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PREFACE

BiRT is an acronym for Bio-Resources & Technologies Tulln, an organisational unit at BOKU which thematically integrates all BOKU departments which are fully or partially located at Tulln. BiRT integrates virtually all fields of research and teaching of BOKU´s research groups at Tulln and represents a highly interdisciplinary domain covering the process chains and cycles of sustainable production, processing and utilization of bio-resources for various human demands including food, feed, and renewable, bio-based materials, chemicals and energy. BiRT serves as a platform of discussion, exchange of ideas and development of joint projects in research and teaching and aims at enhancing BOKU´s profile and visibility at campus Tulln.

Since 2013, BiRT offers the annual DocDay aiming at providing a forum for all PhD students at campus Tulln who want to share their work with their colleagues and supervisors in a highly interdisciplinary environment, and to use the opportunity for networking activities. Moreover, this event is being organised by PhD students themselves, with rotation of the organising committee among the working groups.

On behalf of the BiRT Steering Committee I wish to thank the organisers for the hard work and to welcome all of you to the DocDay 2016. I am looking forward to an interesting event with fruitful discussions across the disciplines. If you want to learn more about BiRT please visit our website at http://www.boku.ac.at/wissenschaftliche-initiativen/birt/.

Univ.Prof. DI. Dr. Walter W. Wenzel

Head of BiRT


Univ.Prof. Walter W. Wenzel
Universität für Bodenkultur Wien

Dear PhD-students!

It has become a pleasant tradition during autumn, to host the DocDay in Tulln.

It gives us a great pleasure that so many PhD students are willing to present their recent works to their colleagues in Tulln (UFT-Boku, AIT, IFA).

The DocDay is a good opportunity to get to know, not only each other's projects, but also have personal conversations between colleagues. An interdisciplinary exchange between the students can be intensified this way and new ideas can be involved in the existing projects.

We would like to thank the BiRT initiative for the financial support, which makes it possible to have such a great and interesting DocDay. Thanks to all the students who are submitting with their abstracts. Thankfully there were so many participants, that we would even have needed a second day to listen to all the oral presentations.

The only remaining task now is, to wish us all an interesting conference with a lively exchange and a splendid Oktoberfest afterwards!

The organizing committee

PROGRAM

8:30	Registration
9:00	Opening - Welcome Words
	WOOD Chair: MIRIAM LETTNER (KPLUS)
09:15	**Marmar Ghorbani (BOKU)** *Lignin Phenol Formaldehyde Resoles: Synthesis, Characteristics, Modification*
09:30	**Stefan Bockel (BOKU)** *Bonding of hardwood with two-component polyurethane adhesives – dissertation plan*
09:45	**Axel Rindler (KPLUS)** *Dimensional stability of multi-layered panels – A review*
10:00	**Šimunović Nenad (KPLUS)** *Forest timber products and sustainability of forests and forestry. Insights from content analysis of scientific discussion.*
10:15	**Janea Köhnke (BOKU)** *Carbon particles: Comparison of four technical lignins as resource*
10:30	**Coffee Break**
	AGRICULTURE Chair: ANASTASSIYA TCHAIKOVSKY (BOKU)
11:00	**Lukas Kramberger-Kaplan (BOKU)** *Functional Analysis of the Arabidopsis At1g64110* AAA+ATPase
11.15	**Elisabeth Schüller (BOKU)** *Molecular Characterization of old Austrian Sweet Cherry Varieties*
11:30	**Krisztian Twaruschek (BOKU)** *New plasmids allowing positive-negative selection for fungal transformation and efficient Cre-loxP mediated marker recycling*
11:45	**Jacqueline Meng-Reiter (IFA)** *Metabolism of the type A trichothecence mycotoxins HT-2 and T-2 in wheat, barley and oats*
12:00	**Olivier Duboc (BOKU)** *Phosphorus in soils and fertilizers: resource use efficiency through recycling and improved laboratory tests*
12:15	**LUNCH BREAK & POSTER SESSION**
13:45	**KEYNOTE LECTURE** **Dr. Wolfgang Kantner (Metadynea)** *Form University to Industry*
	MICROBIOLOGY, HEALTH Chair: STEFAN PINKL (KPLUS)
14:30	**Anastassiya Tchaikovsky (BOKU)** *Tracing the origin of the "black gold": Analytical challenges and potential of (MC) ICP-MS for provenancing sturgeon caviar*
14:45	**Aroa Rodriguez Iglesias (AIT)**

	Relevance of light response and protein phosphatases for physiology in Trichoderma reesei
15:00	**Anika Retzmann (BOKU)** *Multi-dimensional approach to evaluate the diagenetic status of skeletal remains with respect to strontium isotope ratio measurements*
15:15	**Clemens Troschl (IFA)** *Contaminations in Microalgae Culture: Fighting the Ciliate* Colpoda *sp. in Mass Cultivation of* Synechocystis *sp.*
15:30	**Reinhard Beyer (BOKU)** *Clinical* Candida glabrata *strains exhibit a broad and flexible phenotypic spectrum*
15:45	**Coffee Break**
	BIOPOLYMERS Chair: MARMAR GHORBANI (BOKU)
16:15	**Andreas Ortner (IFA)** *Enzymatic activation of poly(lactic acid) for superhydrophobic functionalization*
16:30	**Sakeena Quraishi (BOKU)** *Preparation of monolithic, stiff and transparent aerogels from solutions of 2,3-dialdehyde cellulose in non-derivatizing ionic liquids*
16:45	**Caroline Gamerith (IFA)** *Enzymatic hydrolysis of polyesters and polyester blends for recycling purposes*
17:00	**Nele Sophie Zwirchmayr (BOKU)** *Degradation of 5,8-dihydroxy-[1,4]-naphthoquinone by Hydrogen Peroxide under Alkaline Conditions*
17:15	**Short Break**
17:30	**Awards Ceremony**
18:00	OKTOBERFEST

ABSTRACTS SESSION 1

WOOD

Lignin Phenol Formaldehyde Resoles: Synthesis, Characteristics, Modification

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Keywords: lignin-phenol-formaldehyde resin; lignin; ABES; DSC; modification

Lignin phenol formaldehyde (LPF) resole resins prepared from different types of lignin and levels of phenol replacement by lignin (up to 40 wt.%) were investigated with regard to resin properties. This included thermal behaviour (DSC), time-dependent development of bond strength during hot pressing (ABES), and free formaldehyde content of the resins. Preparation of LPF resoles was accomplished using molar ratios of formaldehyde/phenol and sodium hydroxide/phenol of 2.5 and 0.3, respectively. A range of different types of lignins and lignosulfonates from various plant sources and process types were studied. The synthesis of the resoles was optimized for 20 and 40 w% phenol replacement by lignin. Increasing substitution of phenol resulted in faster gain of LPF viscosity for all studied lignins. The best curing performance of the LPF resoles was observed for pine kraft lignin and sodium lignosulfonate at both 20 and 40% of phenol replacement by lignin. LPF resins prepared from this particular type of lignin also afforded the best mechanical performance amongst all LPF resins tested. Thereafter specific modifications were applied to augment the reactivity of the best performing lignin. A considerable viscosity development was achieved for the modified LPF resins as well as a slight improvement in curing speed. However, no significant acceleration was observed for the bond strength development.

Acknowledgement

The authors gratefully acknowledge the financial support provided by FFG through the COMET-project FLIPPR “Future Lignin and Pulp Processing Research” and the project “Lignorefinery II” (project number 4055890).

Bonding of hardwood with two-component polyurethane adhesives – dissertation plan

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Keywords: two component polyurethane, hardwood, extractives, interphase-relations, adhesive films

Due to changes in forest management, the amount of softwood in Central Europe will decrease in the future, while hardwood will rise significantly [1]. Until now, the majority of hardwood is thermally used [2]. Rising ambitions exist in the higher structural use of hardwood (glulam), the bonding of carbon dioxide and the introduction of formaldehyde-free adhesives in the industry. To the present day, no reliable two component polyurethane (2C PUR) system exists for the bonding of hardwood for structural purposes such as glulam. The reasons for that are diverse (E-modulus, density, water consumption/absorption, swelling/shrinking, extractive content, cell structure etc.)

The aim of this project is to develop a 2C PUR system for hardwood, in particular beech that achieves the requirements for structural bonding after DIN EN 301. Therefore the influencing factors will be investigated, controlled and varied.

This work is divided into the parts: influence of extractives on bonding, interphase-relations of the bonding line, characterization of adhesive films and the bonding of wood itself. Extractions will be conducted by Accelerated Solvent Extraction (ASE) and surface treatment with solvents. Bonding line will be investigated by fluorescence microscopy, Energy-dispersive X-ray (EDX) and Atomic-force Microscopy (AFM). Interphase-relations will be tested in shear strength and the accessibility of hydroxyl groups by adding different compounded layers. Adhesive films and their sorption isotherm will be determined, as well as their moisture-related strain-stress behaviour. Finally, a technically mature 2C PUR system will be tested by delamination and tensile shear strength tests to verify norm implementation. In the latter field, strain measurements via Digital Image Correlation (DIC) are envisaged.

Cooperative partners are Bern University of Applied Sciences (BFH), Collano Adhesives AG, University of Natural Resources and Life Sciences (Boku), Swiss Federal Laboratories for Materials Science and Technology (EMPA) and Swiss Federal Institute of Technology in Zürich (ETH).

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Dimensional stability of multi-layered panels – A review

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Keywords: Continuum micromechanics, Laminate theory, Layered wood based panels, Dimensional stability

The deformation of wood due to swelling and shrinking induced by water absorption and desorption of cell wall components is still challenging the engineering of dimensionally stable multi-layer wood based panels. To overcome this problem and to accelerate the developing process of new wood based panels, numerical methods, developed to describe the deformation stability of man-made composites could also possibly be applied to wood materials. Relevant influencing factors on the hygro-thermal deformation behaviour of wood are needed as input parameters for a numerical description of the material behaviour. On the one hand these factors are collected and described. On the other hand an overview of empirical and numerical approaches for the mathematical description of the deformation behaviour is discussed. Numerical models are based on micromechanical theories, which consider the hygro-thermal deformation of composite materials (laminate mechanics and composite micromechanics models). Micromechanical methods from composite mechanics applied on wood at different scale levels are examined. Challenges that may be considered when using micromechanical approaches to calculate the hygroscopical deformation of multi-layered materials are discussed.

