Forschung Technologie Ausbildung

BioSC
Bioeconomy Science Center

BioSC | Newsletter | 02/2018

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International BioSC Workshop: N/P/C storage pools in algae and cyanobacteria and nutrient uptake from waste streams

September 6-7, 2018, Forschungszentrum Jülich

This workshop aims at creating a community of researchers that study and develop algae as vehicles for sustainable nutrient recycling and water reuse in agriculture. Algae can accumulate large amounts of nutrients, e.g. phosphate or nitrate, from wastewater and at the same time also clean the water, thereby making a game changing difference to the sustainability of human food production.

The workshop consists of a mini-conference on September 6, 2018, and a match-making event on September 7, 2018 which will facilitate creation or development of project consortia.

More information, agenda &
registration: www.biosc.de/workshop/npc_storage

4th BioSC Spotlight: Smart management of plant performance

Oktober 29, 2018, RWTH Aachen

Plants are a major resource for sustainable bioeconomy. They provide food, feed, and fiber to a growing world population and ensure the renewable energy supply. In the frame of the 4th BioSC Spotlight, external guests and BioSC members will present their research activities aimed at contributing to sustainable agriculture by securing crop yield and quality while reducing fertilizer and pesticide use. The event will bring together experts of academia and industry in different disciplines, accelerate the identification of fruitful research fields for further collaboration, establish a network to analyze value chains, and explore opportunities for future dissemination activities.

More information will soon be available
here: www.biosc.de/Spotlight_PlantPerformance_en

3rd PhD Day: Future Bioeconomy

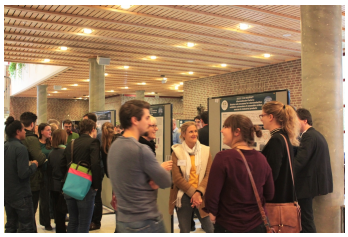
Oktober 31, 2018, Düsseldorf

After two successful NRW-wide PhD days on “Future Bioeconomy” the place and date of the third are fixed now: 31st of October in Düsseldorf. The focus of this event is the perception and description of the bioeconomy aspect in the industry. Representatives of bioeconomy-oriented companies will present their definition and perspective of bioeconomy in plenary talks. Moreover the PhD students will have the chance to discuss these topics with the industry representatives in a world-café format.

More information will soon be available here: www.biosc.de/PHD_Day

5th BioSC Forum - Internal Retreat for BioSC Core Groups

November 12, 2018, Gustav Stresemann Institute, Bonn



The BioSC Forum 2018 takes place on November 12 in the conference hotel of Gustav-Stresemann Institute in Bonn. All projects funded in the frame of the NRW Strategy Project BioSC in 2018 will be presented.

Call for contributions: The Core Groups also have the opportunity to present their **bioeconomy activities beyond the NRW Strategy Project**. These can be funding proposals, but also patents, excellence initiative proposals or infrastructures. Activities arisen from the BioSC competence network or relying on it will be preferred. There are 15 min for each contribution including questions.

If you are interested in presenting your bioeconomy-related activities beyond the NRW Strategy Project, you are invited to send an informal proposal to biosc@fz-juelich.de until September 16, 2018. The proposals will be handed over to the BioSC executive board that will select contributions until October 8, 2018.

More information, agenda & registration:
www.biosc.de/biosc_forum_2018_en

3rd International BioSC Symposium: Towards an Integrated Bioeconomy

November 12-13, 2018, Gustav Stresemann Institute, Bonn

Meeting the Grand Societal Challenges and successfully implementing a sustainable bioeconomy requires the contribution of various stakeholders and research disciplines. Basic, applied and industry-oriented research including the natural, agricultural, engineering and economic sciences have to be bundled into a systemic integrative approach. At the 3rd International BioSC Symposium, experts from academia and industry discuss recent results and new developments for a sustainable bioeconomy from different points of view.

External guests and BioSC members present their interdisciplinary projects in the following sessions and complementary poster presentations:

Session I: Socioeconomic Perspectives within a Sustainable Bioeconomy

Session II: Innovations for Plant Production and Resource Management

Session III: Green Value Chains - Processes and Products from Biomass

The **Call for Poster Abstracts** is open! www.biosc.de/Poster_Call_2018

More information, agenda &
registration: https://www.biosc.de/symposium_2018

2nd Global Bioeconomy Summit in Berlin

The 2nd Global Bioeconomy Summit took place April 19 – 20, in Berlin. It was hosted by the German Bioeconomy Council and was attended by around 700 participants. The BioSC co-organized the workshops on biorefineries, bioeconomy education and "Measuring and monitoring the bioeconomy".




