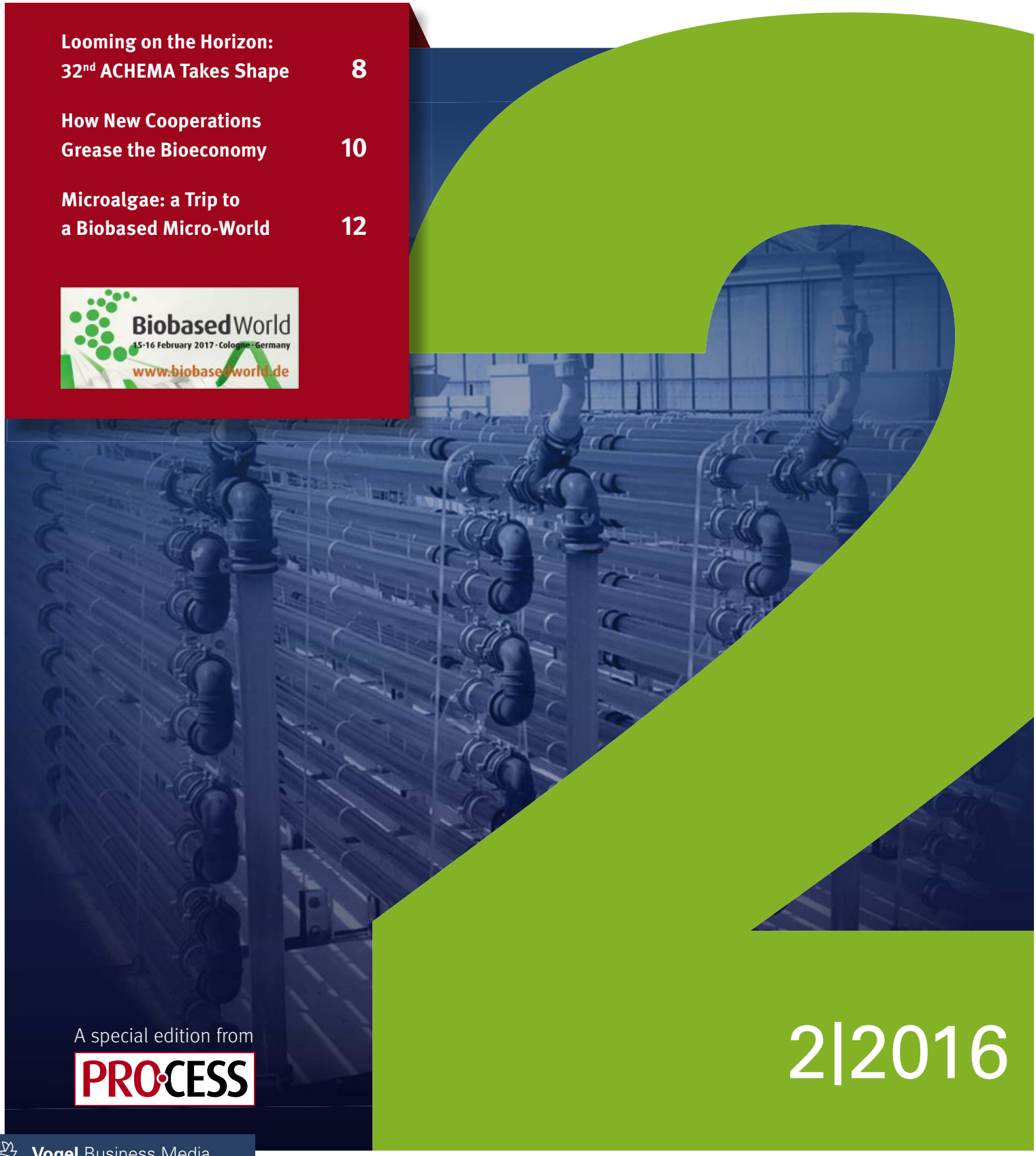
# ACHEMA Worldwide News







A special edition from PROCESS


2|2016

Vogel Business Media

# IT'S TIME FOR CHANGE!

Source: Organobalance

■ **PROF. DR. CHRISTINE LANG**
Co-Chair German
Bioeconomy Council,
CEO Organobalance GmbH ■

In Europe, the term bioeconomy has been in use for more than 20 years — originally to describe the quest for alternatives to the use of finite resources such as oil and gas, but for some time now to embody what it was actually intended for: a bio-based economy.

Bioeconomy refers to developing and marketing products, processes, and services for different industries either based on or by using biological resources, with the support of science and research.

With regard to its visibility and role in scientific communication or at trade fairs, bioeconomy has for the longest time been relegated to remaining a hanger-on, someone invited amicably to the table, but without a room of its own. This is about to change: In February 2017, BiobasedWorld in Cologne will be the first trade show exclusively for and with players of the rapidly growing bio-based industries. They develop products with an outstanding commitment to sustainability: They protect our environment, safeguard future generations, are state-of-the-art when it comes to technology and science, and are often better and healthier than what we're used to from the industries' conventional production processes during the previous century. Simultaneously, they have to be economic in use.

