Workshop on Carbon Cultivation

Report of Contributions

https://events.hifis.net/e/1795

Contribution ID: **2** Type: **not specified**

Welcome

Monday, October 14, 2024 9:00 AM (30 minutes)

Masafumi Yohda
Katrin Böhning-Gaese
Lorenz Adrian

Presenters: YOHDA, Masafumi; BÖHNING-GAESE, Katrin; ADRIAN, Lorenz

Contribution ID: **3** Type: **not specified**

Session 1: Social Acceptability

Contribution ID: **4** Type: **not specified**

Session 2: Sustainable Carbon Cultivation

Taiichiro OokawaThe development of next-generation rice varieties for carbon cultivation

Sohei RIYABiomass waste recycling and greenhouse gas mitigation

Convener: tba

Taiichiro OOKAWA - The development of next-generation rice varieties for carbon cultivation

Sohei RIYA Biomass waste recycling and greenhouse gas mitigation

María Martín ROLDÀN, Evgenia BLAGODATSKAYA, et al. - Role of root hairs in soil C sequestration in a 5 years maize monoculture

Anja MILTNER - Microbial necromass as a significant source of soil organic matter: origin, pathways and implications for C sequestration

Shinya KAJITA - Reducing lignocellulosic recalcitrance by introduction of chemically labile linkages into the lignin backbone

Yoshiki HORKAWA - Development of cellulose materials from hardwoods maintaining hierarchical structure

Contribution ID: **5** Type: **not specified**

Session 3: Carbon-Based Materials

Convener tba

Ryota KOE - Properties of multilayer paperboard prepared from plant fiber

Bruno BÜHLER - BIOWIN: AI-supported biotechnology for resource-efficient active compound and bio-nylon production

Tomonori SONOKI - Glucose-free platform chemical production by the engineered catabolic pathway of Pseudomonas sp. NGC7

Darja DEOBALD - Methyl transferases as a key enzyme activity in sustainable biotechnology

Eiji MASAI - The catabolic system of lignin-derived aromatic compounds in Sphingobium lignivorans SYK-6 and its application to lignin valorization

Micjel Chávez MOREJÒN, Falk HARNISCH, et al. - Tapping new feedstocks for biological synthesis using electrochemical hydrogenations: production of adipic acid from lignin-derived phenols

Contribution ID: **6** Type: **not specified**

Drinks and Poster Session

Monday, October 14, 2024 5:30 PM (1 hour)

Contribution ID: **7** Type: **not specified**

Session 4: Carbon-Based Fuel Production

Convener tba

Atsushi ARAKAKI - Development of technologies to enhance biomass production of marine microalgae

Haruhiko TERAMOTO - Genetic engineering for establishing biohydrogen production technology

Eika Weihua QIAN - Advance in production technologies of sustainable aviation fuel from bio-oil

Katharina RÖHRING - Kolbe electrolysis: An alternative approach for the economic and efficient production of bio-based aviation fuel from wastes

Jens KRÖMER & Bin LAI - tba

Alberto BEZAMA - tba

Contribution ID: **8** Type: **not specified**

Conclusion on the Workshop

Tuesday, October 15, 2024 11:30 AM (30 minutes)

Contribution ID: **9** Type: **not specified**

Campus Tours

Tuesday, October 15, 2024 1:00 PM (2 hours)

Contribution ID: **10** Type: **not specified**

A New wave of biomass ecosystems and lifestyle changes in Japan

Tuesday, October 15, 2024 11:10 AM (20 minutes)

tba

Presenter: YOSHIKAWA, Narumi

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **11** Type: **not specified**

Challenges of social implementation of biomass utilization

Monday, October 14, 2024 9:30 AM (20 minutes)

tba

Presenter: NAGAI, Yuji

Session Classification: Session 1: Social Acceptability

Contribution ID: **13** Type: **not specified**

Science to Policy: CDR assessments for informing the national long-term strategy on negative emissions in Germany

