The 8th International Conference on Biorefinery and Biomanufacturing

ICB 2023

PROGRAM BOOK

Athens, Greece
23-27 July 2023

CONTENTS

Welcome Letter

Dear colleagues and friends,

It is our great honor to invite you to the **8th International Conference on Biorefinery and Biomanufacturing (ICB 2023)**, that will be held between **23-27 of July 2023 in Athens, Greece**. The conference is jointly organized by Beijing University of Chemical Technology (BUCT), China, the University of Western Macedonia (UOWM), Greece and University of Patras (UP), Greece. Previous editions were held in Beijing, China (2007), Syracuse, United States (2009), Bruges, Belgium (2011), Xiamen, China (2013), Vancouver, Canada (2015), Christchurch, New Zealand (2017) and Johannesburg, South Africa (2019).

Over the years, ICB has become a traditional meeting place for international researchers, investors, and decision makers to meet and exchange ideas over the latest research and development in the field, to establish new connections and reinforce existing collaborations. As is well understood, the world's growing population and the limited availability of fossil-based resources to satisfy societal needs, demands giant advancements in finding and sustainably using our resources. To deal with these challenges, we need courageous and innovative ideas providing the spark that ignites their development, which requires the fostering of industrial-academic collaborations to turn them into real solutions.

We expect that the conference will attract over 200 participants with diverse interests in the development of biorefineries. We would be excited if you join us in Athens at ICB 2023 so that we can together innovate the conversion of biomass/C1 into value-added products such as biofuels, biochemicals, bioenergy/biopower, and other biomaterials, while at the same time enhancing the quality of life on Earth.

Sincerely yours,

Theodoros Theodoulidis

Theodoros Theodoulidis
Rector of the University of Western Macedonia (UOWM), Greece

Tianwei Tan

Tianwei Tan
President of Beijing University of Chemical Technology
Academician of Chinese Academy of Engineering

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The 8th International Conference on Biorefinery and Biomanufacturing 2023

Athens, Greece, 23-27 July 2023

Themes:
Biomass Conversion, Bio-based Materials and Chemicals
Synthetic Biology and Biotechnology Integrated Systems
Heterogeneous Catalysis and Bio-catalysis
MIXed plastics biodegradation and Upcycling
Bioenergy / Hydrogen

23 July, 2023	9:00-20:00	Registration, Hotel Lobby, Golden Age Hotel	
	20:00-22:30	Welcome Reception, Location: Benaki museum	
24 July, 2023	9:30-12:30	RegistrationHotel Lobby, Golden Age Hotel	
		Opening Ceremony	Plenary Session
	12:30-14:00	Lunch	Poster Session
	14:00-19:00	Session I: Biomass Conversion, Bio-based Materials and Chemicals	Session II: Synthetic Biology and Biotechnology Integrated Systems
	20:00-22:30	Banquet	
25 July, 2023	9:00-12:30	Session III: Heterogeneous Catalysis and Bio-catalysis	Session IV: MIXed plastics biodegradation and UPcycling
		Session V: Bioenergy / Hydrogen	
	12:30-14:00	Lunch	Poster Session
	14:00-18:00	Panel Discussion and Declaration	
		Plenary Session	
		Closing Ceremony	
26 July, 2023	Full day	Visiting	

Opening Ceremony Location: Sirens 2 Monday, July 24, 2023		
Chaired by Prof. Maria Goula and Prof. Vagelis Papadakis		
9:30-9:35	Welcome Speech by Prof. Tianwei Tan, President of the Beijing University of Chemical Technology, China	
9:35-9:40	Welcome Speech by Mr. Georgios Kasapidis, Regional Governor of Western Macedonia, Greece	
9:40-9:45	Welcome Speech by Prof. Theodoros Theodoulidis, Rector of the University of Western Macedonia, Greece	
9:45-9:50	Welcome Speech by Prof. Dionissios Mantzavinos, Vice-Rector Academic & Int'l Affairs, University of Patras, Greece	
9:50-9:55	Welcome Speech by Mr. Junzheng Xiao, Chinese Ambassador to Greece	
Plenary Session Location: Sirens 2		
Chaired by Prof. Tianwei Tan		
10:00-10:30	PL1-Plenary Lecture: Synthetic and systems metabolic engineering of *Corynebacterium glutamicum* for bioprocesses: a focus on nitrogen	Volker F. Wendisch, Bielefeld University, Germany
10:30-11:00	PL2-Plenary Lecture: Valorization of Food Waste	Gerasimos Lyberatos, National Technical University of Athens, Greece
11:00-11:30	Group Photo and Coffee Break	
Chaired by Prof. Dionissios Mantzavinos		
11:30-12:00	PL3-Plenary Lecture: Green Biomanufacturing	Tianwei Tan, Beijing University of Chemical Technology, China
12:00-12:30	PL4-Plenary Lecture: Sustainable Biorefinery for the Energy Transition	Dion Vlachos, University of Delaware, USA
12:30-14:00	Lunch (Location: Golden Age) Poster Session (Location: Erato)	