Around 700 participants from more than 70 countries met in Berlin from April 19 – 20, among them many high-ranking representatives from politics, science, civil society and the business sector. It was the second time that German Bioeconomy Council had organized the Global Bioeconomy Summit.

More than 100 speakers contributed to the event. They included ministers and government representatives from Asia, Africa, Europe, South and North America, international policy experts from the United Nations, the Organization for Economic Cooperation and Development (OECD) and the European Commission, as well as high-level representatives from science and industry. In ten plenary sessions and

14 workshops, the participants discussed a wide range of societal, scientific, economic and political challenges to implementing the visions of the bioeconomy, which often differed widely among regions, in the context of the Sustainable Development Goals (SDGs).

The Bioeconomy Science Center was a co-organizer of three workshops on biorefineries, bioeconomy education and "Measuring and monitoring the bioeconomy", respectively. Each workshop was attended by around 80 participants. Short impulse presentations given by representatives from different stakeholder areas were followed by parallel activities in small discussion groups, the results of which were ultimately collated.

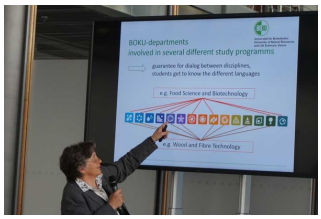
The “Bioenergy and Biorefineries” workshop focused on the problem that current approaches to biorefineries show a much lower level of maturity in integrated processing and a limited portfolio of products when compared to fossil-based refineries. This set the framework for discussion of the key topics of feedstock provision, conversion technologies, sustainability and market perspective. In the “Education and Training” workshop, discussions focused on current deficiencies and new requirements in the curricula of capacities, the contribution of the public and private sector and the development of synergies.

Other GBS workshops dealt for example with Blue Bioeconomy, biodiversity, climate change, or bioeconomy of world regions. The results from all workshops will be presented soon on the GBS homepage (http://gbs2018.com).

At the end of the 2-day conference, the participants of the Global Bioeconomy Summit agreed that the bioeconomy has yet to be appropriately included in international fora on innovation, climate, biodiversity and sustainable development policy and therefore needs its own independent global forum. This was recommended by the 40 members of the Summit’s International Advisory Council in the final communiqué.

International Cooperation in Education and Training – Workshop report from the 2nd Global Bioeconomy Summit

Research, innovation and education at all levels form an indispensable basis for the development of sustainable bioeconomy concepts. At the 2nd Global Bioeconomy Summit the BioSC was a co-organizer of a workshop on bioeconomy education.





There will be no “one-size-fits-all concept” for bioeconomy education. For the specification of the different job profiles of the bioeconomy human resource base the diversity of circumstances and requirements in different regions and macroregions in developing, emerging and developed economies have to be

considered. Educational curricula provided by universities and vocational institutions have to meet the demands of the employers in the various bioeconomy sectors. For universities, this requires research-based training with an interdisciplinary approach that emphasizes systems thinking, strategic planning, economic performance, and evaluating environmental, ethical and social issues. For vocational training and training on the job, the diversity of practical needs is huge and efficient solutions need to be built into existing approaches. In addition to focusing on the natural, technical, economic and social sciences, the curricula should also develop innovation and entrepreneurial skills in preparing graduates for management roles to promote changes in existing industries, but also to develop and grow new ventures in the bioeconomy. There is also the need to raise awareness of bioeconomy in primary and secondary education.

These developments require collaboration between universities, vocational training organisations, industry and policy and governance stakeholders. International cooperation can bring additional momentum and requires accepted standards in order to benchmark and sustain these initiatives for the future. It is important to understand, which are the optimal instruments (e.g. qualifications, quality assurance, mobility, accreditations, fellowships, grants and scholarships, etc) that need to be put in place for an effective workforce for the bioeconomy sector.

In addition to targeting curricula at university and vocational training level, there is also a need to create hubs or centres of excellence/competence in bioeconomy which can represent desired models of operation. Here, the triangle of research, education and training can grow in a way which is fostering integrative approaches by addressing the relevant stakeholders representing the different fields of the bioeconomy; whether this is in the production of biomass (e.g from agriculture, aquaculture, forestry), and its use in the food value chain or in the non-food value chains (e.g. energy, pharmaceuticals, health).Concomitant with these efforts, a campaign raising the awareness is needed to reach out to educational and training activities in the entire life-long training cycle to showcase the objectives of the bioeconomy and what it entails.

