLAYER

‘I see the future of the VDL Groep more as a player which controls the chain. The old paradigm of the linear economy, that is, solely a product supplier, will make way increasingly for circular business models. As a matter of fact, we have been working on that for years. It is just not part of our nature to parade that.’

Text Lucien Joppen Image Bram Saey

Willem van der Leegte, president of VDL Groep, represents the third generation in the Van der Leegte family. His grandfather Pieter founded a metalworking company in 1953 and started developing and producing oil heaters in the 1960s. ‘My granddad wanted to make beautiful things. My father Wim steered the company into a stable position, expanded it and also wanted to earn money from it. What kind of Van der Leegte am I? That is up to others to determine. The ideal would be a combination of my granddad and my father (laughs).’ However it may be, the youngest scion (35) has a huge job running a multinational with an estimated turnover of 5 billion euros. Besides the three MINI models, VDL Nedcar in Born has

recently also started producing the popular BMW X1 series. The other activities are also growing and developing successfully. ‘This doesn’t happen by itself. We have to define all aspects of our business operations properly.’

Willem, VDL Groep is developing very well as far as turnover is concerned. That will jump from 3.2 billion in 2016 to 5 billion euros in 2017. A rocket launch start for you?

‘This growth is explained by the increased supply from our companies which sell to the high tech industry. Of course, VDL Nedcar, our automotive factory in Born, is also a major growth motor. It is wonderful that in addition to the three MINI models we now also make the BMW


NAME Willem van der Leegte (35)

EDUCATION Economics, Maastricht University

EMPLOYMENT worked for VDL Groep since 2004, president since November 2016

PERSONAL STATUS married, two children

INTERESTS likes bicycle racing



X1. That says something about the trust of our client BMW in our collaboration. We are investigating whether we can find a second producer which would be interested in Born. That is to reduce the dependency on a single client. Vehicle assembly forms around 40 percent of our turnover. But over the years we have built up a diverse portfolio of companies so that we have been able to spread the risk well.’

In terms of your portfolio, it does seem to be a patchwork of businesses which are active in numerous sectors. What is the common denominator binding them?

‘Funny that you should ask that. A while ago the board of directors of BMW visited us. In the first instance they also thought that there was no central thread. After visiting a few VDL businesses it was clear to them: there is a great deal of mutual cross-fertilisation between our companies. VDL operates in metal and plastic. We supply to producers like BMW and ASML, and we also produce ourselves, for instance buses and coaches and other end products like suspension systems, automated production lines for automotive factories, heat exchangers and container handling systems. We see this synergy back in real terms. VDL subsidiary companies supply to each other for a total of 200 million euros a year (editor’s note: excluding bus/coach). We have also completed many projects in which different subsidiary companies are involved. For example, we have a cluster that designed and built an Automated Guided Vehicle (AGV) for the container terminal in the port of Rotterdam. This is a hybrid (editor’s note: electric-diesel) vehicle in which we have applied the knowledge from our bus/coach division in the area of automated guided systems. Another VDL company took care of the container handling and (process) automation. There are now 80 of these vehicles driving in the port. And there are many more examples like this in our company.’

Willem, as said earlier, the VDL Groep is experiencing significant turnover growth. Is this a confirmation of your direction? And doesn’t it form an obstacle at the same time to putting the company in the right position for the future?

‘We are on the right track. It is not my intention to totally change course. It is a fact, however, that the world is changing rapidly. That is why we need to prepare for the changes which are also irrevocably heading for us. If you talk about sustainability, for instance, we have been working on that for a good ten years already. It is simply not part of our nature to parade that. We prefer to tackle things that allow us to operate in a more sustainable way and that are good for the company. They go hand in hand in our business. The continuity of VDL Groep is paramount. In the end, it is about the result. Turnover growth alone won’t pay the bills, is what we say here. But with no turnover growth you can’t pay any bills at all (laughs).’

Can you give an example of a circular model you already have experience with?

‘The concession contract for the public transport in the Dutch city of Almere which we won in 2009. We took back the 220 buses driving there and refurbished them: new engines and a thorough overhaul of the interior and exterior. This made these buses fit for service for another ten >>

COLUMN



BIOBOOSTER: A SUCCESSFUL EXPERIMENT

A little over a year ago, the province of North Brabant, the regional development authority REWIN, the Brabant Development Agency (BOM) and InnovatieLink hit upon the idea of setting up an accessible innovation fund – BioBooster – to encourage biobased initiatives in Brabant. This scheme was intended to tie in better with the way innovative SME entrepreneurs were doing business in the biobased economy.

Now, a year later, it is clear that this idea hit the mark. There are five good reasons for this.

1. more with less: with a maximum contribution of EUR 10,000, entrepreneurs go a long way in the initial stage. It guards them against costly disappointments. They quickly find out whether their ideas have some chance of success and the best way to outline further action.

2. cut the crap: the entrepreneur is given a decisive answer about his application within one week. Time is of the essence for entrepreneurs who are at the start of their innovation process. They rarely have the luxury of being able to wait for months; they want to know straight away where they stand.

3. no time to wait: another advantage is that entrepreneurs can submit their application at any time. Entrepreneurs face challenges that come up at a specific moment and require immediate attention. A team of experts in biobased economy and business development assesses the requests. This provides the entrepreneurs with the immediate recognition that they are not the only ones who think it is a good idea.

4. value in kind: it also helps that in exchange the entrepreneurs can put their own time to use in particular. SME entrepreneurs do not usually have a generous budget. An in-kind contribution lowers the threshold for submitting an application.

5. beyond regions: although BioBooster is intended in the first instance for entrepreneurs in North Brabant, cooperation with parties elsewhere in the country is highly desirable. Companies are mainly looking for the best business partners and they do not stop at the regional borders. All in all, BioBooster is a good example of how innovative entrepreneurs can be helped on their way in the initial phase. A scheme that deserves to be followed on a national scale.

Chris Bruijnes

Director InnovatieLink

years. After that we will do roughly the same again to prepare the vehicles for export. We give the guarantee for taking the buses back and are responsible for the maintenance and infrastructure (editor's note: charging stations, among other things). With the development and manufacture of the buses we therefore need to ensure that the technical life span is as long as possible and that the maintenance can be kept to a minimum. That is an economic incentive. If this allows us to offer the customer a better price, they will be more inclined to choose us. That has to do with euros and not with sustainability. We would like to produce fully sustainably, but we do have to remain competitive. We also hold our suppliers responsible for the life span of their products. Years ago, for example, we had problems with the adhesion of the paint and had customers calling us. We then came to an agreement with the paint supplier that he would guarantee the life span and inspect whether we were applying the paint correctly. There have been no further problems with the paint quality since then.'

In the Ravelijn lecture (editor's note: held on 8 May 2017) you argued that circularity is enforced in practice and that it therefore does not have to be stimulated by the authorities.

'That's right. The 93 directors at all the VDL subsidiary companies all have to fend for themselves. Reuse of raw materials and the reduction of waste is good for the bottom line, so it is an economic incentive with the added bonus that we show the market that we want our production processes to be as sustainable as possible. In practice, economic interests and sustainability go hand in hand. A good example is the use of residual heat to heat a nearby swimming pool. I believe that the greatest profit is to be found in responsible material use and the reduction of energy consumption and emissions. The first factor is a matter of recycling and the technical life span of products. We can also reduce waste in the production, for example through 3D printing. This technology enables us to construct parts as a single piece instead of milling them from a larger whole. In the production of certain plastic products such as the sustainable Dopper drinking bottle, we process residual material in other applications. The ideal would be to bring products into a cycle. That is easier with capital goods. For consumer products like the Dopper it is more complicated. In the long run I expect to see more circular models come about in which consumers exchange old products for new versions whereby they receive a discount, for example. It is up to the producer to convert the old models into new products or find another purpose for them. Producers are at the service of the consumer. We should not be so arrogant that we believe we can impose something on the consumer. The consumer is more conscious, articulate and smarter than ever.'