Session I: Biomass Conversion, Bio-based Materials and Chemicals
Location: Sirens 2
Monday, July 24, 2023

Chaired by Prof. Ruihong Zhang and Prof. Christakis Paraskeva		
14:00-14:20	KA1-Keynote Lecture: Circular Biocompatible, Biodegradable and Biobased Plastics	Shijie Liu, State University of New York, USA
14:20-14:40	KA2-Keynote Lecture: "Green" H_2 to Decarbonize Energy and Chemicals' Systems	Jan Baeyens, KU Leuven, Belgium; Beijing University of Chemical Technology, China
14:40-15:00	KA3-Keynote Lecture: Integrated Extraction and Anaerobic Digestion Process for Recovery of Nutraceuticals and Biogas Production from Pomegranate Marcs	Zhongli Pan, University of California, Davis, USA
15:00-15:20	KA4-Keynote Lecture: The Role of Biochars in Environmental Remediation: From Adsorption to Catalysis	Zacharias Frontistis, University of Western Macedonia, Greece
15:20-15:40	KA5-Keynote Lecture: Technologies and Policies of Biomass Heating in China	Guangqing Liu, Beijing University of Chemical Technology, China
15:40-15:55	IA1-Invited Lecture: Combining solid acid catalysis and oxidative organosolv pretreatment to fractionate agricultural residues	Stylianos Stefanidis, Centre for Research and Technology Hellas, Greece
15:55-16:05	OA1-Oral Lecture: Accelerate large-scale biomass residue utilization via co-firing to help China achieve its 2030 carbon-peaking goals	Huimin Yun, Beijing University of Chemical Technology, China
16:05-16:15	OA2-Oral Lecture: Exploitation of agricultural residues in the context of circular economy – technoeconomic and environmental assessment	Vasiliki P. Aravani, University of Patras, Greece
16:15-16:25	Coffee Break	
Chaired by Prof. Shijie Liu and Prof. Jan Baeyens		
16:25-16:45	KA6-Keynote Lecture: Transforming Dairy Byproducts and Food Waste into Bioplastics to Address Plastic Pollution	Ruihong Zhang, University of California, Davis, USA
16:45-17:05	KA7-Keynote Lecture: Biomass conversion based on micro-scale effect	Kai Guo, Nanjing Tech University, China

17:05-17:25	KA8-Keynote Lecture: Valorization of agroindustrial wastewaters and recovery of compounds with high added value	Christakis Paraskeva, University of Patras, Greece
17:25-17:40	IA2-Invited Lecture: Oxidative organosolv pretreatment of biomass for bioferinery products production	Konstantinos Kalogiannis, University of Western Macedonia, Greece
17:40-17:55	IA3-Invited Lecture: Design and manufacturing of bio-based functional materials	Ning Zhu, Nanjing Tech University, China
17:55-18:10	IA4-Invited Lecture: Bio-based polymer (nano)composite materials for application X: A paradigm towards the integrated bio-refinery	Ioannis Zuburtikudis, Abu Dhabi University, UAE
18:10-18:25	IA5-Invited Lecture: Catalyst-microbiome hybrids enable highly selective chain elongation of syngas into n-caproic acid	Wen Wang, Beijing University of Chemical Technology, China
18:25-18:35	OA3-Oral Lecture: Removal of turbidity in low-alcohol Chinese Baijiu by coalescence membrane separation	Dan Hu, Beijing Technology and Business University, China
18:35-18:45	OA4-Oral Lecture: Catering wastes to bio-crude oil via hydrothermal liquefaction	Dimitris Liakos, Centre for Research and Technology Hellas (CERTH), Greece
18:45-18:55	OA5-Oral Lecture: Red-to-blue colorimetric probe based on biomass carbon dots for smartphone-integrated optosensing of tryptamine	Huilin Liu, Beijing Technology and Business University, China
18:55-19:05	OA6-Oral Lecture: Thermophilic Cyanobacteria: Photosynthetic Cell Factories for Power Industry Waste Valorization	Maurycy Daroch, Peking University Shenzhen Graduate School, China
20:00-23:30	Banquet, Strofi restaurant (buses will depart at 19:30 from Golden Age for the restaurant)	

Session II: Synthetic Biology and Biotechnology Integrated Systems
Location： Sapfo
Monday, July 24, 2023