Monday, October 14, 2024 9:50 AM (20 minutes)

The German Ministry for Economic Affairs and Climate Action (BMWK) tasked the German Energy Agency (dena) to develop a national long-term strategy on negative emissions –the so-called Nationale Langfriststrategie Negativemissionen. It is the goal of the strategy to provide a national framework for guiding the implementation and upscaling of carbon dioxide removal (CDR). Based on UFZ research on the feasibility of CDR options, the German Energy Agency (dena) incorporated the CDR feasibility criteria developed by Förster et al. (2022), which now serve as guidance for determining the feasibility of CDR options in Germany.

This policy impact is a result of a broader activity on CDR at UFZ. As part of the Helmholtz Climate Initiative, the UFZ lead a major research effort across multiple Helmholtz Centres on identifying CDR options that are feasible within Germany. First, a scoping of CDR options with different degrees of readiness for implementation was conducted (Borchers et al. 2022). Second, for assessing the feasibility of these CDR options with a holistic perspective, an assessment framework was developed including six feasibility dimensions: environmental, technological, economic, social, institutional and the systemic contribution to mitigating climate change (Förster et al. 2022). Third, through funding from BMBF in the frame of the BioNET project, a feasibility assessment of 13 CDR options was conducted across the six dimensions and a total of 68 indicators (Borchers, Förster, [⋯] Mengis 2024). This activity involved a process of co-design and high degree of interdisciplinary expertise provided, among others, by scientists of the UFZ Research Unit "Environment & Society"from the Departments on Bioenergy (BEN), Environmental Politics (UPOL), Environmental and Planning Law (UPR), and Economics (OEKON).

From the start, policy relevance was at the centre of the work, which has proven to be highly successful due to the direct integration into the national long-term strategy on negative emissions. In stakeholder consultations organized by the German Energy Agency (dena) with representatives from industry, science and NGOs, the criteria developed by Förster et al. (2022) were confirmed. They now serve as guidance for determining the feasibility of CDR options under the national strategy in Germany.

References:

Borchers, M., Förster, J., Thrän, D., Beck, S., Thoni, T., Korte, K., Gawel, E., Markus, T., Schaller, R., Rhoden, I., Chi, Y., Dahmen, N., Dittmeyer, R., Dolch, T., Dold, C., Herbst, M., Heß, D., Kalhori, A., Koop-Jakobsen, K., Li, Z., Oschlies, A., Reusch, T.B.H., Sachs, T., Schmidt-Hattenberger, C., Stevenson, A., Wu, J., Yeates, C., Mengis, N. (2024): A comprehensive assessment of carbon dioxide removal options for Germany.

Earth Future 12 (5), e2023EF003986 10.1029/2023ef003986

Borchers, M., Thrän, D., Chi, Y., Dahmen, N., Dittmeyer, R., Dolch, T., Dold, C., Förster, J., Herbst, M., Heß, D., Kalhori, A., Koop-Jakobsen, K., Li, Z., Mengis, N., Reusch, T.B., Rhoden, I., Sachs, T., Schmidt-Hattenberger, C., Stevenson, A., Thoni, T., Wu, J., Yeates, C. (2022):

Scoping carbon dioxide removal options for Germany–What is their potential contribution to Net-Zero CO2?

Front. Clim. 4 , art. 810343 10.3389/fclim.2022.810343

Förster, J., Beck, S., Borchers, M., Gawel, E., Korte, K., Markus, T., Mengis, N., Oschlies, A., Schaller,

R., Stevenson, A., Thoni, T. and Thrän, D. (2022) Framework for Assessing the Feasibility of Carbon Dioxide Removal Options Within the National Context of Germany. Front. Clim. 4:758628. doi: 10.3389/fclim.2022.758628

Presenters: FÖRSTER, Johannes; Dr BORCHERS, Malgorzata (Helmholtz Centre for Environmental Research GmbH - UFZ); THRÄN, Daniela