Key topics of the workshop were (i), the demands for knowledge, skills and competences for the bioeconomy, (ii), the need for innovation in the current concepts of bioeconomy education and (iii), the need to increase and/or strengthen the cooperation between educational institutions. Therefore, a further aim of the workshop was to provide a basis for the development and implementation of a “European/International Bioeconomy Education Platform”, representing stakeholders from academia, industry, society and public administration. International measures need to define the knowledge, skills and competencies required for developing a bioeconomy that enhances the sustainable use of bio-based materials in manufacturing and in consumer products.

The results from all workshops will be presented soon on the GBS homepage (http://gbs2018.com).

3rd BioSC Spotlight: Phosphorus recovery and cycling

On June 15, 2018, the third event in the “BioSC Spotlight“ series took place in Aachen. 45

participants extensively exchanged views about phosphorus recycling. Scientists from academia and industry held a total of seven specialist lectures. Like preceding events, this BioSC spotlight provided a framework for inter- and transdisciplinary exchange to a thematic field that contributes to the implementation of a sustainable bioeconomy.

Photos: Forschungszentrum Jülich

3rd BioSC Spotlight - Agenda

Phosphorus is a finite resource and an essential plant nutrient. Its reuse, particularly for fertilizing, is of great importance due its unequal and limited global distribution, its accumulation in water and soil and the entry of heavy metals into food chains by mineral P fertilization. In the frame of the 3rd BioSC Spotlight, current approaches towards Phosphorus recovery were presented and discussed.

The event was opened by Prof. Ulrich Schwaneberg, the deputy spokesman of the Bioeconomy Science Center. Subsequently, keynote speaker Dr. Rainer Schnee from the German Phosphorus-Platform e.V. gave a detailed overview of the current possibilities for phosphorus recovery and perspectives for future establishment.

In the first thematic session, “Phytases for phosphate recovery from plant residues”, Prof. Lars Blank from RWTH Aachen presented the BioSC project P-ENG, in the framework of which phytases were optimized to degrade phytate contained in rapeseed cakes and the released phosphorus was stored using yeast. Carolin Block from the University of Bonn presented the results of economic studies about market opportunities for phosphorus obtained this way. Dr. Anna Joëlle Ruff from RWTH Aachen presented the BioSC project PhytaPhos, in which sugar beet residues were treated with optimized phytases to degrade the contained phytate to phosphorus and the treated residues were successfully used as fertilizer.

The second thematic session, “Nutrient transfer from waste water to algae”, dealt with the recovery of phosphorus from waste water but also addressed the necessary further development of phosphorus analytics. Prof. Ulf Theilen from the Technical University of Middle Hesse presented an impressive pilot project on phosphorus recycling using micro algae in the sewage treatment plant of a small town. Dr. Peter Mojzeš from the University of Prague gave an introduction to Raman spectroscopy and explained the possibilities offered by this method for in situ detection of phosphorus in individual cells. Prof. Alexei

Solovchenko from the University of Moscow initially reported on the BioSC project AlgalFertilizer, in which micro algae were used to take up phosphorus from waste water and the algae biomass was then successfully distributed as fertilizer. Subsequently, he presented basic studies on the uptake of phosphorus in micro algae and cyanobacteria and showed which research gaps need to be closed to develop and establish phosphorus recovery using these organisms as a standard method.

Both lectures and the engaged discussions reflected the high topicality and relevance of the topic of phosphorus recycling. The research needs and possibilities not yet exploited were a common theme of discussion. Like preceding events, this BioSC spotlight provided a framework for inter- and transdisciplinary exchange to a thematic field that contributes to the implementation of a sustainable bioeconomy.

Abstracts

Phosphorus recycling: Facts and perspectives (Dr. Rainer Schnee, Deutsche Phosphor-Plattform e.V.)

Phosphorus recycling: Facts and perspectives

Dr. Rainer Schnee, *Deutsche Phosphor-Plattform e.V., Board of Directors*

Phosphor gehört rein mengenmäßig zu den häufigsten Elementen der Erde. Er liegt aber nicht in elementarer Form vor, sondern fast ausschließlich in Form des Phosphat-Anions PO43- bzw. in mineralischen Phosphatsalzen. In der einschlägigen Literatur wird sehr oft von Phosphor gesprochen, obwohl es sich um Phosphat handelt. Die größten Phosphatmengen liegen in mineralischer Form in der Erdkruste, der Geosphäre vor. Ebenfalls große Mengen sind in den Gewässern und Meeren gelöst. Und ein weiterer Anteil findet sich in mannigfaltigen Funktionen in der Biomasse. In den terrestrischen Lebensprozessen spielt demnach Phosphat eine essentielle, lebensnotwendige Rolle.