The authors are gratefully acknowledge the financial support by the Competence Centre for Wood Composites and Wood Chemistry, Wood Kplus, Austria

Forest timber products and sustainability of forests and forestry. Insights from content analysis of scientific discussion.

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Keywords: sustainability, content analysis, forestry, timber forest products

In recent years, both environmental and social sustainability aspects of products are having a rising importance for stakeholders. Both general market studies on multicountry level [1], and wood sector specific, country level studies [2] indicate that most of the customers are concerned with environmental and social impacts of products, and that a significant share of customers is expressing the willingness to pay extra for what is perceived as a sustainable product. Other benefits, like greater customer loyalty and lower price sensitivity are often associated with improved environmental and social sustainability performance of producers and suppliers [3]. Therefore, it is not surprising that environmental sustainability of wood products has been identified as an element of total product quality among European B-to-B customers [3].

However, stakeholders are not only evaluating corporations against their environmental and social performance but also against the impacts of their supply chain. Meeting stakeholder demands and optimizing the sustainability effects of the supply chains could be highly problematic since sustainability has no objective definition [4]. Moreover, sustainability can be characterized as a "traveling concept" which is characterized by the volatility of its meaning as it "*travels between disciplines, individual scholars and between geographically dispersed academic communities*" [4].

Therefore, in order to understand the approach to the assessment of the sustainability of forests of different scientific communities a content analysis comprising the scientific discussion was conducted. In the study we investigate the relationship between forest timber products and various sustainability aspects. The study results identified significant differences in discussion intensity among the geographically different scientific communities. Topics dealing with sustainable forest management and forest management operations have the highest co-occurrence rate with the topic forest timber products, confirming the need for the assessment of full supply chain. Lastly, our results imply that there is a need for a better understanding and validation of social sustainability aspects since these aspects are significantly underrepresented compared to topics dealing with economical or environmental sustainability.

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Carbon particles: Comparison of four technical lignins as resource

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Keywords: Carbonisation, Lignin, Conductivity, WAXS, SEM

Carbon particles were produced from different lignins (kraft lignin, soda lignin, lignosulfonate, organosolv lignin) and different carbonisation temperatures (800 °C, 1200 °C, 1600 °C, 2000 °C) under argon atmosphere. Before carbonisation a thermostabilisation at 250 °C under ambient atmosphere took place to stabilise lignin particles and prevent them from fusing whilst heating for carbonisation. After carbonisation the particles were characterised with scanning electron microscopy, X-ray diffraction and electric conductivity measurements. When thermostabilisation and carbonisation were performed a high mass loss took place. The mass loss depended strongly on the type of lignin and was documented between 35 % for lignosulfonate and 60 % for organosolv lignin at the thermostabilisation process and up to 84 % for organosolv lignin after carbonisation at 2000 °C. The other lignins had mass loss about 78 % after the 2000 °C carbonisation step. The morphology of lignin particles varied a lot. All of the lignins showed broad size distributions. Kraft lignin particles were round shaped and had a hollow structure with a rough surface area covered with small holes. The soda lignin had an irregular shape with edges and plain surfaces without any pores. The lignosulfonate particles looked like broken fragments of round shaped empty globes with smooth, thick walls with small pores inside. In contrast the organosolv lignin particles looked like many very small balls stuck together to a bug cluster. None of the morphologies changed during the carbonisation process. X-ray diffraction showed sharp peaks for all four lignins after carbonisation at 2000 °C, which were identified as graphite structure peaks. Only the soda lignin showed those peaks already at a carbonisation temperature of 1600 °C. Electric conductivity measurements showed that the conductivity was growing with increasing carbonisation temperature and higher pressure. Therefore the best conductivity was measured at a pressure of 800 kPa and a carbonisation temperature of 2000 °C. With those parameters the soda and kraft lignins resulted in about 470.72 $\Omega^{-1}mm^{-1}$. For lignosulfonate only 42.61 $\Omega^{-1}mm^{-1}$ was measured with the same parameters, hence it was showing by far the lowest conductivity.

Many differences between those four lignins were found, not only in shape, but also during the graphitisation process and in conductivity measurements. Those differences indicate lignin should be chosen accordingly to the planned application.

ABSTRACTS SESSION 2

AGRICULTURE

Functional Analysis of the *Arabidopsis At1g64110* AAA+ATPase

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Keywords: Arabidopsis, AAA+ATPase, Heterodera schachtii, syncytium

The Arabidopsis AAA+ATPase gene *At1g64110*, is a member of a small gene family which also includes *At5g52882* and *At4g28000*. It was recently shown that *At1g64110* is strongly expressed in syncytia induced by the cyst nematode *Heterodera schachtii* in *Arabidopsis* roots. Artificial miRNA lines and T-DNA mutants were used to show that this ATPase is important for the development of syncytia. However, nothing is known yet about the function of these ATPases.

Using a complementation analysis of Yeast mutants defective in a range of AAA+ATPases also did not give any hint about the possible function of the *At1g64110* ATPase. Therefore, different constructs for recombinant expression of the *At1g64110* ATPase fragments were used to produce antibodies specific for two different regions of *At1g64110*. The referring antigens where expressed in *E. coli*, purified via HPLC and sent to an external service provider for the production of the antibodies in rabbits. Besides the specific antibodies also tag-specific antibodies against FLAG-tag and GFP where used to confirm the presence of the enzyme by Westernblot. For this, constructs containing fusions of the ATPase with FLAG-tag and GFP were produced and transiently expressed in *Nicotiana benthamiana* for protein extraction and confocal laser scanning microscopy. These constructs and an overexpression construct without tag were also introduced into Arabidopsis for the production of transgenic lines by the floral dip method using the pMAAred plasmid which allows for selection by fluorescence of DSred in transformed seeds followed by qRT-PCR for determination of the expression levels. In addition, a triple knock-out mutant is being produced. These lines will be useful to study the function of these ATPases. Furthermore, two GUS-lines for *At5g52882* and *At4g28000* are produced to determine the distribution of these two ATPases inside the plant.

Supported by FWF project P27217
We acknowledge Gerhard Niederacher for conducting the complementation analysis in yeast.

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Molecular Characterization of old Austrian Sweet Cherry Varieties

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Keywords: sweet cherry, genetic markers, conservation

In the course of three projects on survey and conservation of regional Austrian sweet cherry cultivars some rare old cultivars like `Joiser Einsiedekirsche´, `Schartner Rainkirsche´, or `Sämling von Sauerbrunn´ have been found. A number of other cultivars could not be identified, since their morphologic characteristics differed from descriptions indicated in the literature. The implementation of genetic markers such as microsatellites, also called simple sequence repeats (SSRs), which serve to provide a characteristic genetic fingerprint can help accelerate the process of cultivar identification. The European Cooperative Programme for Plant Genetic Resources ECPGR emphasizes a standard set of microsatellite markers and reference accessions so that fingerprints of cherry collections can be harmonized. We report on the genetic fingerprints acquired in order to further characterize the local cultivars as well as the accessions of the BOKU germplasm collection. The ultimate goal is to identify unknown varieties, verify the trueness-to-type of those identified, as well as to avoid duplicates.

New plasmids allowing positive-negative selection for fungal transformation and efficient Cre-loxP mediated marker recycling

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Keywords: Thymidine kinase, Fusarium graminearum, selectable marker, Cre-lox, fusion gene

In filamentous fungi, disruption of multiple genes of interest in the same strain (e.g. to test for redundant gene function) is a difficult task due to the limited availability of different reliable and efficient selection markers. In *S. cerevisiae*, the *Cre-lox* system can be efficiently used to remove *loxP*-flanked resistance cassettes. Activation of *Cre* gene expression from an inducible promoter (P_{XYN1}) was inefficient to evict the selection marker in a self-excising cassette in *Fusarium graminearum*. To reduce the screening effort, we have created a series of hybrid fusion genes, which allow positive selection of transformants in the first step and subsequent negative selection for marker removal. The constructs consist of *Herpes simplex* thymidine kinase (*HSV-TK*) to which the commonly used drug resistance markers *hph, nptII,* and *nat1* (conferring resistance to hygromycin B, geneticin and nourseothricin) were fused c-terminally. For removal of the *loxP* flanked resistance cassettes, protoplasts of transformants were directly treated with purified Cre recombinase protein. Loss of *HSV-TK* containing cassette can be selected by restoration of resistance to 5-fluoro-2-deoxyuridine (5-F2DU).

Metabolism of the type A trichothecene mycotoxins HT-2 and T-2 in wheat, barley and oats

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Keywords: Type A trichothecenes, Cereals, Plant metabolism, Stable isotopic labelling, Liquid chromatography−high resolution mass spectrometry

HT-2 toxin (HT2) and T-2 toxin (T2) are secondary fungal metabolites, so-called mycotoxins. In Europe, the most frequently HT2- or T2-contaminated plant species is oats followed by barley and wheat [1]. A largely neglected issue for food and feed quality is biotransformation of these toxins *in planta*. The derived toxin metabolites may constitute a health risk for humans and animals since they escape routine analysis, might have increased toxicity or similar toxicity when cleaved during digestion of contaminated food and feed [2].

In my PhD, I studied the metabolic fate of HT2 and T2 in wheat [3], barley [4] and oats. Our in-house developed metabolomics workflow was based on stable isotope labelling, liquid chromatography-high resolution mass spectrometry (LC-HRMS) measurements and data processing by MetExtract II software which allowed a truly untargeted analysis by detecting novel HT2- and T2-derived metabolites. As a result of structure annotation by LC-HRMS/MS, different glucosylated forms of the toxins, acetyl- and feruloyl-conjugates were found in all plant species, whereas malonylglucosides were exclusively detected in barley and wheat.

To determine time course kinetics of the identified metabolites and to establish mass balances, a second, quantitative experiment was performed. Evaluation of samples with time points ranging from the flowering until full ripening stage showed that HT2-3-*O*-*β*-Glc is the main metabolite of both toxins in all investigated plant species. In comparison, oats revealed the highest conversion rates of the native toxins to HT2-3-*O*-*β*-Glc and the smallest remaining part for matrix-bound residues or other metabolites (except T2, HT2, HT2-3-*O*-*β*-Glc). On the whole, our studies facilitated a comprehensive insight how cereals are capable of detoxifying HT2 and T2.

The authors thank the FWF (project “Plant metabolism of T-2 and HT-2 toxin in wheat, barley and oats”; 7971004746) and SFB F3706/15 for financial support.