You mentioned electrification as a spearhead. Does this apply to the entire VDL Groep?

'Yes, electrification is part of what we call smart mobility. We switch as much as possible to technology that causes the least possible nuisance, like noise and emissions. The demand for electric buses is growing. We respond to that. In December we supplied the city of Eindhoven with 43 electric city buses, the largest fleet of electric buses in Europe. Hydrogen is another option. There are now two buses in Eindhoven which run on hydrogen. This technology is too expensive for now, but in the long term it can definitely become big. As I said earlier, automated guided vehicles are a textbook example of smart mobility. It is not only more efficient because the vehicle can run driverless in manned areas, but because it also offers possibilities for using these vehicles as efficiently as possible.'

VERTORO AT BRIGHTLANDS CHEMELOT

SCALING UP LIGNIN CRUDE

Michael Boot already went to the Chamber of Commerce before the summer vacation. With his company Vertoro he plans to scale up a process which produces a crude lignin oil (CLO) based on lignin. 'Our secret? Mainly that we don't make our process any fancier than it has to be.'

Text Lucien Joppen Image Shutterstock

Michael Boot already went to the Chamber of Commerce before the summer vacation. With his company Vertoro he plans to scale up a process which produces a crude lignin oil (CLO) based on lignin. 'Our secret? Mainly that we don't make our process any fancier than it has to be.'

Vertoro evolved from the InSciTe project Lignin Riches, where Boot was project leader. 'The aim of the project was to produce this CLO via a thermocatalytic process. The feedstock in the first instance is lignin which is released as a by-product of second generation bio ethanol production. It is used mainly as an energy source for the above production process but, converted into CLO, it can increase this yield fourfold.'

Boot believes that there is also a market for CLO based on biomass. After all, the fossil fuel oil contains sulphur (3 to 5 percent) and is very polluting. What is more, for the time being electrification is not something the shipping world is looking at.

SCALING UP AT CHEMELOT

It has not come to that stage yet. Boot will first scale up the process at the Brightlands Chemelot Campus in Geleen in the Netherlands. Boot, formerly employed at the Eindhoven University of Technology: 'This site is the best choice as far as facilities (permits and suchlike) and image are concerned. In mid-2018 we will open a mul-



Cleaner alternatives for marine fuels are limited.

tipurpose pilot plant in which we will scale up the process. We need to roll out a barrel (160 litres) of oil a day. The technology of our process is relatively simple and solid. I cannot go into details, unfortunately, because the patent applications are still pending. What I can say is that we took a good look at the petrochemical industry, in particular the extraction of tar sand oil. We do not have to produce an end product with a purity of 99.4 percent; what we aim for first of all is a pumpable oil. So viscosity does play a part.'

According to Boot, the biggest challenge lies in reducing the production costs and fine-tuning the process further. This involves variables such as process temperatures, concentrations of solvents, resting times, etc. 'The degree to which we can use solvents and catalysts again determines the cost efficiency of our process to a large extent.'

HUGE CHALLENGE

This efficiency will increase the more the production capacity is raised. 'Ultimately we want to build a factory (editor's note: estimated investment at least 20 million euros) which should be located close to an existing bio ethanol plant. This can be in the United States, but these production locations also exist in Europe. The funding for such a plant is a huge challenge. That is why we are looking for industrial partners in the value chain with which we can build the first plant together. The applications of CLO go further than just marine fuel. At InSciTe we also worked together with producers of resins, phenol and octane improvers. In the sister projects BioHart (Interreg) and Scelio-4B (OP Zuid) various industrial partners are also involved in examining these CLO applications, but then on pilot scale. BioHart, Scelio-4B and Lignin Riches are substantial research programmes with a combined budget of more than 20 million euros. That illustrates the potential of this route.'

This article was created in collaboration with Source B.

GAINING A Foothold

Home care is a market in which renewable raw materials are establishing an increasingly firmer foothold due to legislation and market demand. In the meantime, not only smaller producers develop 'green' products, but the large players have also entered this market.

Text Lucien Joppen Images Shutterstock, Ecover

Speaking of which – what are we actually talking about? Home – or household – care is made up of the following segments: laundry detergents (as well as softening agents/other additives), surface cleaners, dishwashing detergents, maintenance (cleaning agents/air fresheners) and bleaching agents.

In 2016, Europeans paid a total of no less than EUR 28.5 billion for these products (source: Euromonitor).

The largest segment by far is formed by the laundry detergents with a market share of 47.3 percent (13.5 billion), followed by surface cleaning agents (21.2 percent) and dishwashing detergents (4.4 percent).

This article will deal mainly with laundry detergents, in view of the sales share. In some cases we will digress to dishwashing detergents. The reason: the two product groups overlap considerably as far as formulation is concerned.

PERFORMANCE NUMBER 1

Consumer surveys are essential to gain a picture of the market drivers. In 2016, Nielsen published the findings of a global consumer survey (30,000 respondents) about home care. It dealt mainly with cleaning agents and laundry detergents. A number of conclusions: it is still

mainly women who make the purchase decision, but men are playing a more active role in this area. Products are usually (75 percent) bought from supermarket retailers. In developed markets this percentage will undoubtedly be higher, given the highly developed retail infrastructure.

The key question of the report is: what do consumers expect from a detergent/cleaning agent? Performance – the effect – is the most important factor, followed closely by the price-value ratio. The above factors are determined mainly by experience and trust. Consumers recognise the importance of branding, but consider it less important than experience.

LICENSE TO PRODUCE

According to Nielsen, there are also so-called secondary attributes on which consumers base their purchase decision. Thus the packaging (size) can play a part, but also whether the raw materials and packaging materials are 'natural' or 'organic' (editor's note: 26 percent of the respondents). In other words, the environmental impact is definitely a theme which extends to raw materials, packaging, use of water (during the production and the wash cycle) and chemicals which can have an effect on the (local) environment.

AISE (International Association for Soaps, Detergents and Maintenance Products) argues that the industry is already working very hard on making its processes and products more sustainable, that is, reducing the environmental impact. According to the sector/lobby organisation however, it is not a market differentiator, but rather a condition for remaining on the market; you could call it a 'license to produce'. Furthermore, consumers are generally not willing to pay more for a greener product or make concessions concerning performance; see the Nielsen survey mentioned above. So it is a balancing act. AISE claims that the industry does not want to 'adopt' renewables en masse for the time being until issues such as cost price and performance are brought to the same level.

THE BIG FOUR

This industry is reasonably straightforward in home care. There is a 'big 4', consisting of multinationals which have worldwide coverage with their products and occupy a dominant position in retail. These enterprises are Unilever, Reckitt Benckiser, Henkel and Procter & Gamble. Then there is a long tail with smaller brand owners (B brands and the private labels of retailers) which mainly have their products made by toll manufacturers.

As AISE already pointed out, the industry as a whole has made efforts to reduce the environmental impact and that also applies to the big four. Thus Reckitt Benckiser (RB) launched a programme in 2007 through which it intends reducing the carbon footprint of its products by 20 percent over the period 2008-2020. The British-Dutch multinational sees the sustainability operation as a comprehensive approach. The company is including its entire product portfolio in the operation and examines issues such as CO₂, water use and toxicity.

BADDIES ON THE BLACK LIST

In 2000, RB set up the Ingredient Removal Programme, under which it aims to phase out specific chemicals and/or develop (tightened) guidelines for the use of certain products by consumers. 'We are continually searching for more sustainable/environmentally friendly alternatives for the chemicals we are scrapping,' says Edward Butt, VP Sustainability. By its own account, the corporate group goes further than required by legislation. Thus in 2005 it took the Red Devil Lye oven cleaner off the shelves because it found that the active ingredient sodium hydroxide (caustic soda) was too aggressive.