Session Classification: Session 1: Social Acceptability

Contribution ID: **14** Type: **not specified**

Regional assessment of biomass-based carbon dioxide removal and introduction of ”Carbon Cascadia”: A CDR removal game

Monday, October 14, 2024 10:30 AM (20 minutes)

Carbon Dioxide Removal (CDR, also known as Negative Emissions) is positioned by the IPCC as a necessary component for achieving climate goals and is part of Germany's climate strategy. However, methods for removing CO2 are still not well known. The opportunities and risks of CDR are barely discussed, both among stakeholders and the general public.
In our talk, we will build on the research conducted on biomass-based CDR (bioCDR) in the project "BioNET –Multi-level Assessment of Biomass-based Negative Emission Technologies"to introduce a CDR removal game. Previous stakeholder processes and modelling have shown that bioCDR methods have significant CO2 removal potential but also face numerous challenges. Furthermore, our research indicates that no single CDR option can provide the necessary contributions to meet climate targets. Instead, a portfolio of methods is required to balance the weaknesses of individual approaches, maximize synergies, and consider co-benefits for the environment and society, alongside the removal potential (Otto/Matzner 2024).
Given this complex situation, the challenge is to clearly convey knowledge about various CDR methods and provide opportunities for discussion regarding their application and (competitive) relationships to one another. For this task, we designed a serious game called "Carbon Cascadia" . It serves both as a communication tool and as a means of scientific data collection to better understand the complex interplay of different CDR options. The game has already been successfully tested in a simplified pilot version with stakeholders. Currently, we are developing it further as an online video game.

Otto, Danny/Matzner, Nils (2024): Let Us Get Regional: Exploring Prospects for Biomass-Based Carbon Dioxide Removal on the Ground. In: C, Multidisciplinary Digital Publishing Institute, 10 (1), 25.

Presenters: OTTO, Danny; MATZNER, Nils

Session Classification: Session 1: Social Acceptability

Contribution ID: **15** Type: **not specified**

Role of root hairs in soil C sequestration in a 5 years maize monoculture

Monday, October 14, 2024 1:10 PM (20 minutes)

Plant roots modulate functional traits of the rhizosphere microbial community, which process and transform organic matter in soil. To address the question: how root morphology affects the process of carbon storage in soil, two maize genotypes - a wild-type, and mutant deficient in root-hairs, were grown 5 consecutive years in excavated plots filled with two homogenized soil substrates - loam and sand. We observed an essential 19% increase in soil C content under root hair deficient mutant in loamy substrate, which was accompanied by remarkable 41% increase in N content. We are going to discuss the potential of microbial functional traits to indicate the process of C sequestration, marginally affected by the presence of root hairs.

Presenters: ROLDÁN, María Martín; GHADERI, Negar; IBRAHIM, Zeeshan; TARKKA, Mika T.; VETTERLEIN, Doris; BLAGODATSKAYA, Evgenia

Session Classification: Session 2: Sustainable Carbon Cultivation

Contribution ID: **16** Type: **not specified**

BIOWIN: AI-supported biotechnology for resource-efficient active compound and bio-nylon production

Monday, October 14, 2024 3:50 PM (20 minutes)

The project aims to develop innovative and sustainable technologies for the production of the antifibrinolytic agent ε-aminocaproic acid and bio-nylon monomers. The production strategies are based on the same artificial metabolic pathways, which will be optimized to maximize production rates. E. coli, Pseudomonas, and cyanobacterial strains are used or developed as production strains. Reaction technology and process concepts are being developed for these strains, including biofilm-based concepts. In order to accelerate process development, a paradigm shift from empirical to systematic approaches using AI and in-silico modeling will be implemented.