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Phosphorus in soils and fertilizers: resource use efficiency through recycling and improved laboratory tests

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Keywords: Fertilizer, Phosphorus, Recycling, Ferrihydrite, DGT

Phosphorus (P) - an essential plant nutrient - is a finite resource which we must optimize and recycle. Heterogeneous recycling fertilizers produced from P-rich biowastes such as sewage sludge, slaughterhouse waste or animal manures will therefore become increasingly relevant. Various waste treatment processes further increase the diversity of products. Given the limitation of standard extractions to predict P bioavailability in fertilizers and soils of contrasting chemical properties, there is a need to find methods which accurately assess P availability from increasingly heterogenous substrates.

In the frame of the FERTI-MINE project we investigate a set of complementary approaches to characterize fertilizer P availability. With standard methods of *fertilizer* and *soil* analysis (H_2O, 2% formic acid, 2% citric acid, Neutral Ammonium Citrate, Olsen and CAL extractions) as well as comparably new process-based approaches (diffusive gradient in thin films (DGT), depletion induced desorption of P from fertilizer and imaging of fertilizer P diffusion in soil) more information about the characteristics of P fertilizers is expected to be gained than with standard extracts alone. The method evaluation was conducted on 13 P fertilizers of contrasting origins and solubility, with a 6-week pot trial (Rye) as reference.

While sewage sludge biochars performed worst, chicken manure and struvite (magnesium ammonium phosphate) were as efficient as conventional superphosphate. The DGT and Olsen method explained 90% of variance in plant P uptake. Other approaches that assess fertilizer chemical solubility in water (i.e. without soil interaction) did not give a good prediction. Nevertheless, they could e.g. help predict the P release dynamics from granulated fertilizer, in particular when implemented in combination with chemical imaging. Overall, our results indicate the potential of these complementary approaches to help optimize fertilization and improve sustainable use of P resources.

ABSTRACTS SESSION 3

MICROBIOLOGY, HEALTH

Tracing the origin of the “black gold”: Analytical challenges and potential of (MC) ICP-MS for provenancing sturgeon caviar

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Keywords: provenancing, caviar, strontium, isotopes, MC ICP-MS

Sturgeon caviar is one of the most expensive food commodities. While farming of sturgeons for caviar production is emerging, there is still a decrease in natural populations due to illegal fishing. As a consequence, sturgeon caviar trade has been put under international regulations. However, the control of the origin of sturgeon caviar is still a challenge. Sound analytical methods like elemental and isotopic fingerprinting have high potential for the unambiguous determination of the origin of sturgeon caviar.

In principle it is expected that the elemental pattern and the $^{87}Sr/^{86}Sr$ isotope ratio of water of a specific habitat (fish farm vs. natural environment) is reflected in the caviar. However, feeding of fish but also salting of caviar can have a potential influence on its chemical signature.

In this pilot study therefore untreated caviar, processed caviar (i.e. salted), fish feed, salt and water from six sturgeon farms (one in Austria, four in Italy and one in Iran) were investigated for their elemental and $^{87}Sr/^{86}Sr$ isotopic composition using (multi collector) inductively coupled plasma mass spectrometry ((MC) ICP-MS). Due to the complex matrices, detailed analytical procedures for sample preparation and measurement needed to be developed.

The first results showed that fish farms from geologically different areas could be differentiated by combining the elemental and isotopic signature of water. Moreover, the signature of most of these fish farms was different from the water signature of the natural living habitat of the wild sturgeon in the river Danube from the Iron Gate hydropower plant down to the mouth into the Black Sea. The information of the water could also be found in the untreated caviar even though a distinct influence of the fish feed (with an elemental and $^{87}Sr/^{86}Sr$ ratios suggesting marine origin) could be observed in caviar from fish farms. Nonetheless, the majority of the caviar samples from fish farms could be distinguished from the chemical fingerprint of the Danube water taken as reference for caviar potentially harvested from wild Danube sturgeon. The efficient removal of salt from processed caviar could only be accomplished on selected samples.

Further investigations will focus on the influence of salting and the evaluation of mixing models to determine the contribution of different sources to the final isotopic an elemental pattern in sturgeon caviar.

Relevance of light response and protein phosphatases for physiology in *Trichoderma reesei*

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Keywords: Trichoderma reesei, cellulases, Envoy, Phosphatases, light/stress response

Adaptation of living organisms to their environment requires the detection and subsequent responses to changes in nature. Fungi are the main decomposers of organic matter, revealing the importance of their cellular machinery for industrial applications.

Trichoderma reesei is the major producer of cellulases in nature, and improvement of enzyme production requires elucidation of the signaling network. Environmental cues such as light and nutrient availability can influence cellulases production via a complex signaling network where the light-regulatory protein Envoy (ENV1) is the key player. Through specific residue mutations of ENV1, we demonstrated that this photoreceptor integrates osmotic and oxidative stress responses in a light- and carbon source-dependent manner.

Additionally, the ENV1 is assumed to be regulated via phosphorylation, where protein kinases and phosphatases play a major role. Nevertheless, although protein kinases have been extensively studied, little is known about protein phosphatases as key components of the cellular signaling machinery to maintain a proper balance in phosphorylation cycles. In order to identify the protein phosphatases involved in the signaling network, genes encoding protein phosphatases were annotated and protein phosphatases were classified based on their structure. Knock-out strains of non-essential protein phosphatases in *T. reesei* were generated to study their phenotype. Two clear clusters of protein phosphatases were found, dividing protein phosphatases according to their role in growth, development, stress response, secondary metabolites and enzyme production, in light and dark conditions. Moreover, in some cases a correlation between the transcript patterns and phenotype was found. Consequently, we provide the first characterization of protein phosphatases in *T. reesei* and their potential for enzyme production improvement.

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Multi-dimensional approach to evaluate the diagenetic status of skeletal remains with respect to strontium isotope ratio measurements

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Keywords: Strontium, isotopes, diagenesis, laser ablation, bioimaging

Strontium isotopic analyses of in vivo incorporated environmental signatures (aka 'biosphere fingerprint') in human and animal skeletal remains have been widely used in anthropology to trace residential changes, mobility or living conditions. Often the in vivo isotopic signature in bone and teeth is distorted by cumulative physical, chemical and biological alteration during burial which leads to exchange and/or addition of strontium from the burial environment (soil, water) – referred to as diagenesis. A well-preserved biogenic Sr signal is crucial for a reliable evaluation of historic migration (paths) using $^{87}Sr/^{86}Sr$-analysis. Thus, localizing biogenic areas and the spatial extent of diagenetic alteration is essential. So far there is no sufficiently satisfactory method to differentiate between diagenetically changed and biogenic regions in bones or teeth.

Herein we present the first results of the comparison between solubility profiling and bioimaging of archaeological bone to assess in vivo $^{87}Sr/^{86}Sr$ ratios of the biogenic material. Bioimaging was performed to spatially resolve the extent of diagenesis on bone cross-sections by simultaneous mapping diffusion profiles of $^{87}Sr/^{86}Sr$ ratios and the concentrations of Sr and elements of non biogenic origin (Ba, Pb, U) using laser ablation split stream ICP-QMS and MC ICP-MS [1].

In order to generate accurate $^{87}Sr/^{86}Sr$ ratios LA MC ICP-MS data need to be corrected for matrix-based polyatomic interferences such as Ca dimers and $CaPO^+/ArPO^+$-clusters in addition to Rb and correction for instrumental isotopic fractionation.

Preliminary results show diffusion gradients of trace elements originating from the repository material along with a change in the Sr isotopic composition which can be related to diagenetic processes. Subsequent imaging by ArcGIS allows the selection of areas of minor diagenetic alteration by using selected thresholds.

An Abstract with a similar content has been submitted to the conference 25. ICP-Anwendertreffen (2016, Siegen, Germany).

[1] T. Prohaska, J. Irrgeher and A. Zitek, "Simultaneous multi-element and isotope ratio imaging of fish otoliths by laser ablation split stream ICP-MS/MC ICP-MS", J. Anal. At. Spectrom., 2016, Advance Article, DOI: 10.1039/c6ja00087h.

Contaminations in Microalgae Culture: Fighting the Ciliate *Colpoda* sp. in Mass Cultivation of *Synechocystis* sp.

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Keywords: Microalge, Contaminations, Ciliates, Colpoda, Synechocystis

The cyanobacterium *Synechocystis* sp. is a highly promising production organism for a variety of products like bioethanol as biofuel, polyhydroxybutyrate as bioplastic or phycocyanin as pigment for food industries. Cyanobacteria consume CO_2 for biomass build-up and are considered as eco-friendly and sustainable. Contaminations are a substantial problem in the algae industry and can lead to huge losses in production. Neither open ponds nor closed photobioreactors can be run under sterile conditions and contaminations are inevitable.

In this work a ciliate was isolated out of 200 L tubular photobioreactor and further investigated in the laboratory. With DIC microscopy images the ciliate could be classified due to its morphology and its cysts as *Colpoda* sp. *Colpoda* is a soil organism and was brought into the reactor most probably as dust of the surrounding soil. *Colpoda* is bacteriovore and is able to obtain energy and nutrients by ingesting *Synechocystis*. Its grazing rate exceeds the growth rate of *Synechocystis* by far and it can lead to total clearance of a dense *Synechocystis* culture within 48-72 hours.

The most common means against contaminations are high salinites and high pH values. Though, salinites up to 2% and pH values up to 10 had no effect on this *Colpoda*. Different substances against the ciliate were tested in the laboratory. Chininsulfat, Metronidazol, Chloroquin-Diphosphat and Albendazol had no effect with concentrations up to 50 ppm. Higher concentrations lead to bleaching of *Synechocystis*. However, malachitgreen oxalate had effect in concentration of 0,3 ppm and was further used in the 200 L photobioreactor, which was prior sanitized with 1% $NaClO_2$. Nevertheless, after 4 days a massive *Colpoda* contamination occured again and lead to total clearance of the culture. The failing of malachitegreen oxalate might be because of photodegradation. While pesticides are used in agriculture for decades, the use of similar substances in cultivation of microalgae is poorly known and further investigation is necessary.