RB wants to replace these 'baddies' as much as possible with constituents which perform just as well but are better for humans and for the

environment. According to the company, it has replaced an active substance in its Lysol range with hydrogen peroxide, a fully degradable constituent with a considerably lower CO₂ footprint.

CMI

Suppliers play an important part in making formulations greener or changing them to biobased. Cosun Biobased Products has been working on this for several years already with CMI (CarboxyMethyl Inulin), a chemical it produces which is based on inulin. Francesco Staps, Business Development Manager at Cosun Biobased products: 'One of the things CMI does is prevent calcium deposits on clean dishes. In laundry detergents it prevents the dirt particles from bonding back to the textile. CMI performs better than fossil or phosphorus equivalents on protein (editor's note: blood, leftovers) in particular. This performance does not happen just like that: it is not a matter of a drop-in, but the adjustment of the formulation of the (dishwashing) detergent. That does mean that development costs are involved. In practice, producers that want to stand out with 'greener' products are willing to take that step. The major players are more careful and are making smaller steps in reformulating their products.'

ECOVER: MARKET MORE MAINSTREAM

From the very start (editor's note: established in 1980), Ecover has aimed at making washing and cleaning agents that are more environmentally friendly. Tom Domen, Innovation manager at Ecover: 'Our market was originally a niche market. Luckily it has moved more towards mainstream over the past decades. Now we see that larger companies are launching products with lower environmental impact. That is not surprising: consumers are more open to these kinds of propositions.'

Ecover's home market, Belgium, is where it makes a turnover which is comparable with that of the large A brands. Domen states that north-western Europe (UK, the Netherlands, Belgium and Germany) comprises the largest (growth) markets for Ecover. 'We do not position our brand so much solely on biobased, that is the degradability or toxicity of constituents, as on presenting a wider story. It is also about what is better for people, that is, their skin (editor's note: allergies, skin conditions). Aspects like experience, design, colour and fragrance are also important if you want to become a mainstream brand.'

SURFACTANTS FROM RAPESEED OIL

The broader proposition does not mean that Ecover deviates from the path they set out >>

COLUMN



MORE THAN TWO BIRDS WITH ONE STONE

My first TEDxAmsterdam talk, in 2009, was called 'Towards a circular economy: let's be positive'. Yes indeed, an ecologist leading the way in the economy. But that is really not at all strange, because circularity is an ecological principle. That is how nature works. Tested in 3.8 billion years of Research & Development.

I am always positive, but definitely since 2006 when the excellent VPRO Tegenlicht documentary 'Afval is Voedsel' ('Waste is Food') was broadcast. In 2009 I was in the middle of the new building project for the Netherlands Institute of Ecology (NIOO-KNAW, see nioo.knaw.nl/gebouw), my head and diary full of sustainable innovations. It had to be possible to build differently, and we ecologists decided that we were simply going to do that. Embracing circularity, power from the sun and biodiversity instead of destruction: the three principles of sustainability. Ellen MacArthur came to film during the construction process, and established the Ellen MacArthur Foundation to promote the circular economy. Following this, Circleeconomy.com was set up in the Netherlands to stimulate businesses here as well to step out of that incorrect linear economy.

The enthusiasm for this positive approach was catching. It is now also on political and scientific agendas. During the Dutch EU presidency, Mark Rutte launched the Netherlands Circular Hotspot campaign. And in Paris, 195 countries chose for sweeping climate and sustainability goals, including the transition to a circular economy. Everyone knows the concept now.

The advantage is not only potential cost reduction through decreased raw material use (between USD 340 and 630 billion per year for the EU, as estimated in 2012 already by McKinsey). The benefits are mainly in creating different, new values such as exciting sustainable innovations, new business models, greater inclusiveness, increased employment, more appreciation by society and most importantly, a great deal of cooperation between unexpected parties: local, national and international. It is a real system change! It requires leadership and courage to accomplish this, and you will also have losers. Just as we are experiencing now with the energy transition, these losers will be mainly the stragglers without any long-term vision or those lacking the courage to make the attempt.

The Netherlands can be a leader in the new economy if we join forces. Come on, new government and Dutch businesses. Go forth and multiply (your knowledge) - a nice slogan for this new government, for that matter... Good for the Netherlands Ltd., your grandchildren and the entire planet. Economic, ecological and social to boot!

Professor Louise Vet
Director Netherlands Institute of Ecology (NIOO-KNAW)

on previously. Of course sourcing – which constituents and which environmental impact – also plays a part.

'The focus of R&D at Ecover is definitely on renewable raw materials,' according to Domen. 'We can go up to 80 to 90 percent of the volume. For the time being it is still difficult to replace some constituents, such as preservatives, because of lower performance. On the other hand, surfactants, volume-wise the most interesting constituent, can be fully renewable. The price is currently higher than for fossil surfactants. In addition, the sourcing is also an issue. Biobased surfactants are usually produced on the basis of palm oil. Ecover does use palm oil which has been certified as sustainable and has already switched to a large extent to local feedstocks such as rapeseed oil. The next step is to set up local supply chains which use waste streams.'

ATTAINABLE OBJECTIVE

As Domen already stated, surfactants are the most interesting constituent to make biobased. As far as volume is concerned, this group forms the main constituent and in terms of technology it is an attainable objective. Various types of surfactants are available, with the choice for a specific surfactant depending on different factors such as washing temperature, type of textile, the product form or the production method.

Fossil surfactants are degradable in the environment (legislation), but they are detrimental in terms of ecotoxicity and CO₂ footprint. That is why new generations of surfactants, based on oils, fats or sugars, have entered the market. By now the first generation – linear alkylbenzene sulphonates (LAS) – have more or less replaced the 'old' alkylbenzene sulphonates (ABS). The second generation, PAS (sulphates based on vegetable oil/fatty alcohols), are both fully degradable and renewable. These surfactants deliver comparable (washing) performance, but are still more expensive. The latter point is logical, given the scale advantages for established chemicals. Experts (including BIO-TIC project, FP7) expect that biodegradable, biomass-based surfactants will come more out of the niche in the long term. The larger surfactant producers are investing in biobased surfactants and the demand will grow, especially due to 'environmental concerns.' ●

UNILEVER AND PROCTER GO 'GREEN'

Reckitt Benckiser is not the only one of the Big 4 which is improving the sustainability of its range. Especially since the arrival of Paul Polman, Unilever (including Omo, Persil, Biotex) has grown into the textbook example of sustainable product development. That also applies to its washing and cleaning agents, in which it endeavours to minimise the use of finite, fossil raw materials in the formulations and the weight. Thus the company argues that its new product Powergems (a hybrid between solid and liquid) contains substantially less chemicals – volume reduction – than pure powders. In 2016, Unilever took over the Seventh Generation company through its acquisition policy. This American company develops and produces 'natural and eco-conscious' cleaning agents: the non-food version of Ben & Jerry's. Through this acquisition, Unilever also wants to put pressure on Procter & Gamble (P&G) which holds a strong position in the United States with Tide. In 2016, P&G launched a biobased version of the brand under the name Purclean. 65 percent of the product is made up of biobased constituents, allowing it to bear the Biopreferred certificate. Internet reviews show that the washing detergent performs well. According to P&G, the product will only break through if the performance does not suffer from the new formulation. 'We cannot have a positive effect on the planet with our products if the consumers do not buy them massively,' according to Sundar Raman, VP North American Fabric Care van P&G.

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JOINT FORCES NEEDED

'The PEFerence-project is of great importance to us. We are in the process of opening up a market for a new plastic based on renewable feedstock. This is a major challenge, which requires a broad range of experience and expertise.'

Text Lucien Joppen Image BASF

For Patrick Schiffers, CEO of Synvina (joint-venture between BASF and Avantium), bringing PEF and its precursor FDCA to market, is a huge undertaking, especially for the 'spring chicken' Synvina.