Presenter: BÜHLER, Bruno

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **17** Type: **not specified**

How methyltransferases can contribute to CO2-neutral production of methylated chemicals

Monday, October 14, 2024 4:30 PM (20 minutes)

Methylation reactions are highly versatile in the chemical industry, playing a crucial role in both bioenergy and pharmaceuticals. Traditionally, these reactions in the chemical industry rely on strong bases, metal catalysts, and often toxic methyl group donors such as methyl halides and methyl sulfates, requiring extreme conditions like high temperatures, pressures, and pH levels. However, these chemical methylations are often neither chemo- nor regioselective, which is particularly critical in the synthesis of pharmaceuticals and natural products. Methyltransferases (MTases) offer a sustainable, biological, and environmentally friendly alternative to the conventional chemical reactions. In my group, modular cobalamin (B12)-dependent methyltransfer shuttle systems are investigated, which can be used for various methylation reactions, utilizing simple C1 compounds like methanol, methylamines, or acetyl-CoA –derived from CO2 fixation –as methyl group donors. This modular B12 methylation systems present new opportunities for sustainable methylation processes across various sectors, contributing to a reduced CO2 footprint and supporting the bioeconomy.

Presenter: DEOBALD, Darja

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **18** Type: **not specified**

BISON: a biohybrid solar energy collector

Tuesday, October 15, 2024 10:50 AM (20 minutes)

Biophotovoltaics combines the advantages of light-driven biological water splitting with electrochemical technologies to liberate electrons and drive reductive catalysis. The concept and applications of this approach will be presented and discussed.

Presenters: KRÖMER, Jens; LAI, Bin

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **19** Type: **not specified**

Kolbe electrolysis: An alternative approach for the economic and efficient production of bio-based aviation fuel from wastes

Tuesday, October 15, 2024 9:50 AM (20 minutes)

Presenters: RÖHRING, Katharina; SCHMIDT, Matthias; HELL, Max; MOREJÓN, Micjel C.; ROSA, Luis F. M.; HARNISCH, Falk

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **20** Type: **not specified**

Tapping new feedstocks for biological synthesis using electrochemical hydrogenations: production of adipic acid from lignin-derived phenols

Monday, October 14, 2024 5:10 PM (20 minutes)

A sustainable circular economy requires linking different sectors and scales [1]. The sector of electric power production and storage and the sector of production of chemicals and fuels can be linked in electrobiorefineires [2]. A highly important role for electrosynthesis in electrobiorefinieres play electrochemical hydrogenations and hydrodeoxygenations [3]. Here we showcase an electrobiorefinery converting lignin-derived phenols into adipic acid (AA) that is established using an electrochemical hydrogenation step followed by a microbial cascade reaction [4]. The combined route resulted in a steady production of AA with an overall yield of 57% when an aromatic mixture resembling depolymerized lignin is used as feedstock.
[1] de Vasconcelos B.R., Lavoie J.M.. Recent advances in power-to-X technology for the production of fuels and chemicals. Front. Chem., 2019, 7: 392.
[2] Harnisch, F., Urban, C. (2018): Electrobiorefineries: Unlocking the synergy of electrochemical and microbial conversions Angew. Chem.-Int. Edit. 57 (32), 10016 - 10023 10.1002/anie.201711727.
[3] Harnisch, F., Chávez Morejón, M. (2021): Hydrogen from water is more than a fuel: Hydrogenations and hydrodeoxygenations for a biobased economy. Chem. Rec. 21 (9), 2277 - 2289 10.1002/tcr.202100034.
[4] Chávez Morejón, M., Franz, A., Karande, R., Harnisch, F. (2023): Integrated electrosynthesis and biosynthesis for the production of adipic acid from lignin-derived phenols. Green Chem. 25 (12), 4662 - 4666 10.1039/D3GC01105D.