Plastics from plant matter, enzymes in cleaning products, microbial-based pharmaceuticals — agriculture, forestry, energy, pharmaceutical, chemical, food, and apparel industries and many other sectors can no longer be imagined without the bioeconomy. The turnover of the EU bioeconomy has been estimated at 2.1 trillion euros in 2013, representing about 8 % of the total non-financial business turnover.

In recent years, the bioeconomy has been boosted in particular by what is known as white or industrial biotechnology. Now that policymakers, trade associations, and stakeholder groups have also recognized what it offers to businesses, people, and nature and are promoting specific research activities, the bioeconomy has gained a broad base. It preserves resources for future use and often relies on materials we previously had disposed of as waste. In addition, collaboration between businesses and research institutions is intensifying across various sectors of the bioeconomy.

*"Many sectors can no longer be imagined without the bioeconomy."*

The new trade show BiobasedWorld will be the first to adequately represent the bioeconomy's standing and development potential, and the significance of its products. It offers to all participants an important platform to exchange ideas, present advantages and opportunities for economy and society — in Germany, Europe, and worldwide — and increase their international visibility.

# CONTENTS

■ **MICROALGAE**
What is so exciting about microalgae? For example, at the world's first mesh ultra thin layer reactor algae production and conversion to biokerosene has been investigated. ■


■ **ACHEMASIA 2016**
When the halls closed, exhibitors and organizers left with a smile: AchemAsia in retrospect. ■


■ **ACHEMA 2018 ...**
... will again be the place where technology trends are launched. Three focal topics promise to set new impulses. ■

# ACHEMASIA BRAVES ROUGH ECONOMIC ENVIRONMENT

The signs pointed to storms ahead, but this year's AchemAsia travelled the rough economic seas safely: When the halls closed, exhibitors and organizers left with a smile.

All in all 11,834 visitors found their way to China's most international exhibition for the process industries, only slightly less than in 2013 when 12,470 were counted. This is especially remarkable because in the run-up to the event the number of exhibitors had dropped significantly, with especially Western firms hesitant about their current China engagement.

"The visitor response shows that in economic challenging times as these, to come forward, to present your products and technologies and to keep in touch with suppliers and customers is crucial", said Dr.-Ing. Thomas Scheuring, CEO of DECHEMA Ausstellungs-GmbH. "The Chinese industry is in a state of transformation. With new goals being set — not least by the lately published new Five-Year-Plan — experts are on the lookout for new




Source: DECHEMA

technologies and innovative ideas." Scheuring said that he felt especially happy that the loyal exhibitors had been rewarded by not only a large number of visitors, but many had also complimented on the visitors' quality.

Overall, 295 exhibitors from 17 countries took part in AchemAsia. The largest share came from China with 194 exhibitors, including a number of international subsidiaries. The second largest delegation came from Germany with 49 companies, followed by France with 17.

"AchemAsia was a very good show and brought a range of interesting visitors to the exhibitors. Distributors and especially a significant number of customers were on site, a proof that the event is well-known in the chemical community. Despite the overall economic slowdown in China, this sector plays an important role for innovation and stays a major factor in the Asian economy", says Philippe Marrec, Director of Industries Division at the Business France China Beijing Office.

Exhibits on display included plant equipment, filter technologies, mechanical and thermal engineering devices, laboratory equipment, analytical devices as well as biochemical equipment and plant engineering services.

The congress that consisted of several satellite symposia also received much attention. Especially the sessions on Separation Technology and on New Findings in Process Technology, where exhibitors presented their latest innovations, drew large crowds, leaving hardly a seat unoccupied. Other sessions such as the "Internet+" Intelligence Construction Symposium, the Forum on Detection and Repair of Volatile Organic Compounds, on Water Treatment and on Bio-Corrosion, on Current Challenges of the Petroleum Industries also met with high interest.

"The range of topics that was covered in the congress is impressive", Prof. Dr. Kurt Wagemann, Executive Director of DECHEMA, said. "Having different partners organize the sessions, choosing themes for their topicality and up-to-dateness, ensures that the congress program overall offers highlights for all the different stakeholders."

In addition, some exhibitors used the opportunity to offer workshops and symposia for their customers and interested visitors. Thus, Sartorius presented its single use technology equipment in a workshop where both the company's application developers and products managers and customers relayed their experiences. Single use technologies allow for maximum flexibility especially in biopharmaceutical production and are a striking example for modular production concepts that are nowadays discussed extensively in "traditional" chemical production as well. ■

**Save the Date**

The next AchemAsia is scheduled for May 2019 in Beijing/PR China.

# LOOMING ON THE HORIZON:

Considering today's work pace an event mid 2018 feels pretty far away. But — then again ...

DR. THOMAS SCHEURING*

Large events need to be organized well in advance. And ACHEMA 2018 no doubt will be large in every aspect: 170,000 participants from more than 100 countries, including 30,000 executives, will make ACHEMA the top communication hub of the process industry. In 2018 ACHEMA will again be the place where technology trends are launched, investment decisions are taken and new ventures initiated.

Nowhere is the heartbeat of the process industry faster, more intense, more up-to-date, more innovative and international than here: ACHEMA is the trendsetting event for all sectors of our industry, is showcase of current technological developments and technology platform with a worldwide signalling effect.