Da keine nennenswerten Phosphatmengen über die Atmosphäre transportiert werden, ist die Mobilität im Boden und im Wasser entscheidend. Gegenwärtig werden pro Jahr über 200 Millionen Tonnen Phosphat aus mineralischen Lagerstätten gewonnen und vor allem in der Landwirtschaft als Dünger und Futtermittel eingesetzt. Insofern ist die lokale, regionale und globale Verfügbarkeit von Phosphat für die Futter- und Nahrungsmittelproduktion lebensentscheidend und nicht substituierbar. Zusätzlich werden Phosphor und Phosphate in der Nahrungsmittel-, Waschmittel-, Baustoff-, Halbleiterindustrie in verschiedenen Funktionen eingesetzt. Ein umfassendes und detailliertes Monitoring der gegenwärtigen und zukünftigen Phosphor-Stoffströme ist unabdingbar für das Verständnis und das Management seiner raum-zeitlichen Dimensionen und Funktionen.

Von zentraler Bedeutung wird die effiziente Nutzung als Düngemittel sein. Damit einher gehen eine Optimierung der Pflanzenverfügbarkeit, eine Minimierung der dissipativen Verluste, eine möglichst geringe Eutrophierung der Gewässer und eine möglichst hohe Rückgewinnung als Sekundärrohstoff mittels Akkumulation und Recycling in den technisch-industriellen und biologischen Wertschöpfungsketten. Das sind zusammen mit den sozio-ökonomischen Kontexten die Eckpfeiler einer zukunftsweisenden

Ressourcenstrategie für Phosphor.

Als Grundlage für die Bewertung der Kritikalität von Phosphor wird ein Ressourcenstrategie-Konzept angewendet, das anhand spezifischer Kriterien den Lebenszyklus und seine unterschiedlichen Wertschöpfungsketten von der Förderung in den Lagerstätten über die Aufbereitung, Funktionalisierung und Nutzung in mannigfaltigen Prozessen und Produkten bis hin zur Nachnutzung oder Entsorgung erfasst, analysiert und bewertet. Eine Kritikalitätsanalyse für Phosphor ergibt u.a., dass

- nach menschlichem Ermessen zwar ausreichend Reserven vorhanden sind, aber nur wenige Lagerstätten den Weltmarkt beliefern und diese sich aus geographischer und geopolitischer Sicht teilweise in kritischen Regionen befinden.
- viele mineralische Phosphatquellen mit Schwermetallen und radioaktiven Elementen belastet sind, die in der Aufbereitung zu Produkten, insbesondere zu Düngemitteln, unbedingt abgetrennt werden müssen um deren unkontrollierte Dissipation zu verhindern.
- der unsachgemäße Einsatz in der Landwirtschaft zur Anreicherung in Böden und zur Eutrophierung von Gewässern führen kann.

Weitere technisch-funktionale, ökonomische, ökologische, soziale und politische Dimensionen der Phosphornutzung werden in Betracht gezogen und zu einer umfassenden Analyse und Bewertung seiner Kritikalität zusammengeführt.

P-ENG: Efficient phosphate recovery from agro waste streams by enzyme, strain, and process engineering (Prof. Dr. Lars M. Blank, RWTH Aachen University)

P-ENG: Efficient phosphate recovery from agro waste streams by enzyme, strain, and process engineering

Prof. Dr. Lars M. Blank, Institute of Applied Microbiology, RWTH Aachen University

The project focuses on the development of a new value chain to recover phosphate from plant waste material. The ultimate aim is to recycle phosphate into polyphosphates of new values. Therefore phytase, the enzyme able to release phosphate from plant material, is studied in this BioSC project. Through variations in protein modification (glycosylation) different properties such as thermostability or enzyme activity are optimized until a superior phytase is created. The impact of the enzyme production on the production host, the yeast *Pichia pastoris*, is analyzed with the whole metabolism in sight. Through this approach it is possible to predict steps in the cell metabolism during protein production which can be tuned to further improve phytase production. Bioprocess development contributes through establishing high-throughput screening environment in form of micro bioreactor systems. Utilizing that system clones generated by the other partners can easily be tested to identify the best producing strains. With the use of yeasts that collect phosphate it is possible to use the released phosphate to form polyphosphates. The possible market entries for superior phytase and polyphosphates are evaluated on a basis of market research, existing products, and company interviews. Furthermore the generic technology potential will be studied (e.g. IP).

Commercializing phosphorus from renewable resources: What are the major challenges? (Carolin Block, University of Bonn)

Commercializing phosphorus from renewable resources: What are the major challenges?

Carolin Block, Institute for Food and Resource Economics, University of Bonn

The use of renewable resources opens up the way for more sustainable production systems. Recovering resources from low value by-products or waste streams reduces the dependency on fossil materials. However, the change from traditional to bio-based technologies leads to several challenges for value chain actors. Thus, actors for instance might face high switching costs, missing industry or quality standards. Moreover, in the bioeconomic setting actors from distinct industries need to establish new relationships leading to structural changes and emerging value chains.