Presenters: MOREJÓN, Micjel C.; SAEDI, Navid; FRANZ, Alexander; SEIBERT, Lea; KARANDE, Rohan; HARNISCH, Falk

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **21** Type: **not specified**

Microbial necromass as a significant source of soil organic matter: origin, pathways and implications for C sequestration

Monday, October 14, 2024 1:30 PM (20 minutes)

Soil microorganisms utilize plant-derived organic compounds as their C source for growth. From their substrates, they produce biomass. After cell death, the microbial biomass residues contribute to soil organic matter (SOM) formation. We investigated the fate and the C balance of bacterial and fungal biomass residues in soil. 20-40% of the biomass residue-derived C remained in the soil until the end of the incubation experiments. More detailed analyses indicated that bacterial biomass residues were first consumed by fungi and then stabilized in the form of fungal residues. Microbial biomass residues thus are an important direct source of SOM and should be considered when assessing C sequestration in soils.

Presenters: MILTNER, Anja; ZHENG, Tiantian; KINDLER, Reimo; SCHWEIERT, Michael; HOFFMAN-JÄNICHE, Claudia; KÄSTNER, Matthias

Session Classification: Session 2: Sustainable Carbon Cultivation

Contribution ID: **22** Type: **not specified**

The development of next-generation rice varieties for carbon cultivation

Monday, October 14, 2024 10:10 AM (20 minutes)

Rice is widely cultivated in Japan, East and South-East Asia, and fixes enormous amounts of CO2 and produces biomass. Under the SDGs, there is a need to make effective use of unutilized biomass such as rice husk and straw, reduce chemical fertilizers and pesticides, and reduce greenhouse gases such as methane from paddy fields. Of the carbon fixed by rice, about 30% is contained in the rice grain and 70% in the husk, straw and roots. With roots, husk and straw are ploughed into the soil, and used as the main source of methane production. There is a need to increase rice biomass production under reduced chemical fertilizers and pesticides, and to develop the next-generation rice varieties for carbon cultivation with low accumulation of starch and other carbohydrates in the rice straw for repressing methane production from rice residues. However, such varieties have not been developed yet. Japonica rice varieties widely cultivated in Japan have perennial characteristics, and accumulate high amounts of starch and other storage carbohydrates in the stem at harvest, while indica rice varieties derived from the annual-type wild rice (Oryza rufipogon) accumulate little carbohydrates. The characteristics of indica are expected to contribute to the suppression of methane emission from rice straw. In addition, methane is produced under reductive conditions in paddy fields, and methane production can be suppressed by controlling oxidative conditions. The objectives of this research are (1) to develop the next generation rice varieties with high biomass production, lodging resistance, nitrogen use efficiency and methane suppression under reduced chemical fertilizers and pesticides through genome breeding, (2) to utilize bioplastics from non-standard rice grain, husk and straw, and (3) to study the effects of the soil stirring function of the 'Aigamorobo'on weed suppression and methane production.

Presenter: OOKAWA, Taiichiro

Session Classification: Session 1: Social Acceptability

Contribution ID: **23** Type: **not specified**

Reducing lignocellulosic recalcitrance by introduction of chemically labile linkages into the lignin backbone

Monday, October 14, 2024 1:50 PM (20 minutes)

Unlike annual herbaceous plants, which have a single-year generation cycle, perennial woody plants have an excellent ability to stably store carbon dioxide fixed through photosynthesis. In addition, the solid density in woody plants is much higher than that of grass monocots, which grow quickly but have many voids, and the moisture content of aged wood (wood), which is the main solid content, is relatively low. There is a low risk of deterioration due to rot after harvest. These properties of woody biomass are advantageous for long-term storage after harvesting and long-distance transportation, and are properties suitable for use as raw materials for various industries. On the other hand, since wood contains 20 to 30% of its weight in lignin, an aromatic polymer, it is generally more durable and hard in shape than other biomass such as rice straw, and is difficult to handle due to physical and chemical treatments. For efficiently recovery of polysaccharides from wood, which are the main raw materials for the production of liquid fuels through fermentation and for the production of chemical substitutes such as fibers, it is usually necessary to separate polysaccharides and lignin under high temperature and pressure. In order to realize a carbon-negative society, in addition to creating herbaceous and woody plants that grow fast and increasing the production of plant biomass itself, it is also necessary to reduce greenhouse gases emitted during biomass processing. Furthermore, it is possible to improve the efficiency of processing from both the methods used for processing and the raw materials to be processed.
Under the background described above, we are conducting research and development with the aim of contributing to improving the processability of biomass by modifying the molecular structure of lignin contained in wood biomass.