What sets ACHEMA apart from other trade shows for our sector is the synergy potential which is being created through sheer technological diversity. Environmental protection, biotechnology or materials science for instance are all topics of overriding significance, exploiting technological solutions which are all enabled by process engineering.

Production-integrated environmental protection has correspondingly become one of the hallmarks of ACHEMA. Or, another example: nowhere is the merging of molecular and industrial biotechnology as tangible as at ACHEMA.

And the list goes on: Given the shortage of water resources, efficient industrial water management is an essential requirement for the operation of any industrial site. Today's challenges, such as the energy turnaround, demand innovative solutions — that in turn rely on the progress in materials science. But, without coherent safety concepts, all of this is: Nothing!

In 2018 we will once again showcase the complete spectrum of process engineering — hence a broad spectrum of innovative technology which will spur the implementation of new projects.

## Three Focal Topics

Keeping up with ACHEMA's strategy to address hot topics with the potential to revolutionize our industry we are coming up with three focal topics which promise to set new impulses:

- Biotech for Chemistry: from gene to process to product — chemical and biotechnological processes are merging.
- Flexible Production: smaller batches, more specialised products, faster cycles — the digital integration of the value chain makes it possible.
- Chemical and Pharma Logistics: from service provider to system partner with higher-level solutions — the digitization of the logistics chain opens new doors in supply chain management and distribution.

A high-profile, explicitly practice-oriented conference programme is complementing the exhibition and contributes to ACHEMA's all-around approach. Numerous special and guest events, expert round tables, panel discussions, and plenary lectures offer a comprehensive overview of current trends and the multifaceted diversity of process engineering.

To present practice-oriented topics in compact form by experts associated with our exhibitors — this is the mission of the recently implemented, highly attractive ACHEMA-PRAXISforums. They will be held in close proximity to the respective exhibition group in the midst of the exhibition grounds with the following topics fixed already now:

- Pharma meets Production
- Chemicals' & Pharmaceuticals' Logistics
- Innovative Mixing & Separation Solutions
- Sensor-based production control
- Lab of the Future
- State of the Art in Fluid Handling
- Safety First!
- Advanced Reactor Design
- Bioprocessing: speed, flexibility, disposables

School and university students have their own special programme at ACHEMA, giving the next generation — tomorrow's customers and employees! — an all-around introduction to the world of process engineering.

Thanks to the personnel resources of 170,000 participants, ACHEMA is — virtually in passing — also the perfect setting for a targeted personnel search. Where else could you find a better platform for filling open positions than at ACHEMA? With the well-established "jobvector career day" ACHEMA supports exhibiting companies in finding suitable young talent and filling vacancies.

## ACHEMA Start-Up Award

Another highlight is the ACHEMA Start-Up Award: Whose business concept is the best, bringing the process industry forward with fresh ideas and entrepreneurial spirit? Through this award the ACHEMA honors outstanding ideas and start-ups from the fields of chemistry, process technology and biotechnology. Endowed with prize money of 10,000 Euro each, the award offers the three finalists financial start-up aid as well as media backup and becomes the stepping stone for entrepreneurial breakthrough.