'One company can hardly achieve this on its own. That's why PEFerence is so important because it brings together key players along the whole value chain from raw material to end-product and recycling to achieve this. For Synvina's endeavor to bring FDCA and PEF to the market, it is important to have these strong partners along the value chain in a regular dialog. PEFerence enables this.'

PRODUCTION PLANT IN ANTWERP

The PEFerence project was established in the first half of 2017. As mentioned before, key value chain partners will work closely together to develop and commercialize key applications for a new plastic based on renewable feedstock PEF (polyethylenefuranoate) and its monomer FDCA (furanedicarboxylic acid). Ultimately, the project should lead to the establishment of a 50.000 kT production plant on the BASF 'Verbundsite' in Antwerp.

PEF has several interesting applications, most notably in packaging of carbonated beverages due its superior barrier properties. Avantium has established various partnerships with compa-

nies in the PET-value chain, for example Danone, Alpla and Toyobo to develop a 100 percent biobased PEF-bottle. Also PEF can be used in other applications such as carpets or textiles.

Within the PEFerence-consortium, coordinated by Synvina, the following companies are involved: BASF, Avantium, Tereos Participations, Alpla Werke Alwin Lehner GmbH & Co Kg, OMV Machinery Srl, Croda Nederland B.V., Nestec Sa, Lego System As, Nova-Institut für politische und ökologische Innovation GmbH and Spinverse Innovation Management Oy.

STRENGTHENING LOCAL ECONOMIES

As PEFerence covers the entire value chain, feedstock research is an indispensable part of the project as this factor has a significant impact on the production process and the end products. Momentarily, Synvina uses bio-based carbohydrates from corn, wheat or other crops to produce FDCA.

According to Synvina, this process is competitive and 'working well'. However, by using sugars

based on second generation biomass - for example waste/sidestreams from forestry or agriculture, the company might be able to produce a more sustainable or cost-competitive chemical. There is also an added benefit if these feedstocks are locally sourced. By using regional agricultural resources (for example lignocellulosic biomass) and decreasing the dependency on oil imports, value will be added to the European economy. More-over, the setting up of (local) bio-based value chains will create jobs in rural areas throughout the value chain.

As for producing FDCA based on first generation carbohydrates, Synvina needs to scale up this process.

Schiffers: 'To build a large-scale plant for a new molecule is complex and needs to be analyzed carefully. We are well positioned for this challenge. Synvina holds the right expertise for this challenge by combining the technology leadership of Avantium and the production excellence of BASF.'

FDCA'S BROAD SCOPE

Once scaled up, the impact of FDCA on various value chains could be huge. About ten years ago, the US Department of Energy identified FDCA as one of the twelve 'green' chemicals of the 21st century.

For the time being, PEF - given the sheer size of



FDCA is able to replace purified terephthalic acid in a variety of applications. For instance, FDCA can be polymerized into polyethylene furanoate (PEF).

the PET market - is the main route. This also applies to the PEFerence-project. However, PEF is just one the many materials that can be derived (partly) from FDCA. Additional to the applications with PEF, FDCA can be processed to polyamides for engineering plastics and fibers, to polyurethanes for foams, coatings and adhesives and to esters for personal care products and lubricants.

PUDDING

Within PEFerence, the focus will be on the following applications: PEF-based packaging, toys and coatings. As mentioned before, the (food) industry from the likes of Coca Cola, Danone or Nestlé has expressed an interest in using more sustainable plastics for its products. PEF is based on 100 per cent renewable feedstocks and fully recycable, therefore it has a more favourable CO₂-footprint. The ultimate usp's, however, are the aforementioned barrier pro-

perties which enables for example the competition with other packaging formats such as glass or aluminum. The material also offers a higher mechanical strength, which enables thinner PEF packaging, there less material use and lower logistical costs.

In the end, the PEFerence consortium should lead to the demonstration, validation and commercialisation of at least three 100 per cent bio-

based materials in end user applications in packaging, toys and coatings. These applications should be based on local bio-based value chains from raw material sourcing to PEF-based end products. Finally, the environmental and socio-economic performance of the developed products should be demonstrated. Ultimately, the proof the pudding is in the eating. The project partners are eager to 'dig' in. ●

The PEFerence project has been awarded a 25 million Euro grant by the "European Joint Undertaking on Bio-Based Industries (BBI)". Dirk Carrez, executive director of the Biobased Industries Consortium: 'This BBI flagship project clearly illustrates the objectives of the BBI: stimulate innovation with a strong focus on deployment, and keep investments in innovative first-of-a-kind production plants in the EU!'

MORSSINKHOF PRODUCES rPET YARNS

Morssinkhof Rymoplast is one of the largest plastic recycling businesses in Europe. The company reduces different plastics into flakes or granulates. It is also working on getting the production of industrial yarns based on rPET up and running. ‘There are definitely opportunities in high quality applications which aim more at the B2C market.’

Text Lucien Joppen Images Morssinkhof Rymoplast

Mark Ruesink, Production & Innovation director at Morssinkhof Plastics, sees the high quality recycling of fossil polymers such as PET, PE and PP as an effective method for bringing materials and the accompanying CO2 into a cycle. ‘We just don’t do it enough. In Europe, a little more than half of the PET bottles are recycled, while the rest end up in landfill or are incinerated

[Source: EUPR, Plastic Recyclers Europe]. The fossil raw materials are lost forever that way.’ That is not for want of trying by Morssinkhof. At seven production locations in the Netherlands, Belgium, Germany and Poland the company processes no less than 225,000 tonnes of plastic every year, mainly the above voluminous streams. Rymoplast specialises in PE while Morssinkhof concentrates on HDPE, PET, PP

and PS. The company is able to recycle PET bottle-to-bottle: food grade recycling for all the large brand owners in Europe.

MACHINES UP AND RUNNING AGAIN

Morssinkhof Sustainable Products is the third member in the holding company Morssinkhof Rymoplast Group, alongside Morssinkhof and Rymoplast. This activity focuses on the production of more sustainable products, starting with industrial yarns. It does this using the spinning machines which date back to the Diolen era. Diolen arose from the former Akzo Nobel Fibers & Polymers division, but closed its doors in 2008. At the time it could no longer compete with Asian companies. Since 2008 Morssinkhof has been using the upper floors of the former Diolen building at the Emmtec site (in the Dutch city of Emmen, ed.) for the post condensation of PET granules. It also dries them and makes them food grade there. Production and the pilot spinning machines are

on the lower floor. The company has now revived the well-preserved machines. It has also developed new types of so-called high tenacity yarns for the B2B market.

PRICE-SENSITIVE

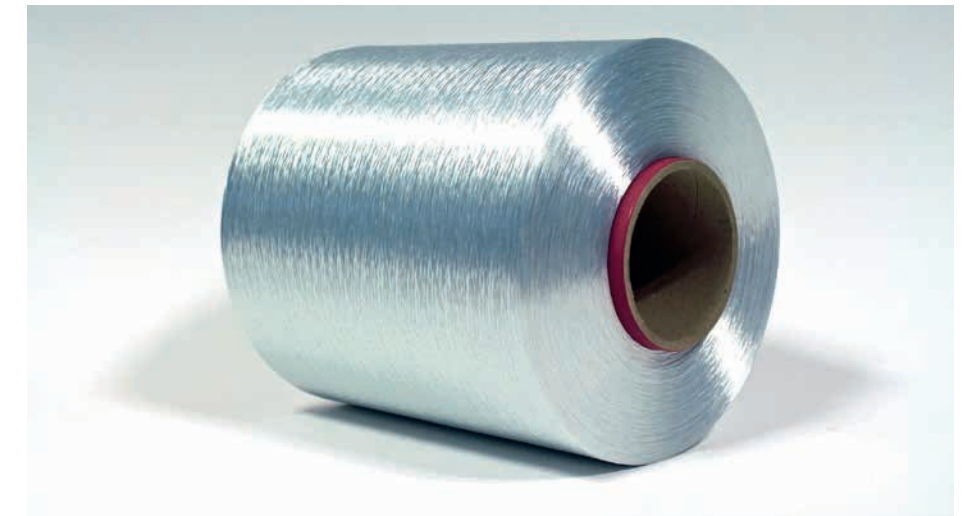
‘Examples are lashing straps, conveyor belts and suchlike. In this market we are aiming at niche applications: yarns in small volumes which combine specific added properties (editor’s note: for example, colour, fire resistance). This is definitely a highly price-sensitive and conservative market, where clients will not willingly switch to an alternative based on recycled polymer. Low cost options from the Far East are still the most sought after. Another obstacle is that ‘new’ materials (editor’s note: based on recycled polymer) have to be tested again, which involves extra costs. Industrial yarns will offer competitive prices in the long term, definitely once the location in Emmen can produce more volume,’ according to Ruesink.