Clinical *Candida glabrata* strains exhibit a broad and flexible phenotypic spectrum

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Keywords: Clinical Microbiology, High-troughput screening, Candidiasis, Phenotype screening

C. glabrata is a yeast generally known for its commensal lifestyle in the human host, however, it has reportedly caused life-endangering systemic infections and has gained attention due to its resistance against commonly prescribed antifungals. Furthermore, its frequent occurrence on inanimate surfaces, such as catheters, shifts the interest towards this yeast. Due to its asexual lifestyle, the degree in geno- and phenotypic variance of this pathogen is of interest, especially in respect to its ability to adapt to new environments (e.g. the human host). Through the exploration of the phenotypic space and its flexibility, we hope to get insight in the stress resistance mechanisms of *C. glabrata* relevant for *in vivo* and *in vitro* persistence.

In this study, we explored the phenotypic variation of a set of several hundred clinical isolates. We quantitatively measured growth *in vitro* under different stresses in a high-throughput screening setup. Our strains were exposed to different environmental conditions and agents such as osmotic stress, drought, oxidative stress, iron-starvation and exposure to antifungals (fluconazole, caspofungin). We also assessed their ability to form biofilm structures on plastic surfaces and measured *in vitro* growth in a temperature range between 15°C and 47°C. Furthermore, we screened selected strains of our library for the ability of creating stable or transient sub-populations. In addition, to connect phenotypes to genotypes, we chose seven strains for genome sequencing and explored the transcriptome.

Our high-throughput phenotype screen revealed broad variation of phenotypes within a collection of clinical isolates when exposed to selected stress agents. Furthermore, we found that about 15% of all strains could be identified as efficient biofilm formers. We found that all strains had a temperature optimum at around 39°C but many strains showed either shifted or narrowed temperature ranges, indicating an adaptation to higher or lower temperatures.

We conclude that, despite its lack of a sexual cycle and thus reduced opportunity for genomic recombination, *C. glabrata* still exhibits a broad phenotypic spectrum under stress. We further observed adaptation to different temperatures and ability to form biofilm structures among our strain collection. At last, we also could observe flexibility towards more resistant phenotypes and the frequent occurrence of sub-populations for selected conditions. It requires further elucidation of the genetic and epigenetic basis of these adaptations in order to fully understand the success of *C. glabrata* as an opportunistic commensal.

ABSTRACTS SESSION 4

BIOPOLYMERS

Enzymatic activation of poly(lactic acid) for superhydrophobic functionalization

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Keywords: Poly (lactic acid), superhydrophobic, functionalization, Cutinase

Superhydrophobic materials have a big influence in a wide spectrum of applications like microfluidics or biosensors in the biomedical field. Normally, the increased surface roughness at the micro or nano scale needed for superhydrophobic surfaces [2] is achieved by coating of different substances, which in combination with a lower surface energy lead to Water Contact Angle (WCA) values greater than 150°. In this study, a limited enzymatic surface hydrolyis poly(lactic acid) (PLA) was combined with spin coating of a steraic alkene ketene dimer (AKD) layer. The selective enzymatic hydrolysis creates, in a gentle and controlled way, new hydroxylic and carboxylic groups on the polymer surface without damaging the material bulk properties like alkaline treatment does. The creation of new hydrophilic surface groups lead to a significant increase in the hydrophilicity, decreasing the WCA to less than 30° while raising the roughness from an Rrms of 50.5 to 90.8 nm concomitantly increasing the exposed surface vs. the projected one by 13.2%. Coupling of PLA hydroxyl groups with AKD was demonstrated by using a PLA model substrate and subsequent identification of the reaction product via LC-TOF/MS. On the PLA film, FTIR based detection of the characteristic β-ketoester bond peak between the AKD and enzymatically generated hydroxyl groups on the FTIR surface confirmed sucessful coupling. Scanning Electron Microscopy (SEM) & Atomic Force Microscopy (AFM) imaging confirmed the presence of fractal strucures after curation of the enzymatically activated PLA film. The suitable size, 4.15 µm on the lateral dimension and 0.7 µm on height of the structures, together with the high density of these fractal structures lead to a superhydrophobic surface (WCA >150°). This environmentally friendly process represents an alternative to produce chemically inert superhydrophobic bio-based polyesters surfaces, by combining mild biocatalytic activation of a polyester film with non-toxic chemicals.

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Acknowledgment
This work has been supported by the Federal Ministry of Science, Research and Economy (BMWFW), the Federal Ministry of Traffic, Innovation and Technology (bmvit), the Styrian Business Promotion Agency SFG, the Standortagentur Tirol and ZIT - Technology Agency of the City of Vienna through the COMET-Funding Program managed by the Austrian Research Promotion Agency FFG and by DSM.

Preparation of monolithic, stiff and transparent aerogels from solutions of 2,3-dialdehyde cellulose in non-derivatizing ionic liquids

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Keywords: aerogel, transparent, oxidation.

Based on our previous work on super-strong transparent films from 2,3-dialdehyde cellulose and on preparation of birefringent, transparent aerogels from TEMPO-oxidized nanofribrillated pulp, this work investigates the preparation of transparent aerogels from solutions of 2,3-dialdehyde cellulose (DAC; degree of oxidation ≤ 34% AGU) in non-derivatizing ionic liquids, such as TBAF or [BDMIM]C] using variables quantities of the co-solvent DMSO. Depending on the amount of DAC dissolved, transparent aerogels featuring apparent densities of 30-90 mg cm^{-3} and internal surface areas of up to about 250 m^2 g^{-1} were obtained after coagulation of DAC by addition of ethanol and subsequent $scCO_2$ drying of the respective alcogels. Compression test revealed that periodate oxidation significantly improves both strength and stiffness of the aerogels compared to the non-oxidized reference material (Avicell). This is evident from the flow limit (defined as yield strength at 0.2% plastic deformation) which increased from about 6.8% to 10.6% compression strain when increasing the degree of cellulose oxidation (DO) from 0 to 24% AGU. Simultaneously, the force needed to achieve the flow limit increased from about 116 to 157 mN mm^{-2} and reached 227 mN mm^{-2} for a DO of 34%. Similarly, the force needed to achieve 60% compression increased from about 294 mN mm^{-2} to 396 mN mm^{-2} (DO 24%) and 669mN mm^{-2} (DO 34%), respectively.

The financial support of the Austrian Science Fund (FWF; I848-N17) and the French L'Agence Nationale de la Recherche (ANR-11-IS08-0002) through the Austrian-French Project CAP-Bone and the Federal Ministry for Agriculture, Forestry, Environment and Water Management (BMLFUW) through the WoodWisdom Net+ project AeroWood is thankfully acknowledged.

Enzymatic hydrolysis of polyesters and polyester blends for recycling purposes

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Keywords: Thermobifida cellulosilytica, cutinase, poly (ethylene terephthalate), polymer blends, enzymatic polymer recycling

The world's production of plastics materials is constantly increasing and reached 311 million tonnes in 2014 [1]. The fact that in 2014 30.8 % of the post-consumer plastic waste ended up in landfills [1] together with consumer environmental awareness leads to an increased interest in developing efficient recycling processes to valorize waste streams. In addition nowadays, fast fashion has also led to an increase in waste generation.

In this study we investigated the ability of a cutinase from Thermobifida cellulosilytica (Thc_Cut1) to hydrolyze PET (poly (ethylene terephthalate)) moieties in different polymer blends. The influence of various parameters like temperature, particle size, crystallinity and product inhibition on hydrolysis of PET moieties by Thc_Cut1 was investigated. The smaller the particle size the higher the hydrolysis rates were. The amount of products released was up to 10 times higher when the incubation temperature was increased from 40 °C to 60 °C. An inhibitory effect of soluble released products on Thc_Cut1 was seen both for a soluble model substrate as well as for PET powder.

When incubated with PET blended with PE (polyethylene) or PA (polyamide) from packaging and bottles without prior separation, Thc_Cut1 selectively hydrolyzed the PET moieties releasing terephthalic acid (TPA) and mono-(2-hydroxyethyl) terephthalate (MHET). Polymer blends were hydrolyzed in an up to 9 times higher extent compared to pure PET. The fact that Thc_Cut1 is able to hydrolyze PET blends without prior separation could represent an enormous advantage for recycling of complex mixtures of plastic wastes allowing "extraction" of valuable terephthalic acid and ethylene glycol recycling of complex mixtures.

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Acknowledgment
This work has been supported by the Federal Ministry of Science, Research and Economy (BMWFW), the Federal Ministry of Traffic, Innovation and Technology (bmvit), the Styrian Business Promotion Agency SFG, the Standortagentur Tirol and ZIT - Technology Agency of the City of Vienna through the COMET-Funding Program managed by the Austrian Research Promotion Agency FFG and by Carbios.

Degradation of 5,8-dihydroxy-[1,4]-naphthoquinone by Hydrogen Peroxide under Alkaline Conditions

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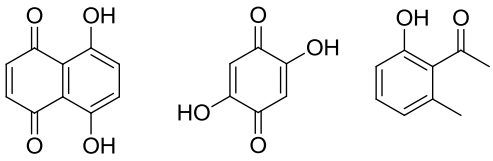
Keywords: 5,8-dihydroxy-[1,4]-naphthoquinone, cellulose; hydrogen peroxide; P-stage

Chromophores in pulp and paper originate from oxidative damage of lignocellulosic fibres caused by pulping and bleaching processes. These chromophores are intensely coloured conjugated carbonyl structures. 2,5-dihydroxy-[1,4]-benzoquinone (DHBQ), 5,8-hydroxy-[1,4]-naphthoquinone (DHNQ), and 2,5-dihydroxyacetophenone (HAP) have been identified as the dominant species among primary chromophores in cellulosics (three "key chromophores").[1] Chromophores decrease product brightness, thus the pulp and paper industry has a strong interest in detecting them and minimising their amounts. This allows to optimize bleaching sequences in terms of costs and chemical use. In order to do so, the chromophores' reactivity towards common bleaching reagents needs to be thoroughly analysed. Analyses are difficult due to the chromophores' high stabilization: in neutral and alkaline media, they are stabilised by anionic resonance effects whereas in solid state and acidic media hydrogen bonding is the cause of increased stabilization. Furthermore, in cellulose samples their amount is as low as in the ppb range, which further complicates chemical analyses. So far, DHNQ has not yet received attention regarding its reactivity towards bleaching agents and degradation product formation. In this study, DHNQ was subjected to H_2O_2 bleaching, mimicking the P-stage in industrial pulp bleaching. Under the applied conditions the reaction was determined to be of first order kinetics. Based on UV/Vis results the reaction constant *k* was calculated. Large-scale degradation experiments were performed to determine the degradation products. ^{1}H NMR, 2D NMR spectroscopy, and GC-MS measurements allowed to identify several carboxylic acids as the main degradation products, with DHBQ as an important intermediate of the underlying radical reaction.