In order to explore the challenges for the chain actors, a case study on a new technology for phosphorus recovery from rapeseed oil press cakes, a by-product in oil mills which ends up in animal feed, was carried out within the BioSC project P-ENG. The literature research and expert interviews with 4 different value chain actors (phosphorus processor, biotechnological company, rapeseed oil processor and feeding mix producer) reveal that there are challenges referring to five major categories, namely organizational, institutional and regulatory, economic viability, geographical and product quality issues. None of the current chain actors has the competencies to carry out the phosphorus recovery process from extraction to commercialization on its own. The results highlight the need for further research developments such as closer integration of academia and industry and economic viability studies to tackle these challenges.

PhytaPhos: Optimizing the phosphorus cycle in the sugar beet production process by phytase supplement (Dr. Anna Joëlle Ruff, RWTH Aachen University)

Optimizing the Phosphorus Cycle in the Sugar Beet Production Process by Phytase Supplement

Anna Joëlle Ruff*[1]*, *Prof. M. Becker*[3]*, Dr. U. Arnold*[3]*, Dr. M. Trimborn*[3]*, Prof. U. Schurr*[4]*, Dr. S. Schrey*[4]*, A. Robles Aguilar*[4]*, Ulrich Schwaneberg*[1,2]

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[3]*University Bonn; Institute of Crop Science and Resource Conservation INRES, Bonn, Germany*

[4] *FZ Jülich, IBG-2, Institute of Bio- and Geosciences: Plant Sciences, Jülich, Germany*

Phosphate is a main component of fertilizers and therefore essential to feed humankind. Subsequently, recycling concepts for phosphorus are a key request to ensure a self-sustaining food production in Europe and to avoid rapid depletion of concentrated natural deposits. Within the BioSc-funded project PhytaPhoS,

we propose a new value chain to recover phosphate from plant waste material. The principle storage form of phosphorus in plants is phytate (inositol hexaphosphate). The approach is based on the naturally occurring phytases that free the phosphate bound in an organic form. In sugar production processes this could be achieved by supplementing thermally resistant phytases to leach the phytate phosphate form sugar beet slices. With this procedure the phosphorus concentration in sugar beet slices in fodder and in consequence P-excess in fields will be reduced. Instead, isolated phosphorus will be transferred into spent lime and subsequently back to the sugar beet fields. Thereby a hub forward to an independent phosphorous use would be enabled and emerging value chains contribute to a sustainable bioeconomy.

Phosphorus removal with microalgae – reduction of the effluent concentration from municipal wastewater treatment plants (Prof. Dr.-Ing. Ulf Theilen, Technische Hochschule Mittelhessen)

Nutrient Removal with Microalgae – Reduction of the Effluent Concentration from Wastewater Treatment Plants

Wawilow, T.[1]; Hasport, N.[1], Theilen, U[1]and Thomsen C.[2]

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An alternative, environmentally sustainable method to remove nutrients from wastewater is to integrate an algae-mediated wastewater treatment to reduce nutrient loads to preserve water bodies from eutrophication and generate effective biomass. Compared with conventional treatment methods the generated microalgae biomass is more energetic and rich in content with phosphorous (P) and nitrogen (N). Therefore, a tertiary biotreatment coupled with the production of potentially valuable biomass, which can be used for energetic or material purposes, is an efficient alternative to avoid using chemicals for the removal of phosphorus via precipitation and flocculation. Algae species Scenedesmus was applied for wastewater treatment and had proven abilities of removing nitrogen and phosphorous in retention time of 24 hours. In this study, a photobioreactor (PBR) was implemented for large-scale research to treat the effluent of the WWTP while microalgae growth rate, nutrition removal as well as operational and external conditions were evaluated. Moreover, the biomass was separated and methane potential tests were conducted using microalgae as substrate.

Detection and quantification of polyphosphate by means of Raman microscopy of microalgae (Dr. Peter Mojzeš, Charles University, Prague)

Detection and quantification of polyphosphates in microalgae by means of Raman microscopy

Peter Mojzeš, Institute of Physics, Faculty of Mathematics and Physics, Charles University, Prague, CZ

The potential of microalgae to sequester phosphorus from wastewater and to return it to agriculture as a fertilizer has emphasized the importance of microscopic methods allowing detection and quantification of polyphosphates *in situ* at single cell level. Confocal Raman microscopy, a method combining the molecular

specificity of vibrational spectroscopy with spatial resolution of confocal optical microscopy, can be a method of choice, since Raman signal of polyphosphates is clearly recognizable even in the presence of other biomolecules in the same cellular region. However, routine applicability of Raman microscopy to microalgae has long been hindered by a strong autofluorescence of photosynthetic pigments. Recently, we have developed a simple methodology [1] for fast and efficient suppression of the algal fluorescence, which open the door to an unexplored world and enabled relatively rapid and simple quantification of polyphosphates from Raman chemical maps along with other biomolecules [2]. Recent progress in the field, advantages, limitations and pitfalls of the method will be demonstrated and discussed.