THINNER YARNS

He emphasises that Morssinkhof is still in the early stage of the process. The staff start up the machines every so often for an initial order. There is no question yet of continuous utilisation. ‘But we do not have to go from zero to one hundred,’ according to Ruesink. ‘We have the process properly under control now, and that is an essential step. Next, we have to have a good look at the right product-market combinations. As we said before, the B2B market is anything but easy. But we also notice that especially brand owners, like car manufacturers and retailers, are increasingly making their products and processes more sustainable. This also has consequences for the suppliers of these players. All of a sudden a car safety belt made from PLA, for example, does become interesting, despite it being much more expensive than polyester.’ Another option is to spin thinner (textile) yarns or (BCF) carpet yarns based on rPET. That brings totally different applications into the picture, according to Ruesink. ‘In that case, we could take the step towards the consumer market: shower curtains, carpets, mats etcetera. These products are often reinforced with polyester yarns.’

THE IKEA LINK

Stenden University of Applied Sciences, the Faserinstitut Bremen, Senbis Polymer Innovations and Cumapol among others are participating in the project Sustainable Fibers, in which Morssinkhof is investigating whether it can



PILOT AVAILABLE FOR THIRD PARTIES

Morssinkhof Sustainable Products also has a pilot line on which it can develop new and innovative yarns. ‘We can also rent this line out to third parties: companies which have developed a polymer on laboratory scale can use our line to produce larger volumes for application testing. We can also use the pilot system to produce other yarns, such as PLA, PA and PBS.’ The post-condensation of various polymers from 25 kilograms up to industrial quantities is another possibility.



IKEA acquired a minority interest in Morssinkhof at the start of 2017. The multinational wants to make its plastics supply chain more sustainable and considers the participation as a way of getting a better grip on the underlying chain.

develop markets for low titre yarns and BCF yarns. ‘We cannot produce these yarns ourselves in Emmen yet. We could invest in new machines, but we would first have to have a view of the market volumes. Would we be able to compete at cost price? No, not in all cases, but it is possible for the price-quality ratio as well as short lines to our customers in Western Europe. Our rPET has a very good reputation in the market and Asian recyclers are not known for good, consistent quality.

When it comes to a step towards the market, then Morssinkhof has a ‘stepping stone’ at any rate. At the start of this year, IKEA acquired a minority interest (editor’s note: 15 percent) in the company. The Swedish multinational considers the participation as a strategic move to get a better grip on the plastics supply chain. IKEA ultimately wants to produce only recycled materials. Ruesink: ‘It certainly opens doors. It does not mean that we will receive orders straight away, but we are in the front ranks.’ ●

DECISIVE, PROACTIVE BUT ALSO FACILITATING

A transition to a biobased/circular economy requires the public sector to have a proactive and facilitating attitude. The same applies, even more so, to the regional government. The Province of Limburg has chosen to play a decisive role and has set the standard high: it has set its sights on a leading position on an international level in more sustainable chemicals and materials.

Text Lucien Joppen Images Laurens Bouvrie

In 2012, exactly five years ago, a number of parties – the Province of Limburg, Greenport Venlo, Maastricht University and Chemelot, with the support of Industriebank LIOF – signed a declaration of intent. The signing was the kick-off for a ‘competition’ to catapult Limburg into a European top region in the biobased economy.

Two years later, Source B. was introduced during the national network meeting Biobased Economy in Venlo. Source B., a networking organisation, endeavours to bring the individual parties from the business community and the knowledge community together. The focal points are components and residual streams from biomass in the primary sector, and new materials based on green building blocks. The important point is that the entire value chain is involved: from crop to end product.

At the table are Emmo Meijer, figurehead of Source B. and Top Sector Chemistry, among other things, and Twan Beurskens, member of the Provincial Executive for Economy and Knowledge Infrastructure. The two gentlemen look

back and to the future on the province’s ‘voyage of discovery’ to the economy of the future.

Mr Beurskens, why has the Province of Limburg chosen to participate in the race for a ‘biobased’ leading position in chemicals/materials?

‘To explain that, I have to go back to the peak of the crisis, in 2012. In that year, the Netherlands and Limburg as well felt the impact of the ailing economy only too well. As a province we were faced with a fundamental choice: how were we going to mobilise our resources to build a future-proof working and living environment? There were several currents of feeling: one suggested abandoning the manufacturing industry and aiming at a combination of leisure and business

services. For my part, I particularly liked the idea of strengthening the manufacturing industry by placing a heavy emphasis on innovation. In the Netherlands it is difficult for us to compete on price with other countries or regions. That is why businesses increasingly need to develop new processes and/or products to have any relevance on the market and to create added value. Biobased/circular concepts offer

prospects of new materials and revenue models which can help businesses to stand out. Limburg has a strong chemicals cluster and an active primary sector. So we are already well prepared to play a leading role in this respect.’

A transition as drastic as the (partial) change from fossil to renewables is not a surprise, however. In actual practice it turns out that many business cases are lagging behind from a market or technological point of view.

(Emmo Meijer) ‘You cannot expect everything to be in order within the space of five to ten years. These kinds of transition processes take decades. I have personal experience of how long it takes for large-scale movements to get going, at DSM among other places, for instance the change of policy from pure chemistry to a hybrid business model with biotechnology. Whatever the case, the lights on the horizon are clear, at least as far as the objectives for making our society and economy more sustainable are concerned. In concrete terms for the chemical sector this means that 15 percent of the feedstock (editor’s note: and 10 percent of recycled raw materials) must be made up of biomass in 2030. We are currently in the exploratory phase and it is not yet entirely clear how we are going to achieve the above objectives. It is more of a lottery with the details becoming clearer in the coming years. The same applies to the chemicals and materials project portfolio which has been built up in Limburg.’

Can you already provide an interim evaluation of the current projects? Can you already identify winners?

(Meijer) ‘I wouldn’t want to burn my fingers on that one at this stage. What is certain, is that an impressive portfolio has been built up in a short time, with the project value amounting to dozens of millions of euros. Because the projects involve different TRLs, I cannot and do not want to make any predictions. As is usually the case, a number will not make it. The haze will dissipate in the coming years and we will be able to apply more specific focus. And this is also a natural process, in which some projects will

come up against market or technological barriers and others will find their way to the market. We must also put the importance of biobased into perspective and not make it bigger than it is or can become. The chemical and manufacturing industries will continue to rely mainly on fossil raw materials. Biobased may be a major part of the puzzle in making these sectors more sustainable, but this will certainly be in combination with other approaches. The fossil CO₂ will have to be restricted as much as possible to a closed cycle, and the energy required for these processes can be disconnected from fossil and become fully “renewable”.’

Mr Beurskens, the Province of Limburg has invested heavily in the past few years in facilitating developments in four top sectors in Limburg (chemicals/materials, life science, agrifood, big data/smart services), including chemicals and materials. Do you have the same patience as Mr Meijer?