DHNQ **DHBQ** **HAP**

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POSTER PRESENTATIONS

P1: Influence of physicochemical properties of dietary fibre on the digestibility of nutrients in piglets

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Keywords: piglets, fibre, physicochemical properties

There is a lack of information about intrinsic physicochemical properties of feeds, especially fibre rich feeds passing the gastrointestinal tract. The knowledge of specific buffering capacity and water holding capacity is important to balance a diet for e.g. piglets with limited amounts of HCl production in the stomach or to influence nutrient absorption in the small intestine.

The aim of the study was to quantify fibre rich feeds for their physicochemical properties *in vitro* and *in vivo* to estimate the influence on digestibility of nutrients in piglets.

In the first part of the study the linearized form of the BC (the linear buffering capacity rate, LBR [1]) and water holding capacity of several fibre rich feeds *in vitro* were evaluated. For this, laboratory methods to measure were established for different sources of fibre. Additional measurements like crude fibre, crude protein and ash as well as fibre components [2] and total dietary fibre (TDF) were performed to related them with the physicochemical properties.

In the second part a feeding trial with weaned piglets fed four rations differing in fibre source to obtain different physicochemical properties but similar TDF content was performed. Beside the performance data of the piglets, faecal samples for digestibility calculation, digesta for microbial metabolites and intestinal tissue for morphological analysation were collected.

Currently the *in vitro* classification of the fibres and are the feeding trials completed. Frist results show differences in physicochemical properties of fibres *in vitro* with relations to their individual ingredients like CP and TDF. The performance data show no significant differences among feeding rations. Further results are expected to complete the evaluation.

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P2: Occurrence of masked mycotoxins in Croatian wheat harvested in 2015

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Keywords: LC-MS/MS multi-mycotoxin detection, deoxynivalenol, modified deoxynivalenol, Croatia, wheat

Deoxynivalenol (DON) is one of the most frequently occurring trichothecene mycotoxins and it is produced by various *Fusarium* species causing *Fusarium* head blight disease which affects yield and quality. As a defence system, plants can metabolically transform DON and form conjugated mask mycotoxins deoxynivalenol-3-glucoside (D3G), deoxynivalenol-3-sulfate and deoxynivalenol-15-sulfate which are not currently legally regulated (Audenaert et al. 2013, Berthiller et al. 2003). Modified forms can be transformed back to free DON during digestion so it is important to monitor their concentrations (Audenaert et al. 2013, Berthiller et al. 2003). DON and its modified forms 3-acetyldeoxynivalenol (3-AcDON), 15-acetyldeoxynivalenol (15-AcDON), deoxynivalenol-3-glucoside (D3G), deoxynivalenol-3-sulfate and deoxynivalenol-15-sulfate were determined in 62 wheat samples collected from all regions of Croatia using a liquid chromatography–tandem mass spectrometry multi-mycotoxin method. DON was detected in 50% of the samples (n = 31), with the maximum concentration of 1065.3 ppb and median 123.4 ppb. D3G was detected in 26 samples (42%) and the maximum concentration was 182.1 ppb, and median 31.0 ppb. 3-AcDON was detected in 7 samples (11%), maximum concentration was 10.6 ppb, and median 4.7 ppb, while DON-sulfates and 15-AcDON were not detected. Most samples with detectable DON as well as its highest concentration were measured in samples originating from eastern Croatian regions. Air temperature and amount of rain in May 2015, during wheat flowering, were above average ineeastern Croatia creating favorable conditions for *Fusarium* infection. On the contrary, weather conditions in south Croatian regions were stable so there was less *Fusarium* infection of wheat. Measured DON concentration was low (up to 10.6 ppb), and no modified DONs were detected.

Acknowledgments: This research was financially supported by the European Structural and Investment Funds, European Social Fund (ESF), Power of Development – Human resources development, CroMycoScreen HR.3.2.01-0274

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P3: Step-reaction *vs.* chain-reaction polymerization of lignin: two facile approaches towards lignin aerogels and carbon aerogels

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Following our previous works on hydro- and aerogels from different lignins cross-linked with oligo (alkylene glycol)-α,ω-diglycidyl ethers (Passauer et al. 2011a and 2011b; Perez-Cantu et al. 2014) and on the preparation of phenol-formaldehyde (PF) adhesives of high lignin content (Ghorbani et al. 2016), this paper reports the preparation of mechanically stable, monolithic aerogels from ligneous precursor materials that have been brought to gel formation by either step-reaction or chain reaction polymerization. Thermo-induced gelation of ligneous resole resin pre-condensates (40% replacement of phenol by lignin, v ≈ 1000 mPa·s) in ethylene glycol afforded freestanding, homogeneous gels that were converted to respective aerogels by consecutive neutralization, washing, incremental replacement of water by ethanol and $scCO_2$ drying. Depending on the extent of resole dilution by ethylene glycol the brownish aerogels featured bulk densities of 40 to 690 mg cm^{-3}. Scanning electron microscopy, nitrogen sorption at 77 K and thermoporosimetry using *o*-xylene as probe solvent revealed a largely homogenous internal mesoporous morphology featuring accessible specific surface areas as high as 448 m_2 g^{-1}.

In an attempt to increase the lignin content of respective aerogels, different types of lignins were pre-activated by increasing their amount of hydroxyl groups, subsequently permethacrylated and then subjected to radical homopolymerization or copolymerization with methyl methacrylate (MMA) in toluene using azobis(isobutyro)nitrile (AIBN) as radical starter.

While copolymerization affords homogeneous gels but inhomogeneous aerogels due to "ballooning effects" during $scCO_2$ drying of hitherto unknown reason, homopolymerization gives access to both homogeneous gels and aerogels whose shape and dimension can be preserved throughout gelation and $scCO_2$ extraction of toluene. Preliminary carbonization tests revealed that both types of synthesized ligneous aerogels can be converted to respective carbon aerogels at virtual full preservation of their geometry independent on whether they were first subjected to oxidative stabilization (0.5°C min^{-1}, T_{max} 250°C, synthetic air) or directly carbonized in argon atmosphere (T_{max} 1300°C).

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P4: Effects of selected root colonizing sebacinoid fungi on tomato root morphology

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Keywords: Tomato, Fungal endophyte, Plant growth promotion, *Sebacinales*

Sebacinales as root endophytic fungi can colonize the roots of different plant species. In crop plants, *Serendipita indica* is the most well-studied member of this order. In previous studies this fungus promoted plant growth and increased resistance and tolerance to biotic and abiotic stresses. However, *S. indica* is rather problematic for the application in Europe due to its foreign origin. Until now studies on European isolates of *Sebacinales* are scarce but are essential to investigate the potential of these fungi for plant growth promotion and biological control of plant diseases.

In this study, in order to assess the impact of *Sebacinales* on the root morphology of tomato plants, the following four members were investigated in in-vitro experiments: *S. indica*, *Serendipita williamsii*, *Serendipita herbamans* and *Sebacina vermifera.* Tomato seedlings were placed on Knop medium, inoculated with the selected *Sebacinales* and were grown under a 10-h light and 14-h dark photoperiod at 24°C. After 14 days the roots were scanned and images were analyzed by using the software Win RHIZO Pro. The obtained results showed a significant increase in tomato root length, root surface area and root volume of tomato plants inoculated with *S. vermifera*. Furthermore, root surface area and root volume were increased in all *Serendipita* sp. treatments compared to the non-inoculated plants. In contrast, root diameter of tomato plants inoculated with *S. herbamans* and *S. vermifera* were not affected. However, *S. indica* and S. *williamsii* enhanced the root diameter significantly compared to the control plants.

These results clearly show that the selected sebacinoid fungi promote tomato root development in-vitro. It is intended to explore this plant growth promoting effects further in more complex substrates like soil. Additionally, the impact on disease resistance will be investigated in future experiments to elucidate the full potential of these native fungal isolates.

P5: Biodegradation of ionic phthalic acid based polyesters by wastewater microorganisms and their enzymes

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Keywords: sulfonated polyesters, household product, cutinase, *Pseudomonas sp.*

Ionic phthalic acid based polyesters are, as a consequence of their water soluble properties and applications in e.g. household products, disposed via sewage systems to wastewater treatment plants (WWTP). Therefore, polymers should ideally be degraded in WWTPs. Microbial communities have an essential part in biodegradation processes of polymers in WWTP, because polymer biodegradation is expected to be a two-step process. First, microorganisms produce extracellular enzymes hydrolyzing polymers to oligomers which are taken up by microorganisms for further degradation. [1-6]. In order to systematically study microbial and enzymatic hydrolysis of polyesters, a group of structurally different ionic phthalic polyesters was synthesized designed as model substrates for polymers used in household products. The aims were to identify enzymes and microorganisms able to hydrolyze ionic polyesters in WWTP and to investigate how polymer architecture affects microbial and enzymatic hydrolysis. We successfully identified, based on in-silico search, a cutinase from a typical wastewater microorganism *Pseudomonas pseudoalcaligenes* (PpCutA) as effective polyester degrader. PpCutA was successfully expressed in E. coli and purified for further investigation. PpCutA and *P. pseudoalcaligenes* were proven to successfully hydrolyze all structurally different polyesters. Increasing water solubility and increasing hydrophilicity were shown to significantly enhance enzymatic hydrolysis. Biodegradation of the ionic phthalic polyesters in simulated freshwater with WWTP sludge as inoculum were also demonstrated. The improve knowledge about microbial mineralization of polymeric substances in WWTP by studying the enzymatic hydrolysis of polymeric substances can be used in the development of improved biological WWTP processes.

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P6: Bottlenecks in the development of new biorefinery processing lines – insights from researchers along the entire value-chain

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Keywords: Wood-based biorefineries, research and development needs, Delphi-analysis

Wood has the potential to end in a broad spectrum of value-added products and energy carriers. Biorefineries are capable to possibly convert wood and its residues to achieve high values. Within the framework of several national and pan-European funding programs, research and development are pursued intensively in this field. However, a significant part of the valuable wood biomass is still used in different side-streams and low value-added applications. Further modelling and optimisation of diverse technologies and their application in successive or alternative routes is important, since many methods are still under development and not ready to hit the market. To face these challenges and foster forest-based biorefineries, a sound analysis of the scientific and technological bottlenecks is required.