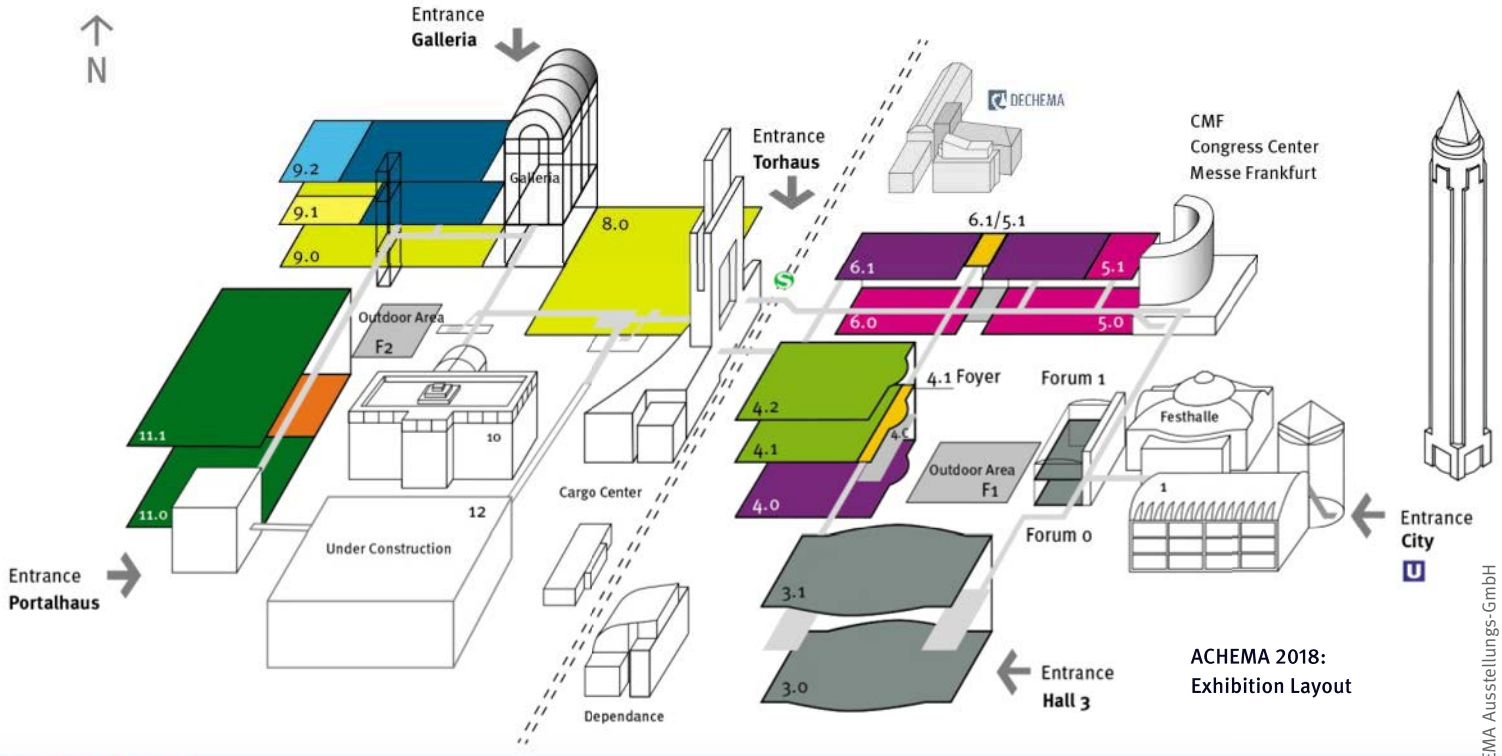
## Quick Access to All Information

Efficient navigation aids facilitate access to all information and create a clear pathway through the vast array of ACHEMA services (www.achema.de).

And last but not least: We have something on offer for everybody as we aim to address the needs of medium-sized enterprises, international companies, family businesses, start-ups or industrial holdings likewise. Different stand options geared towards different budgets make this feasible. Just talk to us — and find out what works best for you and your company! ■

*T. Scheuring, CEO DECHEMA Ausstellungs-GmbH

# 32ND ACHEMA TAKES SHAPE




ACHEMA 2018:
Exhibition Layout

Source: DECHEMA Ausstellungs-GmbH

## EXHIBITION GROUPS

- Engineering 9.1, 9.2
- Literature, Information, Learning and Teaching Aids Foyer 4.1 , Passage Hall 5.1-6.1
- Pharmaceutical, Packaging and Storage Techniques 3.0, 3.1, Forum 0, Forum 1
- Thermal Processes 4.0, 5.1, 6.1
- Research and Innovation 9.2
- Mechanical Processes 5.0, 5.1, 6.0
- Pumps, Compressors, Valves and Fittings 8.0, 9.0, 9.1
- Materials Technology and Testing 11.0
- Laboratory and Analytical Techniques 4.1, 4.2
- Instrumentation, Control and Automation Techniques 11.0, 11.1
- Industrial and Labour Safety 9.1


Picture: Jean-Luc Valentin / Dechema

# HOW NEW COOPERATIONS GREASE THE BIOECONOMY

Imagine you are a producer of lubricants, and you want to go biobased …

DR. KATHRIN RÜBBERDT*

The market is there, for sure, because many applications — from the chain saw in the forest to the wind power generator in the Wadden Sea — require biodegradable lubricants — a feature that can easily be achieved with biobased source materials.

The technical requirements are no obstacle: German lubricant producer Fuchs Petrolub estimates that from a technical point of view, about 90 % of all lubricants could be replaced by biobased products. Apart from a lack of knowledge and some consumer mistrust to the "natural" alternatives, the higher prices — up to twice or three times that of mineral-oil based lubricants — present the main hurdle that keeps buyers from switching from fossil to bio. On the other hand, the German "Fachagentur Nachwachsende Rohstoffe" has calculated that the savings due to a longer operating life of biolubricants more than compensate the higher initial price.