Presenter: KAJITA, Shinya

Session Classification: Session 2: Sustainable Carbon Cultivation

Contribution ID: **24** Type: **not specified**

Development of cellulose materials from hardwoods maintaining hierarchical structure

Monday, October 14, 2024 12:30 PM (20 minutes)

Cellulose is the most abundant organic compound on earth and is an eco-friendly polymer that is naturally synthesized by various organisms, including trees, and completely degraded by fungi. In addition to conventional paper products made from pulp, cellulose nanofibers, have been attracting attention in recent years, and their unpredictable functionality is boosting research and development. Once dispersed, it is so difficult to control the structure of pulp and nanofibers, and it is impossible to orient cellulose fibers. On the other hand, cell walls are formed by piling up sheets of oriented cellulose fibers, and these cells arrange in an orderly manner to form an anatomical structure. This optimized 3-dimensional architecture supports the huge body of the tree and enable a life of more than 1,000 years. In order to utilize the suprastructure to bring out the physical properties of cellulose materials, a top-down approach, rather than a bottom-up approach, would be the shortest distance to solving the problem. Therefore, the target of this study was to establish a preparation technique consisting of a single component while maintaining the hierarchical structure by incorporating a chemical pretreatment technique. Currently, a preparation method for a softwood from Japanese cedar has been established, but hardwoods are still unexplored. Therefore, this year we challenged to optimize the preparation conditions for cellulose materials from hardwoods.

Presenter: HORIKAWA, Yoshiki

Session Classification: Session 2: Sustainable Carbon Cultivation

Contribution ID: **25** Type: **not specified**

Development of technologies to enhance biomass production of marine microalgae

Tuesday, October 15, 2024 9:30 AM (20 minutes)

This research aims to contribute to the establishment of a recycling-oriented society through carbon fixation and biomass utilization with marine microalgae.

Presenter: ARAKAKI, Atsushi

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **26** Type: **not specified**

The catabolic system of lignin-derived aromatic compounds in Sphingobium lignivorans SYK-6 and its application to lignin valorization

Monday, October 14, 2024 4:50 PM (20 minutes)

This research group has investigated cultivation of marine microalgae using large outdoor ponds, and developed basic technologies for biomass production as well as valuable compound production. In addition, the group has obtained several candidate microalgal strains with superior carbon fixation capacity. In this study, we will select candidate strains that are available for biomass production and production of useful substances on a pilot scale. In order to maximize the material production potential of the microalgae, we will establish molecular engineering techniques and attempt to improve the biomass production potential. In addition, we aim to improve biomass productivity by constructing scale-up cultivation systems for each strain, and optimizing culture conditions according to the cultivation site. The goal is to achieve carbon sequestration of 50 t/ha/year or more.

Presenter: MASAI, Eiji

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **27** Type: **not specified**

Properties of multilayer paperboard prepared from plant fiber

Monday, October 14, 2024 3:30 PM (20 minutes)

Marine microalgae are responsible for about 50% of primary production on the earth, and show high CO2 fixation capacity than higher plants on land (approximately 10 times higher in terms of unit area). Furthermore, they can convert atmospheric CO2 into a variety of substances, and are expected to be used as hosts for the production of oil and other valuable resources. Despite the high potential of microalgae, large-scale cultivation has yet to be realized using a wide range of marine areas. In addition, most conventional research has been conducted using model microalgal strains, while studies on the use of practical non-model microalgae have been limited. Furthermore, Japan has diverse environments, and thus there is a need to select microalgal strain that grow predominantly in these environments, and to establish their cultivation technologies.