Wood K plus is currently working on this research topic within the project “European Research Infrastructure for Circular Forest Bioeconomy” (ERIFORE), EU-funded by Horizon 2020. For this reason, European researchers along the entire biorefinery value-chain participate in a survey concerning their key insights on existing bottlenecks and gaps. The interdisciplinary composition of the expert panel enables an innovative approach to capture the complexity and variety of biorefinery research and development. To provide a future oriented picture of the research needs, closely linked to required research infrastructure, a Delphi-analysis was carried out. The method, named after the ancient oracle, is an iterative survey in order to form a stable group opinion. Consecutive written consultations enable a structured exchange of views, giving each respondent the opportunity to review his position. The first and preliminary results of this study will show the existing bottlenecks and constraints in forest-based biorefinery research and development along the entire value-chain.

P7: Local adhesion testing on lignocellulosic fibers with nanoindentation
A Sample preparation technique

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Keywords: adhesive, MUF, PUR, nanoindentation, interface

The performance in a wood adhesive bond is determined by many factors, among others, the adhesion between adherent and adhesive. The adhesion between adherent and adhesive at the interface can be determined by means of nanoindentation at the microscopic scale.

Nanoindentation is a micromechanical testing method enabling the calculation of mechanical values such as modulus, hardness, or deformation energy from a load-displacement curve recorded during a local indentation.

To characterize the behaviour of various available interface types between single lignocellulosic fiber (MDF, single wood fibers, pulp fibers) surfaces (S2, S3, ML) and different adhesives (UF, PUR), an experimental setup needs to be developed to be able to gain comparable testing conditions for all different interface types within one single specimen which will be presented in this talk.

With the help of the newly developed specimen preparation technique we aim for analysing the effects of varying surface conditions (originated by cell wall anatomy or fibre pre-treatment) in combination with different adhesives on adhesion performance.

P8: Passive sampling devices to quantify the accessibility of aromatic pollutants in soil

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Keywords: PAH, HCB, accessibility, passive sampling, competitive sorption

Aromatic pollutants cover a wide range of soil contaminants which differ in size, structure and properties. Once introduced into the environment, they tend to sorb to soil constituents and potentially posing a threat to the surrounding ecosystem. To evaluate the risk of exposure it is important to understand the binding kinetics between soil constituents and organic pollutants and to quantify the accessible fraction of a contaminant. In this study the innovative passive sampling technique Sorptive Bioaccessibility Extraction (SBE) was used to evaluate the exposure of aromatic pollutants in soil samples. Based on physical partitioning processes, a silicone rod out of polydimethylsiloxane (PDMS) acts as a large capacity absorption sink to capture mobilized contaminants, and allows simple back-extraction of pollutants for their quantification [1]. The method was applied to assess (i) the π-π Electron Donor-Acceptor (EDA) interaction model between pollutants and soil constituents, (ii) the Correlation between accessible fraction and microbial biodegradation and (iii) the enhancement of the accessible fraction by competitive sorption of an additional sorbate (e.g. toluene). Soil samples were sampled from industrial sites in Austria containing polycyclic aromatic hydrocarbons (PAH) or hexachlorobenzene (HCB). SBE experiments with a PAH contaminated soil showed an accessible PAH fraction of 41.2 ± 1.3% without competitive sorption of an additional sorbate. An increased release of PAH with passive dosing of toluene (48.9 ± 1.7%) at levels below solubility effects indicates a competition for binding sites and enhances mainly the accessibility of PAH with higher molecular weight. Accessibility experiments with HCB contaminated soil showed a complete release of the contaminant, indicating that HCB is not retained significantly by soil constituents. The π-π electron donor-acceptor interaction model will be further investigated by competitive sorption experiments with different sorbates. Furthermore, SBE accessibility studies will be correlated with microbial degradation studies to proof the biological accessibility of absorbed contaminants.

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P9: Quantitative and Qualitative Determination of Anaerobic Petroleum Biodegradation via Isotopic Shifts in Terminal Electron Acceptor $\delta^{15}N$ and $\delta^{34}S$ Ratios

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Keywords: petroleum hydrocarbons; *in situ* bioremediation; terminal electron acceptors; stable isotope ratios; monitoring

Anaerobic clean-up methods for petroleum hydrocarbon (PH)-contaminated aquifers that rely on the capability of microorganisms to degrade toxic organic chemicals using terminal electron acceptors (TEA), termed *in situ* bioremediation, are promising approaches. However, *in situ* process control is difficult in the presence of discrete PH-phases (NAPL) due to compensation of PH-degradation by resolubilisation from the NAPL. Thus, the objective of the present study is to determine the practicability of interpreting acceptor sided stable isotopic shifts ($\delta^{15}N$ in nitrate and $\delta^{34}S$ in sulfate) as process parameter for the quantitative and qualitative monitoring of PH-degradation in contaminated aquifers. Long-term anaerobic degradation experiments were carried out in laboratory scale anaerobic microcosms supplemented with PH-contaminated sandy aquifer material as well as (i) nitrate (NIT), (ii) nitrate and sulfate (MIX) and (iii) nitrate and molybdate (MOL) as TEA. TEA-concentrations were monitored *via* IC and total petroleum hydrocarbons (TPH) were analyzed quantitatively via GC-FID as well as semi-quantitatively for polar degradation products following derivatisation on GC-MS. A 16S rDNA assay using Illumina-Miseq was performed for detection of the present archaeal and eubacterial microbiome. Isotope ratios were analyzed *via* EA-IRMS. Statistical correlations between TEA-depletion and the shift of acceptor sided stable isotope ratios was analyzed *via* linear regression analysis. After 8 months, all reactors showed TEA-depletion and similar TPH-degradation, while biodegradation was most complete in terms of metabolite recovery at MIX, which also showed higher microbial biodiversity than NIT and SUP. With advancing TPH-degradation, good statistical correlations between isotope shifts ($\delta^{15}N$ and $\delta^{34}S$) in the residual TEA-fraction and the corresponding decline in TEA-concentrations with R^2-Values of at least 0.82 were found, which shows the practicability of this method for quantitative monitoring of the biodegradation process. Looking at enrichment factors (ε) calculated *via* Rayleigh Equation, NIT and MOL showed higher fractionation than MIX. This observation can be attributed to the fact that under mixed terminal electron accepting conditions, less strongly N-fractionating lithotrophic, sulfide dependent denitrification by *Thiobacillus* and more strongly fractionating organothrophic denitrification, i.e. hydrocarbon degradation, took place in parallel, while at NIT and MOL organotrophic denitrification was the main denitrifying process.

P10: Techno-economic Analysis and Life Cycle Assessment of Lignin Based Products

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Keywords: Life Cycle Assessment, Lignin, Market Diffusion, Biobased Materials

One of the most significant challenges nowadays is the development of a sustainable global economy. Therefore, it is necessary to develop processes and technologies that allow sustainable production of materials from renewable natural resources [1]. Lignin – nature's most abundant aromatic polymer – is one of the most interesting by-products of the pulp and paper industry. Over forty million tons are generated each year, but only 1-2% of lignin worldwide is used for purposes, other than energy production [2].

This research aims at the assessment of new developed valorization routes and lignin- based products, like lignin-based PF resins, with the help of Life Cycle Assessments (LCA) and techno-economic analyses. The LCA assesses the in- and outputs and the potential environmental impacts of a product or process throughout its life cycle. While the majority of LCAs are performed at industrial scale when the process is mature, the aim of this project is to conduct an LCA on a technical R&D project. Additionally, a Hot-Spot analysis should reveal the environmental Hot-Spots along the developed technologies and the products life cycle. Techno-economic analyses should help to identify market related barriers and incentives which are influencing the success rate of the new lignin-based products. Moreover, a Perception-Gap analysis was conducted which exposed gaps between the wood-based panel industry and researchers working on lignin based PF-resins, in terms of expectation and importance of relevant factors. Identifying such gaps between these areas provides an important basis for further research and recommendations for action, in order to help increase the market potential of lignin-based products.

R&D projects are characterized by significant levels of risk due to high uncertainties and low data availability. But assessing new technologies and products during early research stages might be the key to successfully develop sustainable processes and products [3].

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P11: Hay for biogas production: effect of steam explosion pretreatment on the gas yields and biodegradation kinetics

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Keywords: Methane; Lignocellulose; Anaerobic digestion; Degradation; Biofuel

Growing grassland biomass in an extensive way and its subsequent transformation into hay for a further utilization in a biogas-based biorefinery concept could be a solution to increase incomes and maintain the grassland area. In this way, grasslands can be promising biomass sources for decentralized energy generation. Efficient biogas production from this lignocellulosic biomass requires a pretreatment step. One of the most efficient pretreatment methods for lignocellulosic materials is steam explosion. In the present study, the effect of steam explosion on the biomethane potential (BMP) of hay was determined. In addition, the biodegradation kinetics of the main structural compounds were studied in order to better understand the influence of the pretreatment on the anaerobic digestion process.

Different steam explosion conditions were tested, with temperatures ranging from 140 to 200 °C and different residence times ranging from 2 to 15 minutes. For every pretreatment, BMP tests and chemical analyses were performed. In parallel to the BMP tests, a biodegradation kinetic trial with untreated and pretreated biomass was done using a modification of the rumen simulation technique (RUSITEC).

The results show that with increasing the pretreatment intensity up to 150 °C, the methane yield improved around 10%. Then, the produced methane decreased under harder conditions, which may be due to the formation of pseudo-lignin and inhibitors. The degradation kinetic trial showed that methane formation and biomass degradation accelerated with increasing the intensity of the pretreatments. In addition, the degradation trial showed that harsher steam explosion conditions enhanced lignin degradation.

P12: Wood colour modification using heat-pressure-steaming technology

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Keywords: heat pressure steaming, wood colour, wood modification

The modification of established wood colours is demanded by industry mainly for aesthetic reasons, to provide a wider pallet of colour combinations for the design of wood products. Wood modification via heat pressure steaming is a very time efficient way to change the colour of wood without additional chemicals like ammonia. Beside the time benefit of only 1/10 (approximately) compared to conventional steaming process, it provides a homogeneous changed colour thru the whole cross-section of the treated wood boards. In this study selected European wood species were investigated according to their colour change under heat pressure steaming. Therefore the process parameter temperature, process time and process pressure were varied.