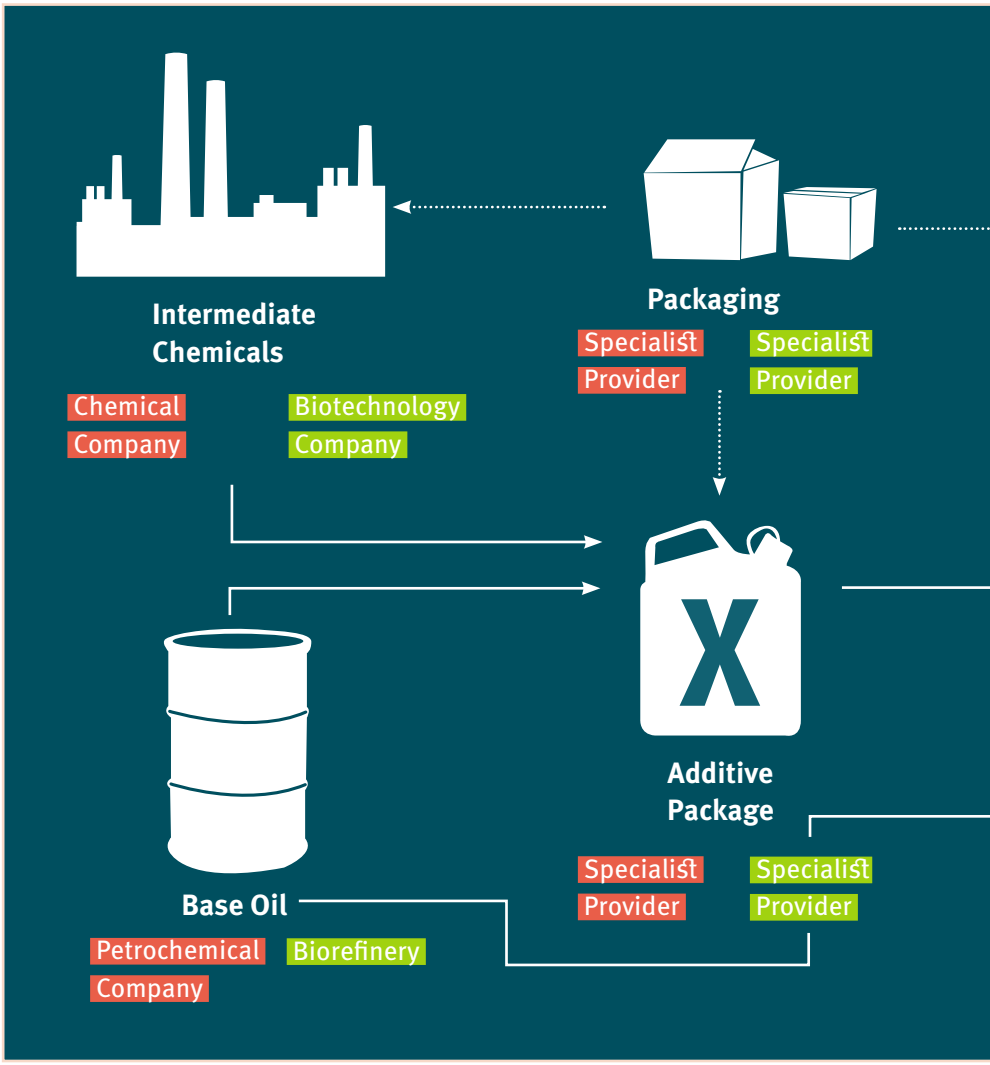
## Looking for New Suppliers

So now you have to go looking for new suppliers. Conventional base oils come either directly out of the petrochemical refinery or are chemically processed to obtain the desired properties such as a specific viscosity, low sulfur content or thermostability. The lubricant producer processes the base oil and formulates it with about 15 % up to 30 % of additives; these are often pre-formulated by additive suppliers that buy the ingredients from chemical companies. A lubricant may contain up to 20 substances; the formulations are mostly proprietary information and well-guarded trade secrets. The formulators usually sell directly to distributors and end-users.

Until now, you have bought your base oil from one of the large petrochemical companies. Now, you have to look for companies that offer base oils made from rapeseed or palm oil.

One new-comer in the market is Biosynthetic Technologies. Its primary product line, sold under the name of Biosynthetic Base Oil, is comprised of biobased oils that are synthesized specifically for high performance lubricant applications in the automotive and industrial sectors. Currently available in a low and a high viscosity, the company claims that the biosynthetic oils can be blended into a variety of viscosities to meet most lubricant applications.

Another supplier is Renewable Lubricants that claims to sell over 250 products to the biobased lubricant market. Combining vegetable oils with proprietary additives, the applications range




*K. Rübberdt, Head of Biotechnology, DECHEMA e.V.

from racing engines to hydraulic requirements in extremely cold temperatures.

Elevance Renewable Sciences is co-owner of a world-scale biorefinery in Indonesia. Using metathesis, renewable natural oils are turned into high-value specialty difunctional molecules, olefins and oleochemicals with a capacity of 180 kMT. The chemicals are then processed both into base oils and additives for tailor-made biolubricants.

### Speaking of Additives

If you want to sell biobased lubricants, you need biobased additives as well. Biobased lubricants usually require less additives than their petroleum-based cousins to improve the lubricating qualities. However, they are more prone to hydrolysis and oxidation, thus requiring more preservatives. Other required additives may include thickeners, antifoaming agents, tackifiers etc. To maintain parameters such as biodegradability and environmental safety, the additives need to be free of toxic metals and phosphate.