[1] Š. Moudříková *et al.*, Algal Res. 16 (2016) 224-232.

[2] Š. Moudříková *et al.*, Anal. Chem. 89 (2017) 12006-12013.

Luxury phosphorus uptake and diazotrophy in green algae & cyanobacteria: AlgalFertilizer and follow-up projects (Prof. Dr. Alexei Solovchenko, Moscow State University)

Luxury phosphorus uptake and diazotrophy in green algae & cyanobacteria: AlgalFertilizer and follow-up projects

Alexei Solovchenko, Olga Karpova, Tatiana Ismagulova, Larisa Semenova, Irina Selyakh, Alexandr Lukyanov and Olga Gorelova*

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Sustainable usage of finite and non-renewable phosphorus (P) resources is a grave challenge to humanity. Shortage of P fertilizers threatens the food security. The P lost due in inefficient processing chain gives rise to eutrophication of water bodies. In view of this, potential environmental, social, and economic impact of currently non-sustainable usage of P is commensurate to that of oil and gas shortage.

Single celled phototrophs including cyanobacteria and eukaryotic microalgae featuring so called “luxury uptake” of P constitute promising vehicle for by sequestering the lost P and returning it, in form of P-rich biomass, to the field. The reasons are (i) fast growth rate of these organism, (ii) capability of rapidly taking up P up to 4−7% of their cell dry weight, and (iii) gradual release of the accumulated P upon application of microalgal biomass to the soil in the from available to crop plants.

Diazotrophic species of cyanobacteria are capable of fixing atmospheric nitrogen (N). On one hand, this process makes them less dependent on the availability of N in the medium so cyanobacteria can potentially recover P from waste streams with imbalanced N:P ratio. On the other hand, diazotrophy is a very energy-intensive process which can compete for ATP with the processes of P acquisition and storage in the cell. The successful biotechnological application of cyanobacteria to close the P loop is limited by insufficient understanding of C/N balance impact on and the molecular mechanisms of luxury P uptake.

We report on the effect of diazotrophy on luxury P uptake and storage in the cell in a diazotroph strain *Nostoc* sp. PCC 7120 in comparison with a nearly-isogenic non-diazotroph strain *Nostoc* sp. PCC 7118.

Although the P starvation and the fast phase of inorganic P (P_i) uptake were similar in both strains studied, induction of diazotrophy impared significantly the ability of PCC 7120 to accumulated inorganic polyphosphate (PolyP) in the cell. Since PolyP is a main P storage compound in the cell, the availability of N seems to of primary importance for efficient recovery of P from waste streams. Biotechnological implications of using diazotrophic and non-diazotrophic cyanobacterial strains for recovery of P from waste streams with different N/P balance are discussed.

BioSC guest scientist: Prof. Gregory LeFevre, Iowa University

From June 26 to July 9, Prof. Gregory LeFevre, University of Iowa, stays in the Core Group of Prof. Ulrich Schwaneberg, RWTH Aachen. Main topics of his research are biotransformations in relation to the impact and fate of various contaminants in the environment.

Gregory LeFevre is an Assistant Professor at the Department of Civil & Environmental Engineering at the University of Iowa and at the same time faculty member of the Center for Biocatalysis and Bioprocessing. His expertise is in the areas of biotransformations, the fate of contaminants in the environment as well as in phytoremediation. Furthermore, he focuses his research on elucidating novel products, .g.via mass spectrometry, and novel pathways.

The state of Iowa is a state with intense agricultural production and therefore faces many challenges associated with environmental and water quality degradation, as well as human health exposure. Prof. LeFevre works on the fate of chemical compounds like pesticides or herbicides especially in water. Two research fields directly related to pesticide application are the restoration of agricultural systems already affected by pesticides and herbicides and the development of detection and protection measures for existing and emerging contaminants of freshwater sources (*i.e.*, herbicides or microplastics).

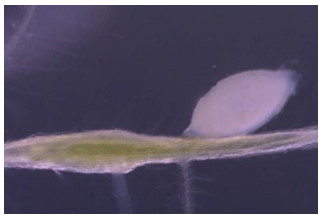
Understanding the fate chemicals in general as well as being capable of assessing their impact in the environment are keystones of a sustainable bioeconomy, *i.e.*, for the preservation of water and agricultural resources.