The investigation showed, that the different species respond individually on the applied parameters of the modification. In general, with increasing treatment intensity, the colour change increased. However for some species the colour saturation (C*) gets lower when a certain treatment intensity is overrun. The reason for the individual colour change behaviour for each species is found in the individual composition of wood constituents, especially hemicellulose contend and extractive content and distribution. With the described treatment method it was possible to generate new and interesting colour impressions for local wood species without the use of additional chemicals.

P13: Feed or fight – the light dependent balance of secondary metabolites and enzymes in *Trichoderma reesei*

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K**eywords:** *Trichoderma reesei*, light, cellulases, secondary metabolism

Changing light conditions, caused by the rotation of earth resulting in day and night or growth on the surface or within a substrate, result in considerably altered physiological processes in fungi. For the biotechnological workhorse *Trichoderma reesei* (syn. *Hypocrea jecorina*), regulation of glycoside hydrolase gene expression, especially cellulase expression was shown to be a target of light dependent gene regulation. Investigation of genes regulated in response to light in *T. reesei* and their distribution within the genome revealed several genomic clusters. We investigated the relevance of one light regulated gene cluster in regulation of secondary metabolite production and regulation of enzyme expression.

In strains with different defects in light and nutrient sensing under different conditions in light and darkness the transcription factor in this cluster is regulated in response to light and nutrient signals as mediated by the respective signaling cascades. Transcriptome analysis of mutants lacking this transcription factor revealed regulation of CAzyme encoding genes as well as secondary metabolism in a light dependent manner.

High performance thin layer chromatography of supernatants from strains lacking the genes of this cluster in light and darkness along with transcript analysis and mass spectrometry indicates that secondary metabolite production and enzyme expression are connected processes in *T. reesei*. Moreover, this regulatory connection is different in light and darkness.

P14: Automatic Evaluation of Resin Distribution in Particleboards

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Keywords: pattern recognition, resin distribution, particleboard

For optimising the metering of resin in the production of particleboards, it is necessary to quantify the resin distribution within the particleboard. The goal is to reduce the amount of resin within particleboards without affecting the properties of the final products. Thus the resources and costs can be reduced and the production process becomes more efficient. For the quantification of the resin distribution, microscope images of cross sections of particleboards are recorded under halogen and UV light. In the present study, these images are analysed in detail. The obtained resin distribution is used to compute an approximation of the resin distribution of the whole particleboard. At the moment the microscope images are stitched and edited manually using image processing programs. A crucial step of the evaluation is the detection of the boundaries of the wood particles. Using these boundaries the bond line can be determined. Thus, the amount of resin that is penetrated into the particles and resin in the bond line can be calculated. Subsequently the resin, which is neither penetrated nor in the bond line, can be computed. The manual evaluation is very time-consuming and therefore the development of an automatic evolution method is desired. In contrast to the manual evaluation, the automatic evaluation is reproducible. For automatic computation of the resin distribution there are four steps: stitch together the single pictures, detection of the boundaries of the wood particles, detection of the resin and calculation of the resin distribution. For stitching together the single pictures the best fit of the overlapping area is considered. The resin can be detected using the difference in contrast. The automatic detection of the boundaries of the particles, using methods of pattern recognition, is currently in progress.

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P15: Expander processing of corn and its impact on animal performance, nutrient digestibility, microbial metabolites and product quality of fattening pigs and broiler chicks

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Keywords: corn, HTST-technology, performance, carcass characteristics, digestibility, product quality, fattening pigs, broiler chicks

Feed manufacturers are constantly trying to reduce processing costs with few losses in quality of processed feed. Especially processing feed with high temperature and short time (HTST) technology like the expander processing yields technological and nutritional benefits. This may improve the physical pellet quality, as well as the feed conversion rate. However, specific consideration regarding the heat sensitive ingredients like AA, vitamins, feed additives and carotenoids must be given, as it might adversely affect animal performance and product quality [1]. To formulate rations based on digested components covering requirements of the animals, knowing the mode of action of this method is prerequisite for their successful application.

In this context a study with two experiments were conducted to determine the effects of expander processing on the nutritive value of the single component corn, fed to barrows and or broiler chicks. In the control diet (C), corn was untreated and quantitatively replaced by short- (60s, SC) and long-term (1080s, LC) conditioned and subsequently expanded corn of the same batch, respectively. In treatment LC+AA, the animals received diets with corn processed as treatment LC, but including additionally 10% Lysine and, if necessary, a supplementation of essential amino acids (AA) to maintain the ideal protein content. By this supplementation it should be possible to reduce the risk of higher fat proportion and increase the yield of lean or breast meat of the fattening pigs or broiler chicks.

Currently, both trials are successfully finished and the laboratory analysis as well as the statistical analysis are under progress.

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P16: Increasing phytomining efficiency on waste incineration bottom ash

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Keywords: Waste incineration bottom ash; phytomining; hyperaccumulators; PGP-bacteria;

Phytomining could offer an environmentally sound and low-cost technology to recover valuable trace elements (TE) from waste incineration bottom ash. Fresh bottom ash is a difficult substrate for plant growth, characterised by an extremely alkaline pH, high salinity and soluble concentrations of some TE toxic to plants. A substrate mixture of bottom ash mixed with material from mechanical biological treatment of municipal solid waste and biochar was selected for a series of pot experiments. These experiments involved growing hyperaccumulators and metal-tolerant high-biomass plants, EDTA-induced metal solubilisation, inoculants of rhizobacterial strains with plant growth promoting (PGP) traits and a still ongoing field experiment on a landfill in Vienna. In these experiments, more than 20 plant species were tested for accumulation of valuable TE.

The hyperaccumulator species tested in the pot experiments grew slowly and most likely suffered from the high salinity and the high soluble Cu concentrations in the substrate. Nevertheless, they showed elevated concentrations of Ni (*Alyssum serpyllifolium*) and Zn (*Sedum plumbizincicola*) in the aboveground biomass. Regarding the PGP-bacterial treatments, increased biomass production could be detected for *Nicotiana tabacum* and *Salix smithiana*. Regarding the EDTA-treatments increased uptake of Zn in *S. smithiana* and *Chenopodium album* could be achieved. However, the use of EDTA is only recommended in closed systems where uncontrolled leaching can be avoided.

We managed to grow a series of plant species on waste incineration bottom ash with high accumulation of Ni and Zn in hyperaccumulators. Moreover, the use of PGP-bacteria or metal chelating agents in combination with high-biomass plants might offer an alternative to slowly and moderately growing hyperaccumulators. Nevertheless, in the focus of phytomining and the need for accumulation of high concentrations of a certain TE in the aboveground biomass, the use of hyperaccumulators is a more appropriate choice. Therefore, further experiments on the optimisation of plant growth and biomass production of these plants are necessary.

P17: Influence of soil tillage and catch crops on the colonisation of arbuscular mycorrhizal fungi

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For soil conservation and soil protection soil friendly farming methods, such as mulch- and direct seeding, and the full-year and full coverage of the soil is important. Many studies have shown that arbuscular mycorrhizal fungi maintain and promote the soil fertility and have many advantages for the host plants. Arbuscular mycorrhizal fungi can colonize the roots and influence the nutrient uptake especially for phosphorus and nitrogen, the pathogen resistance and the water relations. Individual species impact differently on the growth and vitality of the plants. For mycorrhizal fungi more than 220 species have been described yet.

In this study the effect of several soil tillage systems in combination with catch crops, in mixtures or as single components, on mycorrhizal fungi were tested. The studies were carried out in a longtime field trial in Hollabrunn, Lower Austria comprising conventional tillage, chisel plow, minimum tillage and no till plots. The experimental set up consisted of winter wheat and sunflower as main crops and 5 different catch crop groups. Beside one fallow treatment, black oat, a mixture out of legumes, a mixture out of plants with deep roots and a mixture of brassicas were tested. In winter wheat, in the catch crops and in sunflower the colonisation of the roots with arbuscular mycorrhizal fungi was assessed. The morphological traits of the roots were analysed using the Software Win Rhizo©. The root length, root surface area and the root volume of wheat and the catch crops were evaluated. Furthermore in sunflower also the amount of phosphorus and other nutrients, the ratio between C/N and the dissolved organic carbon in the soil was determined. From soil samples of the sunflower, mycorrhiza spores were extracted to see if there is an influence of the soil tillage system and the catch crops on the number of spores in the soil.

P18: Synergistic combination of abiotic and biotic PCE-dechlorination

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Keywords: in-situ remediation, perchloroethylene, zero-valent iron, dehaloccoides,

About one third of the expected 2000 severely contaminated sites in Austria are estimated to be polluted by chlorinated hydrocarbons, such as perchloroethylene (PCE). These sites are located mainly within build-up regions, thus only in-situ remediation methods can be used. This project examines an in-situ remediation method, in which the biotic degradation via bacteria is combined with abiotic degradation via Fe0 particles. During abiotic treatment by Fe0 the PCE-molecule is reductively dechlorinated. Fe0 is also consumed by anaerobic corrosion producing H2. To achieve biotic degradation often strictly anaerobic strains of the bacteria Dehalococcoides are used, which are able to completely dechlorinate PCE by utilizing H2. By combining these processes the H2, produced during the anaerobic corrosion of Fe0 , could be used by bacteria for further PCE degradation. Therefore remediation time, the needed Fe0 amount and as a consequence also remediation costs could be reduced. In microcosms the PCE degradation rates of different Fe0 particles (nano- and microscale) and Dehalococcoides cultures were tested. To gain a better understanding of the needed environment for biotic dehalogenation different carbon sources and parameters were tested. In future combined microcosms are planned, including the determination of the biotic inhibition by Fe0 particles. With PLFA-analysis the metabolic destiny of the carbon from the PCE and the hydrogen of H2 will be observed. The gained results will then be tested under more realistic conditions in column and lysimeter experiments. Complete biotic PCE dechlorination could be achieved with a KB1-culture. Using molasses and ethanol as carbon sources leads to the fastest PCE dechlorination with no toxic metabolite accumulation. The tested Fe0 particles showed different dechlorination rates, with the nano-scaled particles leading to a faster dechlorination but also higher H2 production, resulting in a H2 concentration that could favour non dechlorinating bacteria, such as methanogens.