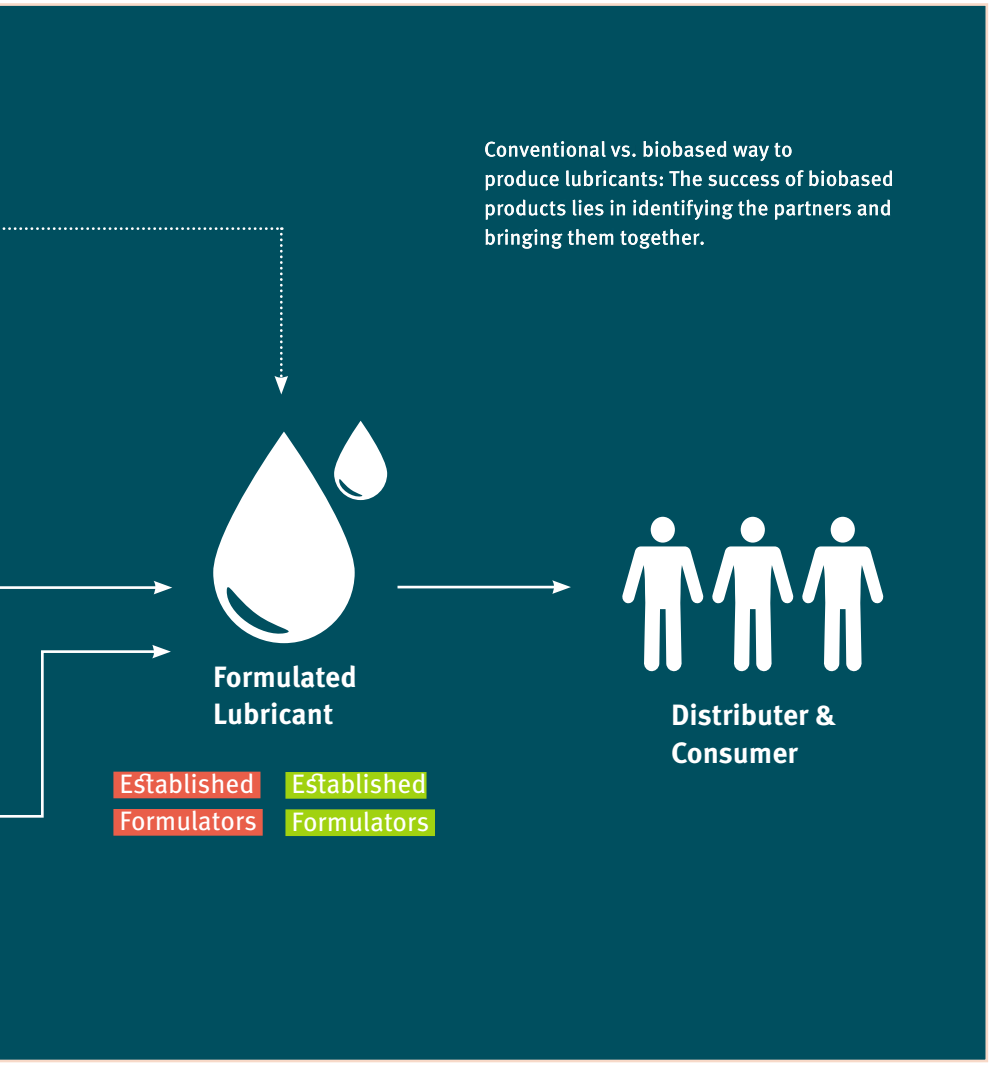


A whole industry is currently developing around biobased additives for biobased applications:

- Fuchs Petrolub is a well-known and globally active lubricant producer who is constantly expanding its range of biolubricants. Together with 14 partners including protein-provider Animox, Fuchs is currently involved in a project called TeFuProt that aims to develop protein-based lubricant additives from biobased waste streams and residues. The raw material is provided by Bunge Deutschland that operates one of the biggest oil mills in Europe.
- Another project consortium including Fuchs and biotechnology specialist Brain is already in the application testing phase for additives produced by enzymatic synthesis.
- Solazyme Industrials offers a solid lubricant tailored to improve the performance of oils and greases at extreme conditions. Upon heat, friction or pressure, the lubricant releases liquid triglyceride oils that improve lubricity and reduce friction and wear.
- Functional Products is based in Macedonia and sells biobased additives for biobased products all over the world, including polymers as thickeners, cold-flow improvers that expand the application temperature range of native oils such as canola down to as much as –30 °C, tackifiers that may be used in food processing equipment, and antioxidants.

By creating your new biobased lubricant, you will also have created a new biobased value net — including some established players such as the formulation specialists, but replacing especially the upstream steps with companies who have either a history in totally different fields such as oil mills or have been explicitly created to serve the biolubricants market.

The success of biobased products lies in identifying these partners and bringing them together — what better place to do this than BiobasedWorld? ■




Conventional vs. biobased way to produce lubricants: The success of biobased products lies in identifying the partners and bringing them together.

Graphic: PROCESS/MJ-GötzelHorn

# TRIP TO A BIOBASED MICRO-WORLD

They are green, they grow fast, they are powerful — microalgae are, so to say, small versions of the incredible Hulk. And they have their superhero story, too. Follow us on a trip to a biobased micro-world …

Source: Forschungszentrum Jülich

**The world's first mesh ultra thin layer reactor at the Algae Science Centre at Forschungszentrum Jülich/Germany: Here, for the last three years, the "Aufwind" project has investigated algae production and conversion to biokerosene.**

A couple of years ago, everybody talked about microalgae as the potential saviors of world climate. When the first planes took off powered by kerosene from algae, general media reported in depth about these bearers of hope. Since then, public discussion has calmed down again — but that doesn't mean that nothing has happened in the field.