‘Yes, we consider it a long-term investment which will run for a period of ten years. The province has taken on a highly active role in facilitating the above sectors, financially and in kind. As a Province, we don’t want to be prescribing the line of march. The businesses and knowledge institutes do that themselves. Nor are we going to be settling accounts immediately. Of course we expect our investments to translate into matters such as economic growth, reduced contraction and a liveable environment in Limburg. In this phase, however, we are still working hard on fleshing out the ecosystem. The fact is that in the past years we have already staked out the necessary areas, with the establishment of the Brightlands Campus organisation, the opening of Center Court at Chemelot and the many public-private research programmes, for example InSciTe. We see that businesses have also become more active in this area, thanks to the investments by the public sector. Not a single relevant business has packed up and left since the crisis started. What’s more, most of the businesses are investing again and many new businesses are being established. In 2016, 90 hectares of industrial estate were

developed in Limburg. That makes us leaders in the Netherlands. We are also seeing good results in employment and contraction.’

Mr Meijer, is a public-private construction an absolute precondition for giving shape to the biobased transition?

‘I am convinced of the effectiveness of the triple helix approach. This often involves new value chains for mainly SME businesses and new knowledge that needs to be developed. That requires support from the public sector. It is not simply a matter of sharing risks, but also of acquiring knowledge and understanding from the education and research world. Over the past years we have worked hard to build up this ecosystem, with the Brightlands Campus organisation forming the backbone which connects all the top sectors. For biobased, that means Chemelot and Greenport Venlo. Now we are also seeing that these initiatives are stirring up interest in the SME. For instance, millions of euros of project value have been realised in the Greenport region in a short time, with half of that invested by SME entrepreneurs. A good example is the biorefinery initiative (editor’s note: Bio Treat Center). This illustrates how the spirit of enterprise in the province is not reserved solely for the larger players. It is precisely also the SME businesses in the primary sector and the manufacturing industry which want to invest in these new innovations. But, as I said earlier, that requires an ecosystem in which they can flourish, which is the case in Limburg. That makes us unique in the Netherlands.’ ●

This article was created in collaboration with Source B.



Twan Beurskens: ‘As a Province, we don’t want to be prescribing the line of march. The businesses and knowledge institutes do that themselves. Nor are we going to be settling accounts immediately. Of course we expect our investments to translate into matters such as economic growth, reduced contraction and a liveable environment in Limburg.’



CONNECTION WITH ADDED VALUE



BioLinX has been present at several networking events within the EU, in this case at the Biobased Delta Business Development Day in Bergen op Zoom (the Netherlands). See also the picture on page 25.

BioLinX is supported by eight parties: REWIN, TNO, SP, PNO, Dechema, Innen, SC and Eunlimited. The above parties combine expertise in innovation (subsidies, PI, etc.), project support, business development, chemistry and engineering. These partners support businesses/consortiums in twelve European clusters, including Biobased Delta, Flanders, Sweden, Finland etc. **On 16/17 October, the second Finance Academy will be held in Gothenburg, Sweden.**

‘Our aim with BioLinX is to guide the businesses and organisations that want to put biobased products on the market through the TRL process faster. The emphasis is on connecting – linking – different parties and providing support in entrepreneurial skills.’

Text Lucien Joppen Images BioLinX

Dennis van der Pas (REWIN West-Brabant) has been managing the above project since 2015. The end date of BioLinX is mid-2018. ‘BioLinX was set up at the request of the European Commission. It saw that many research programmes under the FP7 programme were not resulting in the market introduction of biobased products. That explains the desire of the European Commission to support project owners. That applied to us, that is BioLinX, especially for the projects under the flag of the FP7-Biobased Economy and later also for the Horizon 2020 projects. The FP7 and Horizon 2020 programmes now cover more than 500 research projects, varying from large flagship projects aimed at the pilot

production of biobased molecules to smaller procedures targeting a specific process. Van der Pas: ‘All shades of green were present. That is why we deliberately chose to focus on agriculture and forestry in the project design. In doing this we were also in line with the regions which were involved in the project from the start: southwestern Netherlands, southwestern Sweden and northern Italy.’

MATCHMAKING

The question is: what does BioLinX actually do? Well, it encompasses a range of services (with a budget of approximately EUR 2 million) with which it can support businesses, consortiums or clusters. ‘First and foremost it is about networking,’ says Roald Suurs (TNO), one of the work package leaders at BioLinX. ‘Many companies do not have a clear overview. As a consortium we have built up good contacts in Europe, so we can get parties connected quite quickly. We organise international brokerage events (editor’s note: knowledge sharing and match-making) ourselves, which we organise according to themes. This increases the chance that parties are on the same wavelength.’ TNO developed a method for gathering information about biobased regions. Suurs applied this



method at BioLinX, together with the partners, to 12 European regions. In the studies performed by the consortium, the regions were analysed on matters such as their assets (businesses, research institutes, etc.) and the needs. ‘This kind of exercise is necessary so that we can ultimately perform a good networking role,’ according to Suurs.

HURT

Besides providing support for finding the right partners, BioLinX also helps entrepreneurs with their questions about knowledge. The website, biolinx-project.eu, contains information about intellectual property (IP) and an overview of what is for sale. ‘Companies may think they have developed a unique process or product,’ explains Van der Pas. ‘That can make things unpleasant if their concepts infringe the IP rights of others. It is better if you can prevent that.’ According to Van der Pas and Suurs, entrepreneurial skills are essential if research projects are to continue to grow. That applies mainly to the TRL 4/5 phase. ‘Often it will hurt,’ says Van

der Pas. ‘Processes that have to be scaled up, a need for more capital and stricter requirements on entrepreneurship. Not every project or innovation owner is cut out for that. He or she will need help to develop these skills. We do that through various training sessions and seminars. For instance, TNO provides a session on Intellectual Property. In that, we pay attention specifically to funding, which is one of the largest obstacles for businesses to overcome. Through BioLinX we can make these businesses aware of funding possibilities which are not immediately obvious. We also train people in how to pitch their process or product to venture capital investors. The participants are given practical tips they can use to prepare themselves as best as possible for difficult questions from these parties. In the end we also bring them into contact with investors.’

DESIGNING AN ECOSYSTEM

Two thirds of the term of BioLinX have already passed. Has the project achieved actual results? ‘Definitely’ is Suurs’ answer. ‘BioLinX was set up according to TNO’s Reflective Monitoring

methodology. That allows us to monitor the impact of the project quite regularly. ‘We are involved in a total of 60 projects with FP7 and Horizon 2020. Our impact is mainly on the process. As explained earlier, we support project owners in various areas, so that we do not see the results back immediately one-on-one. That does happen with networking. For example, we brought a party from Scandinavia that was working with lignin into contact with a Dutch manufacturer of coatings. PNO helped an Italian partner set up a new consortium aimed at the valorisation of residual streams from the food industry in three different regions. Did we help parties get through the TRL 4/5 phase faster, as we originally intended? I think it is still too early to know. We have contributed to the design of an international ecosystem in which parties from diverse regions can find each other more easily. This network is ultimately also necessary for realising biobased processes and products, preferably in the regional clusters which come under BioLinX. Businesses will continue to benefit from this ‘legacy’ even after BioLinX has been rounded off.’ ●

DISTINCTION BASED ON FUNCTIONALITY

A large share of biomedical materials is based on fossil resources and metals, but biobased biomedical materials are on the rise. Currently they still form a small market, but definitely one with possibilities in the specific, distinguishing properties which biomass can offer. The development process does require the necessary patience.

Text Lucien Joppen Image Shutterstock



SUCCESSFUL PRODUCTS

Internal bleeding is often a problem which cannot be prevented by conventional techniques such as sutures or staples. There are also tissue adhesives which glue the wound temporarily. Fossil products are available, but they are not always biocompatible or do not perform consistently well. In vitro tests have shown that biobased adhesives based on dextran (editor's note: polysaccharide) do adhere satisfactorily on dry and moist surfaces and do not cause toxic reactions. Moreover, the biodegradability can be controlled, as can the adhesive properties. This gives the adhesive a large area of application, both for IC operations and common interventions.