During his stay, Prof. LeFevre has appointments with various BioSC Core Groups in order to explore cooperations between the University of Iowa and the BioSC.

The BioSC Office points out that a guest scientist`s stay can be applied for at any time. The proposal template comprises only two pages and is available in the BioSC intranet. In case of interest please do not hesitate to contact the office (biosc@fz-juelich.de).

NemaContAnt: Successful follow-up application from BioSC project NovoSurf

Within the "Tailor-made bio-based ingredients for a competitive bio economy" support initiative of the German Federal Ministry for Education and Research, the two NovoSurf project partners successfully raised third-party funds to carry out the NemaContAnt joint project. This project evaluates the use of rhamnolipids to control plant parasitic nematodes.

Plant parasitic nematodes cause large losses in agricultural plant production every year – worldwide and in NRW. Nematicides are largely prohibited in many countries – including Germany – and horticultural measures such as resistant or tolerant plant varieties, if available, often fail to solve the problem completely. Thus, the development of new, effective and environmentally compatible control measures is necessary.

One promising opportunity is the use of naturally occurring, microbiological molecules such as rhamnolipids. This is precisely where the cooperation of both BioSC core groups at the University of Bonn and RWTH Aachen comes in. This interdisciplinary collaboration started with the BioSC project NovoSurf and is continuing with the triennial joint project "Tailor-made rhamnolipids as nature-inspired **nem**atode **cont**rol **a**ge**nt**s for sustainable sugar beet production" that started in 2017 and is sponsored by the BMBF.

Within the NovoSurf project, scientists from both groups have discovered that rhamnolipids are very effective against nematodes. In the NemaContAnt project, the team will now show that a new, tailor-made, bio-based and environmentally friendly product for nematode control can be developed from rhamnolipids.

The production of rhamnolipids is optimized at the iAMB in Aachen. The aim is to increase product yield, structurally diversify the rhamnolipids and purify the molecule more efficiently. The use of molasses - a biological, renewable raw material from sugar refining - will be tested and optimized for rhamnolipid production. Furthermore the production process will be economically evaluated. At the MPM in Bonn, the rhamnolipids produced by the iAMB will be examined and tested for their effectiveness against beet cyst nematodes and their influence on the host plant in order to identify the most promising molecule. Additional studies should be carried out to understand the mechanism of action and to show whether the

rhamnolipids affect non-target organisms in the plant-associated microbiome. On this scientific basis, rhamnolipids can be developed into products for practical application.

Project partners

Prof. Florian Grundler, **Dr. Sylvia Schleker**, Institute of Crop Science and Resource Protection (INRES), Moleculare Phytomedicine (MPM), University of Bonn
Prof. Lars Blank, **Dr. Till Tiso**, Institute of Applied Microbiology (iAMB), RWTH Aachen University

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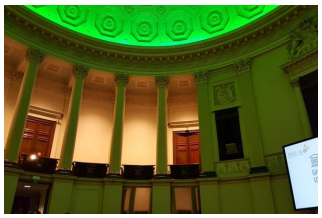
14. International Conference on Renewable Resources & Biorefineries

From May 30 to June 1, 2018, the "International Conference on Renewable Resources & Biorefineries (RRB14)" took place in Ghent (Belgium). Participants from science and industry met for the 24th time to discuss the topic of bioeconomy.





The parallel sessions included contributions to the following topics, among others: biorefineries, bio-based materials and micro and macro algae technologies. In addition to many other interesting lectures, two keynote lectures were held by renowned scientists. Gadi Rothenberg from the University of Amsterdam spoke about "A new biodegradable plastic made from plants" and Mark Mascal from the University of California presented "CMF is the new HMF: Functionally equivalent but more practical in terms of its production from biomass".

The Bioeconomy Science Center was well represented by a series of scientific contributions: In addition to lectures from the focus labs AP^3 (Philipp M. Grande and Holger Klose, FZ Jülich) and Bio^2 (Markus Müller, RWTH Aachen), additional lectures were presented by the core groups Büchs and Mitsos from RWTH Aachen with Benedikt Heyman and Andrea König. The more than 230 participants from over 30 different

countries reflected the very extensive and interdisciplinary spectrum of bioeconomy. In addition to the poster sessions, the breaks between the lectures provided time to make contact with colleagues from academia, industry, different funding organizations and publishers. Last but not least, the involvement of Ghent University, which celebrated its 200th anniversary, and the city of Ghent as one of the sponsors of the conference invigoratingly rounded out the conference and a city and a harbor tour ensured an interesting local context.