What is so exciting about microalgae? After all, they are only microscopical herbal life forms that occur in many aquatic and terrestrial habitats. Some of them have been cultivated in the lab for almost 120 years. Yet, a couple of characteristics combine and make them so attractive for biotechnology: Per surface unit, microalgae can produce up to five times as much biomass as conventional energy crops. Algae have no seasonal growth cycle, but can be cultivated all year round. A volume of up to 100 tons dry biomass per hectar and year is deemed realistic. They do not compete for arable land with feed crops but can be cultivated in dry regions, on industrial wasteland or in the ocean. Their variety is immense: Of an estimated 100,000 species, less than 10,000 are classified, and only about 20 are used commercially.

A comprehensive study published by the EU Commissions Joint Research Centre quotes the total production volume in 2011 as 9,000 tons with large growth rates. While traditionally the lion's share of this market is made up of health food and dietary supplements, other applications are slowly gaining ground. Markets already employing high-value products include e.g. cosmetics and stable-isotope biochemicals as well as fluorescent protein markers.

Compared to the cultivation of agricultural crop, the domestication of microalgae has not even begun. Features to be addressed include the production of new molecules such as recombinant proteins or active pharmaceutical ingredients that are currently still in a research stage. Optimisation of production rates for established products remains an issue as well.

## Tremendous Playing Field for Genetic Engineers

The diversity of microalgae offers a tremendous playing field for genetic engineers; but is has also been observed that the different strains react very differently to modifications, meaning that methods have to be developed individually and customized to the respective organism. But genetic modification does not stop at productivity: Process relevant properties such as "flocculation on demand" can also be introduced, avoiding

The article is based on a DECHEMA Whitepaper on occasion of BiobasedWorld 2017.

biofouling during the growth phase. Sapphire Energy has recently filed a patent for the genetic modification of photosynthetic organisms. In these, production of a flocculating moiety can be triggered by different promoters via light, temperature or other regulatory parameters.

Major progress has already been made in the field of biofuel production with algae — be it bioethanol, biolipids, biodiesel, hydrogen production or a combination of these. But the quest for more sustainable, biobased raw materials has led algae experts to look beyond ethanol or biodiesel. According to a report in "Scientific American", researchers at the Department of Energy's National Renewable Energy Laboratory have "tweaked" cyanobacteria to produce ethylene. And one day cars powered by algae-biodiesel might even run on roads paved with algae based "bio-bitumen": French AlgoSource Technologies is developing together with a couple of universities and research institutes a hydrothermal conversion process to produce viscous phases with bitumen-like properties.

## Cultivation Principles of Microalgae

Two fundamental principles have been established for the cultivation of microalgae: Open ponds are the standard for the commercial production of a number of algal species. They require relatively little technology and allow for the production of algae biomass at moderate costs. The downsides are low biomass concentrations and productivities. So-called raceway ponds are available of the shelf in all sizes from lab equipment to large-scale production plants and account for almost 95 % of global microalgae production. The performance of raceway ponds depends strongly on location, but also on the efficiency of vertical mixing.

All open pond systems are prone to contamination. Although unwanted organisms can be excluded by operating at high salinities or adjusting pH, this in turn limits the range of microalgae species to be cultivated.

For more sensitive applications, closed photobioreactors are the method of choice. As incoming light cannot be dispersed by mixing and steep light gradients occur between the surface and the deeper layers of the suspension, a high surface-volume ratio is one of the important design criteria for photobioreactors.

Source: Etschmann / DECHEMA

**A high surface-volume ratio is one of the important design criteria for closed photobioreactors.**

Simply turning up the light is not feasible as the light uptake by algae is limited and higher intensity might even have negative effects on metabolic performance. Materials for photobioreactors need to be translucent without losing transparency over time, robust and UV-resistant, allow for the construction of long tubes or large plates by thermoforming, should preferably prevent the build-up of biofilms on the inner surface, and as a lot of material is required, cost is a major issue. Schott offers a broad range of borosilicate glass equipment including U-bends and couplings to allow for the construction of large reactor systems. Plastics typically used are low density and high density polyethylene, rigid acrylic, and polyvinyl chloride. Gicon emphasizes that its "Christmas tree" bioreactors are made of a new material blocking UV radiation while preventing biofouling.

Both plate and tubular reactors, the main types currently in use, provide thin layers of algae suspension, thus minimizing the light gradients. A further "dilution" is accomplished by keeping the suspension in constant motion either by pumping or the "air-lift" principle. As $CO_2$ needs to be supplied anyway, mixing the suspension by introducing gas bubbles sounds very logical. However, bubble size and dispersion need to be controlled and closely monitored, because the gas-liquid mass transfer otherwise may limit the productivity.

Different types of reactors are commercially available; main differentiating features are the material and the arrangement of plates or tubes in order to obtain ideal lighting conditions for the whole reactor. For low-volume high-value production where energetic aspects are not a priority, artificial lighting is also an option. Modern LED systems help to avoid the problem of overheating the reactors. Some groups even work on the development of decentralized light systems with small light-emitting modules floating within the algae suspension.