Presenter: KOSE, Ryota

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **28** Type: **not specified**

Advance in production technologies of sustainable aviation fuel from bio-oil

Tuesday, October 15, 2024 10:10 AM (20 minutes)

It is essential to assess the footprint of greenhouse gases generated during rice cultivation and clarify the benefits and feasibility of the new carbon cultivation technologies developed in this project shown below: (1) the new technologies combining the application of fermentation residue and carbides with water management and (2) the new technologies for creating valuable resources through highly efficient biogas recovery and upcycling.

Presenter: QIAN, Eike Weihua

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **29** Type: **not specified**

Genetic engineering for establishing biohydrogen production technology

Tuesday, October 15, 2024 10:30 AM (20 minutes)

(1) Biohydrogen production
Hydrogen fermentation is divided into light-independent dark fermentation and light-dependent photofermentation. This biological hydrogen production technology offers the advantage of operating at ambient conditions, resulting in minimal environmental impact. Furthermore, it enables the development of a zero-emission process through CO2 recycling, using biomass as the feedstock. Our research group, in collaboration with Sharp Corporation, has achieved a high-speed hydrogen production process utilizing a dark fermentation hydrogen production pathway involving formic acid. The hydrogen production rate achieved by our process is one to two orders of magnitude higher than that of conventional fermentation processes. On the basis on this achievement, we are working on improving hydrogen yield by introducing heterologous hydrogen-producing enzymes (hydrogenases) through genetic engineering. This advancement allows for the construction of novel hydrogenproducing microorganisms capable of producing up to four moles of hydrogen from one mole of glucose. Additionally, we are engaged in technology development aimed at establishing an integrated process with photofermentation, theoretically enabling the production of up to 12 moles of hydrogen. (2) Liquid biofuel production
Our research group has been advancing the development of metabolic engineering technologies using coryneform bacteria, industrially valuable microorganisms with a long history of application in amino acid production. In conjunction with this, we have also developed a proprietary growth-independent bioprocess known as RITE Bioprocess. The combination of these technologies enables the highly efficient utilization of non-edible biomass-derived sugars, establishing a high-yield bioprocess that demonstrates significant advantages in terms of fermentation inhibitor tolerance and simultaneous utilization of mixed sugars. Building upon these foundational technologies, in this project, we are constructing an ethanol production process from a wide range of non-edible biomass feedstocks and obtaining proof-of-concept data to move towards practical applications.

Presenter: TERAMOTO, Haruhiko

Session Classification: Session 4: Carbon-Based Fuel Production

Contribution ID: **30** Type: **not specified**

Glucose-free platform chemical production by the engineered catabolic pathway of Pseudomonas sp. NGC7

Monday, October 14, 2024 4:10 PM (20 minutes)

tba

Presenter: SONOKI, Tomonori

Session Classification: Session 3: Carbon-Based Materials

Contribution ID: **31** Type: **not specified**

Biomass waste recycling and greenhouse gas mitigation

Monday, October 14, 2024 12:50 PM (20 minutes)

tba

Presenter: RIYA, Shohei

Session Classification: Session 2: Sustainable Carbon Cultivation

Contribution ID: **32** Type: **not specified**

A legal framework for Direct Air Capture and Storage: The case of the EU and Germany

Monday, October 14, 2024 10:50 AM (20 minutes)

The IPPC's Sixth Assessment Report highlights the importance of removing CO2 from the atmosphere to meet the Paris climate goals. According to the Panel, carbon dioxide removal (CDR) is "unavoidable", especially due to residual emissions. Direct Air Capture and Storage (DACCS) is one of the most debated and researched CDR methods. It captures CO2 from the ambient air using technical equipment and chemical binders, compresses it and stores it underground. This presentation provides an overview of a legal framework for DACCS. It looks at regulations on the German and EU Level for the capture of CO2 and the transport and storage of the removed CO2. Additionally, it shows which incentives and support are available and takes a look at the question of the integration of DACCS into carbon markets.

Presenter: BAUST, Constanze

Session Classification: Session 1: Social Acceptability