New in the BioSC office: Prof. Dr. Ingar Janzik undertakes development and coordination of education measures

Since the spring of this year, Prof. Ingar Janzik has strengthened the team of the head office in the field of education. There was a break in the education activities as a result of the departure of Greta Mittweg. However, an NRW PhD Day in Bioeconomy and activities for networking of the BioSC doctoral students are now planned again for 2018. In addition, plans are underway for the next summer schools and the development of concepts to teach bioeconomy already to bachelor's and master's students as well as to professional people in the framework of life-long learning approaches. Overall, the topic networking of education activities in the field bioeconomy will be an important task at both the regional and international levels.

Ingar Janzik studied Biology in Bochum and graduated from the ETH Zürich. This was followed by a short post-doc stay at the Jülich Research Centre and a junior professorship at the Heinrich Heine University Düsseldorf. Since 2008, according to the Jülich model, she has been professor in Green Biotechnology at the FH Aachen and scientist in IBG-2. Her research focus is the secondary metabolism of plants. In addition, she played a decisive role in the development of the doctoral program at the IGB-2 Institute and the upcoming doctoral student and supervisor platform, JuDocs, at the Jülich Research Centre. She has been member of the doctoral committee for 4 years.

Prof. Dr. Ingar Janzik

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New BioSC Core Group: Prof. Dr. Laura Hartmann, HHU Düsseldorf

Prof. Laura Hartmann heads the chair of Preparative Polymer Chemistry at the Institute of Organic Chemistry and Macromolecular Chemistry of the Heinrich Heine University in Düsseldorf. Her research focuses on the synthesis, characterization and application of biomimetic and biofunctional polymers and materials.

With her group, Laura Hartmann is developing new synthesis strategies for the preparation of highly defined biofunctional polymers. She uses solid phase synthesis in combination with tailor-made components to receive monodisperse, sequence-defined macromolecules on an oligoamide basis. Particular attention is paid to the functionalization of polymers and materials with carbohydrate ligands and their interactions with bacteria and viruses.

Laura Hartmann graduated from the University Potsdam in 2007 after completing her doctoral thesis at the Max Planck Institute of Colloids and Interfaces in Golm. After that, she worked for two years at the Stanford University, California, as a post-doc in a project to develop an artificial cornea in collaboration with the chemical engineering group and the eye clinic. Back in Germany, she has headed an Emmy Noether junior research group at the Max Planck Institute of Colloids and Interfaces in Berlin since 2009 and habilitated in 2014 in the field of Macromolecular Chemistry at the Free University of Berlin. In 2014, she accepted a chair as W3 professor at the Heinrich Heine University in Düsseldorf.

Prof. Dr. Laura Hartmann

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New BioSC Core Group: Dr. Stephan Küppers, Forschungszentrum Jülich

he Central Institute for Engineering, Electronics and Analytics 3 – Analytics (ZEA-3) – in the Jülich Research Centre is developing methods of analysis and is applying these in the framework of relevant scientific challenges. The ZEA fields of competence include the structural elucidation of organic molecules, characterization of proteins and molecule-element interactions, imaging chemical analytics and diffusion process analyses in liquid and solid phases.

Dr. Pitter Huesgen and Dr. Sabine Willbold are members of the new core group under the leadership of Dr. Stephan Küppers.

Dr. Küppers studied chemistry at RWTH Aachen. Following a post-doc stay, he has worked at Schering AG

in the drug development field for 10 years and has been head of the ZAE-3 since 2002. His scientific focus is on process and environmental analyses and process validation.

Together with his team “Analytics of molecular and biological systems” in the ZEA-3, Dr. Huesgen is developing mass spectrometry-based methods for structure elucidation and quantification of signal substances, metabolites and proteins in plants and bacteria. Supported since 2015 by an ERC starting grant, proteolytical processes in plant stress responses is the focus of their research. Dr. Huesgen completed his doctoral thesis in the Department for Physiology and Biochemistry of Plants at the University of Konstanz in 2007. Following a post-doc stay at the University of British Columbia in Vancouver, Canada, he moved to Jülich in 2014.

With her group, Dr. Willbold is an NMR specialist conducting research in particular on the characterization of phosphorus-organic compounds in cells, plants and soils using ^{31}P-NMR spectroscopy. Dr. Willbold studied Chemistry in Bayreuth and graduated there in the field of NMR spectroscopy of organometallic compounds in 1994. After post-docs at the Institute for Inorganic Chemistry of the University Bayreuth and the Institute for Biochemistry and Biophysics of the University of Jena, Dr. Willbold has been working at the ZEA-3 since 2002.

Dr. Stephan Küppers, Dr. Sabine Willbold, Dr.
Pitter Huesgen

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