## Downstream Processing Makes the Difference

A major challenge for commercial algae products is the downstream processing of the micro-algae suspension. Compared to other fermentations, biomass concentrations are significantly lower; up to ten times the volume of conventional fermentation brews need to be handled and processed in microalgae processes. Downstream processing thus accounts for a major proportion of costs incurred, and effective methods are urgently sought for.

If these hurdles can be overcome, the road is open towards an ambitious vision of many algae researchers: The microalgae biorefinery, producing valuable chemicals, fuel, and energy from the gasification of residues. So, maybe the story of microalgae needs to be rewritten: From one superhero saving the world by one heroic action into a serial about a group of specialists acting in different fields and contributing to a larger picture — doesn't "Teenage Mutant Microalgae" hold a lot of appeal, too? ■

### Do You Want to Know more?

Are you keen on looking beyond edge of the plate (or the reactor) and discussion with experts from other disciplines and industries? Then join BiobasedWorld: **www.biobasedword.de**

# SET OUT NOW TO REACH THE TOP AT ACHEMA AND SUBMIT YOUR IDEA FOR THE ACHEMA-GRÜNDERPREIS 2018

Exploring new paths can be a lot easier if you don't have to drag along a lot of heavy luggage. That's why start-ups and enterprising founders play an important role in making ideas come true. And that's why DECHEMA, the Business Angels FrankfurtRheinMain and the High-Tech Gründerfonds want once again to help pave the way for innovations in chemistry, the process industries and industrial biotechnology. For the second time after 2015, they are calling for submissions to the ACHEMA-Gründerpreis competition. From the idea via the concept to the business plan, the ACHEMA-Gründerpreis competition provides what is most needed — advice and guidance by industry and business experts, contact to potential customers and investors and a high visibility to the global industry.


Source: © weber.stricker@gmail.com/Fotolia.com; DECHEMA

Potential founders can submit their business idea or concept as of now; following a first screening, they are teamed with experienced mentors who can help to sharpen the material into a business plan. Teams with a market-ready business plan or even in the first start-up stages don't have to wait for ACHEMA 2018 to make their next move; they get the chance to present their business to private investors and the High-Tech Gründerfonds at any time during the competition.

The most inspiring and convincing teams will be invited to pitch to the jury in spring 2018. Nine finalists are chosen to showcase their business to the whole world of the process industries at the ACHEMA-Gründerpreis booth at ACHEMA 2018 and give a presentation in the dedicated session. On top, three winning teams receive a price money of € 10,000 each.

**Registration and further information at:**
**achema.de/gruenderpreis**

## International Events Organized by DECHEMA

- **February 15–16, 2017 :** BiobasedWorld — the premier trade show for all biobased industries, Köln/Germany
- **February 23–24, 2017:** 26th ATC 2017: Industrial Inorganic Chemistry — Materials and Processes, Frankfurt/Germany
- **April 10–13, 2017:** Electrostatics 2017 — interdisciplinary forum for discussion about electrostatic phenomena and the industrial applications, Frankfurt/Germany
- **May 10–12, 2017:** EuroPACT 2017 — 4th European Conference on Process Analytics and Control Technology, Potsdam/Germany
- **June 25–28, 2017:** 6th International Conference on Self-Healing Materials, Friedrichshafen/Germany

## Further Information:

**DECHEMA e.V., Congress Office**
**Theodor-Heuss-Allee 25**
**60486 Frankfurt am Main/Germany**
**Phone +49 (0)69 7564-129/-333/-249**
**Fax +49 (0)69 7564-176**
**E-Mail:** tagungen@dechema.de Internet www.dechema.de

IMPRINT


**EDITORIAL STAFF**

| | |
|---|---|
| **Editor-in-Chief:** | Gerd Kielburger, +49 (0)9 31/ 4 18 - 25 36, gerd.kielburger@vogel.de |
| **Editor:** | Dr. Jörg Kempf, +49 (0)9 31/ 4 18 - 21 73, joerg.kempf@vogel.de |
| **Editorial Assistant:** | Gabriele Ilg, +49 (0)9 31/ 4 18 - 21 07, gabriele.ilg@vogel.de |
| **Deputy Editor-in-Chief:** | Stephanie Röll |
| **Editorial Office:** | Vogel Business Media GmbH & Co. KG, Max-Planck-Str. 7/9, 97082 Wuerzburg, Germany, Telefax +49 (0)9 31/ 4 18 - 27 50, redaktion@process.de www.process.de, www.process-worldwide.com |

**PUBLISHER**

| | |
|---|---|
| **Publisher's Address:** | Vogel Business Media GmbH & Co. KG, Max-Planck-Str. 7/9, 97082 Wuerzburg, Germany, +49 (0)9 31/ 4 18 - 0, Fax +49 (0)9 31/ 4 18 - 27 50, A Company of Vogel Business Media |
| **Chief Executive Manager:** | Stefan Rühling |
| **Advertising Manager:** | Reiner Öttinger, +49 (0)9 31/ 4 18 - 26 13, reiner.oettinger@vogel.de |
| **Advertising Service:** | Werner Wolz, +49 (0)9 31/ 4 18 - 24 79 |
| **Production:** | Agentur Print/Online |