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P19: Functional characterization of ethylene biosynthesis candidate genes of *Fusarium graminearum*

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Keywords: *Fusarium*, ethylene, ketobutyrate, ACC-synthase, ACC-deaminase

Fusarium graminearum is a plant pathogen which has the ability to infect many economically important plant species. It has been reported that *Fusarium graminearum* is able to interfere with ethylene biosynthesis in monocots and dicots and that ethylene signalling enhances the susceptibility of the host plants. (Chen et al., 2009). Ethylene, a plant hormone, is formed in response to biotic and abiotic stress. *In planta* the biosynthesis starts with methionine which is converted by AdoMet-synthase to S-adenosyl-L-methionine (AdoMet) which is further converted by 1-aminocyclopropane carboxylate (ACC) synthase to ACC. ACC is further oxidized by ACC oxidase to ethylene but can also be degraded by ACC deaminase to α-ketobutyrate (KBA). In our study we focus on the identification and characterization of ACC synthase and ACC deaminase candidate genes in *Fusarium*. Based on sequence similarity three probable ACC synthases and two probable ACC deaminases were identified. We have characterized one ACC deaminase (*ACD2*) of *Fusarium graminearum* by using *in vivo* and *in vitro* methods. The second deaminase candidate gene was characterized as D-cysteine desulfhydrase. For testing of ACC synthase candidate genes on their activity an *in vivo* assay in a modified *E. coli* T7-express strain was used. Single knock out mutants of *Fusarium graminearum* are already prepared. Different wheat infections with *ACD2* knock out mutants were performed to determine the virulence and DON production, ACC- and KBA production, as well as different metabolites. Double knock out mutants are under construction.

P20: Enzymatic recycling of high value pigments and glucose from viscose fibers

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Keywords: cellulose, pigments, glucose, hydrolysis, cellulases

In this last decade the estimated total world-wide fiber consumption is 102 million metric tons [1]. Out of these, man-made cellulosic (MMC) fibers account for more than 10 million metric tons with an average annual growth of more than 2%. Cellulose is the most abundant available natural material, and it represents a major renewable resource for sustainable production of bulk commodities such as fibres [2]. The spinning technologies developed over the last hundred years, such as the classical viscose, lyocell or most recently the Ioncell-F process [3], have all in common that the textile fiber properties (tenacity, titer, elongation at break, etc.) can be adjusted in a wide range. The incorporation of functional pigments, such as color, fluorescent or flame retardant polymers allow the production of multifunctional, cellulosic fibers for various applications, such as personal protection equipment (PPE). From an economical as well as from an environmental point of view, certain functional pigments, such as phosphor-based flame retardants or day-light pigments represent high valuable products. Their recovery from low-grade or waste material would be highly appreciable, but due to their inherent chemical liability, acidic hydrolysis of the cellulosic matrix is not technically feasible.

In this work we present a new strategy for the recovery of chemically labile viscose fibres constituents. The key step is based on the enzymatic hydrolysis of the cellulose fiber matrix below 60°C thereby “releasing” the water insoluble pigments without chemically attacking or degrading them.

To the best of our knowledge this is the first time that cellulases are described for the recovery valuable rayon additives like organic flame retardants which could be re-use instead of being discharged.

A completely eco-sustainable and simple process is presented for the hydrolysis of multifunctional viscose fibers in order to recover incorporated, high value pigments and obtain glucose of high purity.

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P21: Evaluation of protein and energy content of forages in permanent grassland

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Keywords: forage, grassland, N-fertilization, protein and carbohydrate fractionation

In the last years, concerns with environmental issues are related to nutrient losses in grassland especially N. In fact, N losses associated with the efficient N utilization in animals are strongly influenced by the protein quality of feed. Poor efficiency N utilization in rumen causes high N content in urine. In addition, availability of N in the rumen represents the amount of rumen degradable protein, which may be converted to microbial N. This depends mainly on the availability of energy in the rumen (measured as fermentable organic matter) resulting in microbial protein synthesis (MPS). Consequently, the protein in forages should be properly characterized to synchronize degradable carbohydrate and degradable protein for optimizing MPS [1]. Many studies investigated the calculation of the N efficiency of feed management, especially in terms of supplementation, but not much information exists about the forage quality in permanent grassland.

The experiment was established at HBLFA Raumberg-Gumpenstein and the samples are evaluated during 2014 and 2016. The experimental design used is a randomized split plot design, with four replications as blocks. A dose of fertilizer is the main plots and functional groups are the sub plot.

The measurement of N fractionation and carbohydrate profiles of forages is based on the CNCPS. It may provide data to evaluate the N use efficiency of grassland for ruminant nutrition.

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P22: Optimization of a new fully-automated sample preparation system for isotopic analysis of sediment digests via MC ICP-MS

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Over the past decades MC ICP-MS has matured to a powerful tool for the precise analysis of isotopic ratios in various kinds of environmental samples. Especially sediment and rock digests contain various matrix elements at high concentrations such as Si, Al, Fe and Ca. These have to be separated from the analytes of interest, since highly precise measurements of isotopic ratios via MC ICP-MS suffer from isobaric and polyatomic interferences as well as mass bias effects. For this purpose usually hand packed columns with different kinds of ion-exchange resins provided by various distributors are used. However, established separation protocols are often time-consuming and cost-intensive.

The *prepFAST-MC*® sample preparation system provided by *Elemental Scientific* (Omaha, Nebraska, USA) is a fully automated, column based chromatographic extraction system. The system enables the separation of the targeted analytes from matrix rich-samples using an analyte specific resin. Within this work we present first results on the optimized sample preparation protocol for the separation of Sr, Pb and Nd in sediment digests, based on the DGA resin (TrisKem International, Bruz, France).

The new, optimized method opens the possibility to separate three isotopic systems within a single analytical run, which helps to save time and effort compared to conventional (manual) separation techniques. The separation schema can be applied to different sample matrices (sea water, soil extracts, sediment or rock digests) with high recovery rates (Sr >95%, Pb >90%, Nd >95%). Furthermore the DGA resin proved to be highly re-usable with low separation blanks. All three isotopic systems are of specific interest in the field of marine geochemistry, since they allow the tracing of the geological origin of sediments (Sr, Nd) as well as the tracing of anthropogenic emissions (Pb).

An Abstract with a similar content has been submitted to the conference 12. Symposium Massenspektrometrische Verfahren der Elementspurenanalyse und 25. ICP-Anwendertreffen (2016, Siegen, Germany).

P23: Lignofoam: Isolation and Characterization of Lignosulfonate

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Keywords: Lignin, lignofoam, lignosulfonate, lignosulfonate characterization, lignosulfonate isolation.

Lignin is a renewable raw material, which is available in huge amounts, but so far it is utilized in innovative materials only to a very small extent. In a strategic project in our division the development of novel high performance insulation-products is targeted, one of those being foamed lignins. Direct modification of spent sulfite liquor and thus the development of renewable lignin-based foam materials is – due to the compositional complexity of spent sulfite liquor – almost impossible. Also an accurate analysis of respective lignosulfonates requires a proper separation from the interfering materials in spent sulfite liquor, which e.g. are sugars or inorganic compounds. For this purpose a new method for isolation and purification of lignosulfonates from spent liquor has been developed in our research group.[1]

Chemical characterization of four types of spent sulfite liquors has been performed in order to determine which liquor is the most suitable for further processing in terms of lignin content, sugar concentration, differences in MW, degree of sulfonation, etc. The characterization of chemical composition and structural features has been done by a combination of spectroscopic, chromatographic and chemical analytical techniques applicable to the spent sulfite liquors and the isolated lignosulfonates, respectively.

The work was performed at the Division of Chemistry of Renewable Resources, Dept. of Chemistry (UFT Tulln, BOKU), as a strategic dissertation within the K-plus WOOD framework supported by Lenzing AG.

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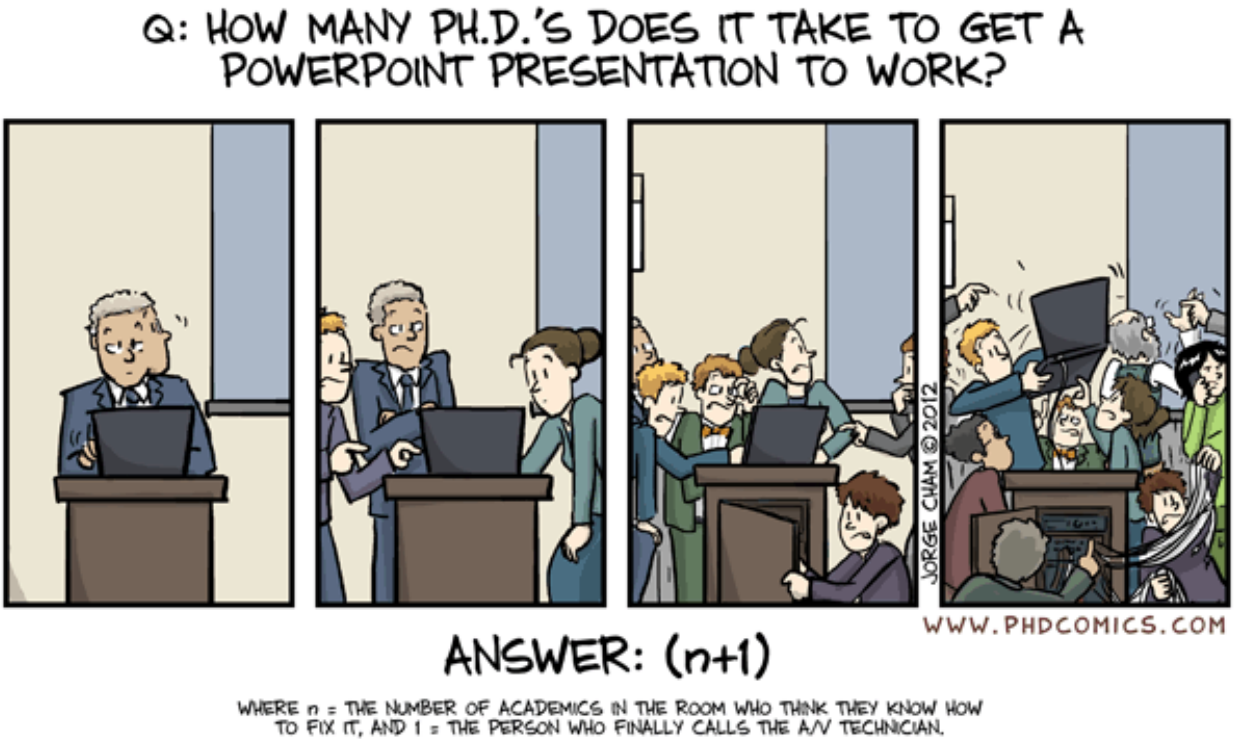
NOTES



Thank you for your participation at 4th DocDay!