Source: Bio-Based Materials step into the operating room, Bhatia, 2012 (American Institute of Chemical Engineers).

But biobased biomedical materials are not new. Linen and cotton have been used for bandages for centuries, for instance, largely because of their absorbent properties. This article is not so much about the common biomedical materials as

sch, associate professor Biobased Materials at Maastricht University in the Netherlands. 'Metal alloys and silicones are also used. Some examples are surgical mesh made from PP, catheters made from PU, metal stents and metal alloys for hip prostheses.'

PATIENT WELFARE FIRST, SUSTAINABILITY NOT IMPORTANT

Instances of biopolymers and/or biocomposites are few and far between, according to Knetsch. 'PLA has become well established now, for example for orthopaedic implants (including screws) or soluble sutures. Because the degradability of PLA can be controlled, it is an excellent material to use for temporary solutions, such as drug delivery within the body. In the case of the first two applications mentioned, it prevents the need for a second operation to remove the materials.'

The latter illustrates the most important driving force behind the development of biomedical materials. The medical profession does not care which materials are used – it is concerned with the implications for the patient. 'Sustainability or CO₂ footprint do not play any part at all,' according to Knetsch. 'These materials are assessed purely on their properties and role in the treatment process.'

BIOCOMPATIBILITY

One property is the above-mentioned degradability, even though there are fossil plastics which can degrade, such as PBS. Degradability in the human body is not the only priority of biomedical materials, however. Knetsch names 'biocompatibility' as a distinguishing property which is relevant in regenerative medicine especially. In this discipline, cells, tissues and organs are regenerated. Examples are bone and cartilage repair, pressure sores and burns and many kinds of organ disorders. 'The materials used

about the 'new generation', with the focus on biopolymers which can replace their fossil counterparts. 'The bulk of biomedical materials – materials which are used in the human body in the healing process – are of fossil origin,' says Menno Knet-

NETTLES

The AMIBM (Aachen Maastricht Institute for Biobased Materials) is investigating wound treatment among other things, examining the potential of the nettle. Not only the fibres of nettles are interesting, but also their bio-active components which prevent infections and aid the healing process. The AMIBM is currently investigating the extent to which these bio-active components can be extracted and purified so they can then be used in an application.

for this purpose function as tools for the body to tackle the healing process. It is important that this material is not rejected by the body and does not cause complications in surrounding tissues. That is where biobased materials are preferable: to start with, they can be biodegradable and they are of organic origin, which reduces the risk of complications.' The literature also mentions the porosity of biobased materials. This property makes it possible to develop 3D scaffolds which can facilitate the growth of new cells. These cells gradually replace this artificial framework (thanks to the porosity), after which the framework eventually dissolves.

UNWANTED SIDE EFFECTS

The degradability of biopolymers in the human body should not be taken lightly. Some constituents that dissolve in nature can possibly cause problems in the body. Knetsch mentions lactic acid, a residual product of PLA, which can result in tissue necrosis (editor's note: the dying off of cell tissue). This unwanted side effect can be avoided by adjusting the formula. Whatever the

case, every blend based on biodegradable biopolymers will have to be investigated for its effects on the human body. This means that the development process of new materials and/or material combinations is lengthy and expensive. 'These materials do have to offer considerable advantages to justify the investment risk for the often smaller-sized companies. The medical profession generally does not switch to new materials or treatment methods that easily. Indeed, why should it if it already has something that works and is reliable.'

PRICE PLAYS NO PART

Another hurdle, price, is less relevant in biomedical materials, according to Knetsch. Material costs generally form only a fraction of the total treatment. Employee costs are the largest cost item. So if biobased biomedical materials accelerate the treatment or prevent a post operation (to remove materials), these would even turn out to be cheaper. Is there no chance at all for biobased materials in healthcare? Far from it. There are already successful products (see box) which are at an advanced stage in the pipeline. Knetsch sees opportunities – as indicated earlier – mainly in regenerative medicine. 'The trend is that biomedical materials have to offer several functionalities – degradability, biocompatibility, regenerative capacity, etc. Biobased materials and plastics have the potential to meet this 'need'. Yes, the development will take time, and that is why an initiative like AMIBM is essential to do the much-needed groundwork. This knowledge base can then serve as the foundation for developing specific applications.' ●

This article was created in collaboration with Source B.

THE BAC:

BROAD FOCUS ON BIOPOLYMERS

‘The Biopolymer Application Centre is intended to bring biopolymers in a general sense to the attention of the industry and consumers. We carry out technical research, but also work on (consumer) research and marketing and communication.’

Text Lucien Joppen Image Be-O, BAC

The environmental impact of plastics has pushed biopolymers to the fore, albeit not always in a positive way. Interest from market parties is growing – just look at the efforts of companies like Coca-Cola and IKEA. These enterprises – and they are

certainly not the only players – want to use renewable raw materials as much as possible so these can then be recycled, possibly together with ‘virgin’ materials. ‘Biopolymers are going from strength to strength,’ says Gertjan Visse, project leader at

the BAC, ‘but they still only have a fraction of the total market. The market is dominated by fossil polymers, which is hardly surprising given the current oil price. Biopolymers which compete directly with fossil counterparts, such as bio-PET and PET, are having a hard time. But biopolymers with functions that stand out from the rest are less affected by price competition. These properties include biodegradability, better barrier properties and an attractive look-and-feel. The more favourable CO₂ footprint of biopolymers is a purchasing argument for parties which are consciously trying to be more sustainable, but for most businesses, the price tag will be the deciding factor.’

MARS WRAPPER

Market ignorance about biopolymers forms another hurdle. Various misconceptions prevail about degradability and functionality, such as the idea that biopolymers perform less well on properties such as heat resistance and life span. Visse: ‘The SIA-RAAK project ‘Functional stability of biopolymers’ has given the Centre of Expertise Biobased Economy and Wageningen University & Research and Fontys University of Applied Sciences valuable insights into the pro-

RODENBURG AS ‘FOUNDING FATHER’

The idea for the BAC was actually thought up by Rodenburg Biopolymers. Founder of the company, Aaik Rodenburg: ‘We wanted to perform small-scale tests for our customers. Very soon we found out that these activities are best performed by a third party. That allows other businesses to use those services as well. If our customers have specific questions that we cannot answer ourselves, we can refer them to the BAC. We have done this several times, for example with a question about processing coffee sediment in an application with our product Solanyl.’ The BAC has also led to insights relating to the role of PHA in Solanyl, according to Rodenburg. ‘This enabled us to improve the heat resistance of the material.’ Rodenburg sees greater advantage for marketing through collaboration with injection moulding businesses and thermoformers. ‘These parties are closer to the market and they also have contact with end users. A good example is the biobased wrapper we developed with a supplier [editor’s note: Taghleef] and Mars. Trainees from Avans also worked on this project.’ The BAC is currently funded by the European Regional Development Fund (ERDF) and the Dutch provinces of Limburg and Noord-Brabant in the Operational Programme South (OPZuid). Funding will continue through 2020.



The Be-O-bottle, by the end of 2017 this biobased drinking bottle will be on the market.

perties of biopolymers which need to have a long life span. The reason is simple. If the use of biopolymers remains limited to short cycle applications, the market will be considerably restricted. In this project we wanted to investigate which structural characteristics are important for properties such as UV resistance and heat resistance. The main part, however, was applied research: a total of more than 200 students completed a practical project, mostly based on questions from SME companies. Students were involved for example in the development process of a degradable wrapper for Mars (see box).’

The research project also received recognition from the National Taskforce for Applied Research, which awarded ‘Functional stability of biopoly-

‘MANY COMPANIES DO NOT HAVE THE MEANS TO CONDUCT FEASIBILITY TESTS. AT BAC WE ARE ABLE RESPOND QUICKLY TO REQUESTS IN THIS DOMAIN.’

mers’ a silver medal in the RAAK awards. The jury found that ‘the project delivered excellent concrete and socially relevant products.’

CHAIN-WIDE

The BAC, which started in 2015 in the Netherlands, forms a follow-up to the SIA-RAAK project above. Among other things, it provides a development workshop where businesses can test applications on a very small scale: prototyping. ‘This is an important service,’ according to Visse. ‘Many companies do not have the means or the equipment to perform these (feasibility) tests. At the BAC we can respond quite quickly to such requests, minimizing the costs. We have equipment for injection moulding, extrusion, compounding and 3D printing.’

Visse stresses that the production process is just one aspect of the BAC. The initiative covers the entire chain, from feedstock selection to marketing. ‘The BAC also plays a part in >>



communication and marketing. The importance of communication in technological innovations is undervalued as a rule. When you want to introduce a technology, you also have to explain what it means so that businesses, consumers and investors are motivated. For instance, we are going to help a number of designers and artists with a Kickstart campaign for their bio-based artworks.'

CROWDFUNDING FOR BE-O

Nijmegen citizen Damir Perkic, founder of start-up Be-O, made use of the services of the BAC. He developed the Be-O bottle, a reusable water bottle which is based on bio HDPE and bio TPE. 'The concept is similar to the Doppler-bottle, but it has a better CO₂ footprint and a striking design. Our pricing is within the range of the Doppler.'

Be-O's mission is to accelerate the transition from fossil plastics to bioplastics, according to Perkic, by 'putting reusable products made from bioplastics on the market.'

Perkic contacted the BAC when he was looking for funding for his start-up. 'In the first instance, I wanted exposure on online forums to generate some name recognition. And I also wanted to obtain some initial funding through crowdfunding. A trainee with the BAC was able to provide

great assistance with the social media and with spreading our message. In the end, the crowdfunding campaign raised sufficient funds for us to continue. We are currently in discussion with several investors, of which some were reached through the crowdfunding campaign. The discussions are positive and we expect to introduce the Be-O bottle on the market in the short term.' The aim is for Be-O to use other bioplastics as well in the future for reusable products yet to be designed. 'Miscanthus is one of the options. This research is being carried out via Food & Biobased Research at Wageningen University & Research and the German FKUR. These parties have made the most progress with this material.'

BERGEN OP ZOOM: FOCUS ON ECONOMY

The BAC not only collaborates with entrepreneurs, but is also commissioned for projects by public parties. The municipality of Bergen op Zoom currently has two projects running through the BAC. Dietmar Lemmens, Economic Affairs project manager for the municipality in the province of Noord-Brabant: 'We had already become acquainted with the BAC in the past, when it was involved in the development of the biobased coins for pop music venue Gebouw-T in our town. Bergen op Zoom sees the biobased/circular eco-

nomy primarily as an opportunity for attracting new activity. In the past, for instance with Philip Morris, it has been clear how vulnerable we are when many jobs are lost at large companies. So we want to stimulate this development actively. No more interminable policy memos, but real lines of action. That is how we are linking culture and design with biobased as well. This can be done through a coin, but also through the carnival associations. We encourage them not to use only fossil plastics on their floats, but to also consider composites or biobased materials.'

Through its purchasing policy, the design of the public space and participation in initiatives such as the Green Chemistry Campus, Bergen op Zoom invests in projects which are intended to speed up the transition to a biobased economy. 'Our efforts should result ultimately in increased employment. That won't happen overnight. Patience and perseverance are vital.' ●

This article was created in collaboration with Biobased Delta.

Interested in the activities/services of BAC?
www.biopolymeer.nl or call Gertjan Visse
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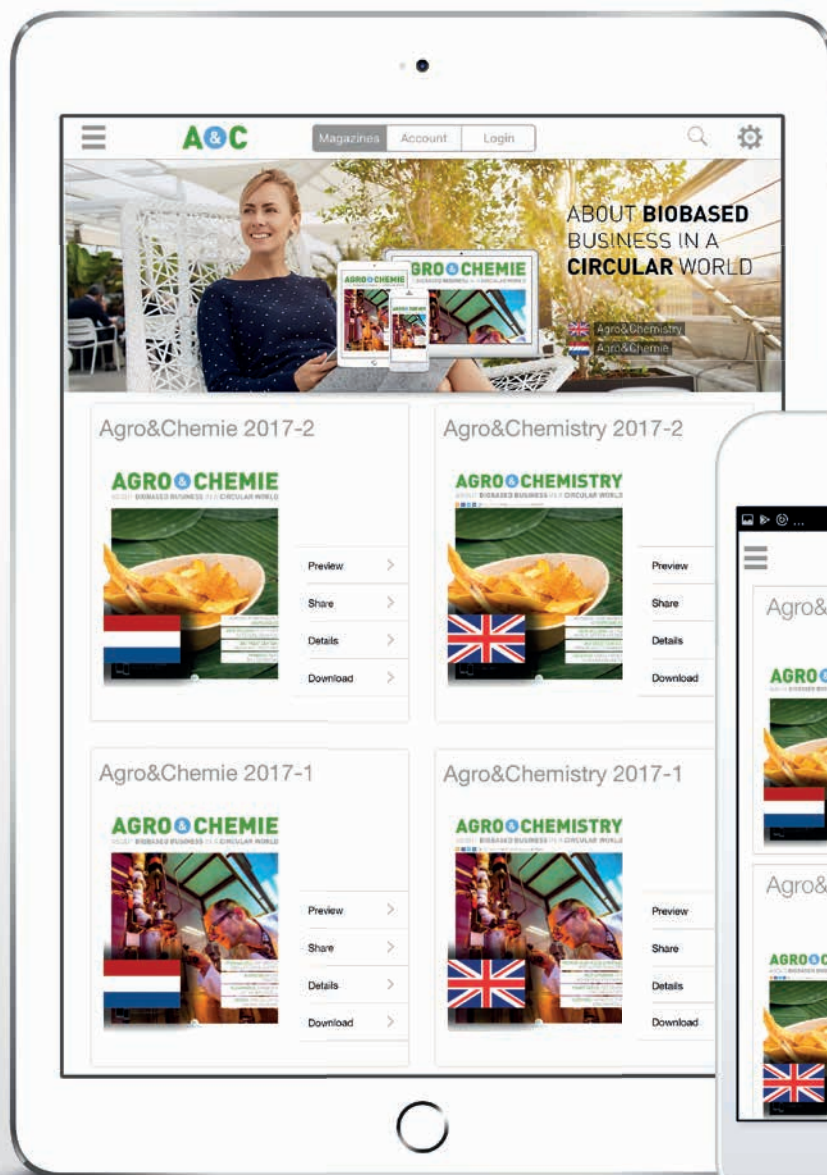
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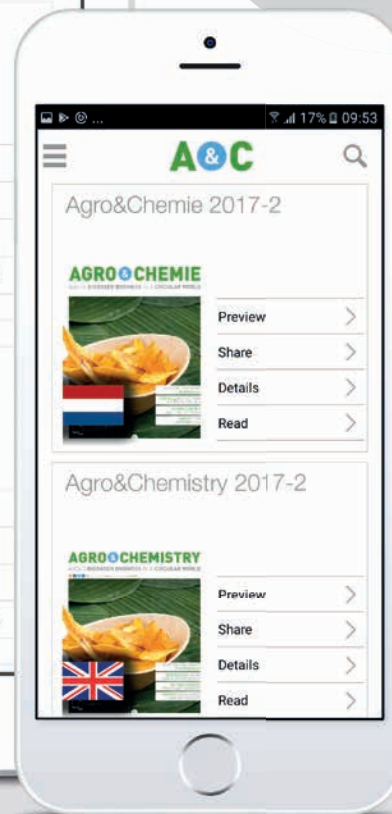
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