Chaired by Prof. Zacharias Frontistis and Prof. Pascal Fongarland		
14:00-14:20	KB1-Keynote Lecture: Microbes as a tool for the Green Transition	Irini Angelidaki, Technical University of Denmark, Denmark
14:20-14:40	KB2-Keynote Lecture: DNA Data Storage	Xingyu Jiang, Southern University of Science and Technology, China
14:40-15:00	KB3-Keynote Lecture: Advancing biochemicals production via systems metabolic engineering	Yun Chen, Chalmers University of Technology, Sweden
15:00-15:15	IB1-Invited Lecture: DLC lignocellulosic sugar platform for biofuels and biochemicals production	Mingjie Jin, Nanjing University of Science and Technology, China
15:15-15:30	IB2-Invited Lecture: Engineering *Saccharomyces cerevisiae* for synthesis and accumulation of aldehydes	Jifeng Yuan, Xiamen University, China
15:40-15:50	OB1-Oral Lecture: Poly-hydroxybutyrate (PHB) production by *Chlorogloeopsis fritschii* grown in diluted digestate	Savvas Giannis Mastropetros, University of Patras, Greece
15:50-16:00	OB2-Oral Lecture: Construction and mechanism of "Ammonia recovery-Microbial protein production" based on bioelectrochemical system	Ziyi Yang, Beijing University of Chemical Technology, China
16:00-16:10	OB3-Oral Lecture: Predictable and efficient gene expression via genetic tools with gradient strength in Bacillus species	Qin Wang, Hubei University, China
16:10-16:20	OB4-Oral Lecture: De novo biosynthesis of 1,3-butanediol via multi-strategy metabolic engineering in *Escherichia coli*	Yang Zhang, Beijing University of Chemical Technology, China
16:20-16:30	Coffee Break	

Chaired by Prof. Jinping Li and Prof. Irini Angelidaki		
16:30-16:50	KB4-Keynote Lecture: Immobilization of Lipase on PDA-Modified Magnetic Microparticles with Different Length PEI	Zisheng Zhang, University of Ottawa, Canada
16:50-17:10	KB5-Keynote Lecture: The Strategies for the Construction of High Efficient Cell Factory in Synthetic Biology	Qipeng Yuan, Beijing University of Chemical Technology, China
17:10-17:30	KB6-Keynote Lecture: Using genome-centric metagenomics and metabolic flux balance analysis to investigate biogas upgrading and CO2 methanation	Stefano Campanaro, University of Padua, Italy
17:30-17:45	IB3-Invited Lecture: A carbon-neutralizing bioroute for sustainable aviation fuel production from greenhouse gases	Qiang Fei, Xi'an Jiaotong University, China
17:45-18:00	IB4-Invited Lecture: Genetic tools development in novel Methylotrophs	Ying Zhang, The University of Nottingham, United Kingdom
18:00-18:15	IB5-Invited Lecture: Advances in synbiology study of hyaluronan	Xueping Guo, Bloomage Biotechnology, Shandong University
18:15-18:25	OB6-Oral Lecture: Biosynthesis and application of Selenium compounds in Bacillus subtilis	Fenghuan Wang, Beijing Technology and Business University, China
18:25-18:35	OB7-Oral Lecture: Valorization of Food Waste through Anaerobic Digestion	Hamed M. El Mashad, UC Davis, USA
18:35-18:45	OB8-Oral Lecture: International Situation Analysis of C1 Compound Bioconversion Technology	Xiaoyan Wu, Chengdu Library and Information Center, Chinese Academy of Sciences, China
18:45-18:55	OB9-Oral Lecture: Enhancing energy metabolism of central carbon metabolic flow of engineering pichia pastoris to promote protein high-yield	Hao Shi, Beijing University of Chemical Technology, China
20:00-23:30	Banquet, Strofi restaurant (buses will depart at 19:30 from Golden Age for the restaurant)	

Session III: Heterogeneous Catalysis and Bio-catalysis Location：Sirens 2 Tuesday, July 25, 2023		
Chaired by Prof. Kyriaki Polychronopoulou and Prof. Zisheng Zhang		
9:00-9:20	KC1-Keynote Lecture: Hydrogen production and utilization through thermocatalytic processes	Maria Goula, University of Western Macedonia, Greece
9:20-9:40	KC2-Keynote Lecture: A Biotechnology-Powered Net-Zero Future	Guifang Wu, Novozymes (China) Investment Co. Ltd
9:40-10:00	KC3-Keynote Lecture: Catalytic pyrolysis of bio-plastics into carbon nanotubes and hydrogen and downstream methanol to olefin	Runduo Zhang, Beijing University of Chemical Technology, China
10:00-10:15	IC1-Invited Lecture: Heterogeneous Catalysis Mediated Cofactor Regeneration for Biomanufacturing	Xiaodong Wang, Lancaster University, United Kingdom
10:15-10:30	IC2-Invited Lecture: Boosted Activity by Engineering the Enzyme Microenvironment	Yongqin Lv, Beijing University of Chemical Technology, China
10:30-10:40	OC1-Oral Lecture: A Microbial Cell Factory for New-to-Nature Biosynthesis of Cycloalkenes Harbors an Artificial Metathase	Zhi Zou, University of Basel, Switzerland
10:40-10:50	OC2-Oral Lecture: Optimizing Food Waste Composting Process with Recurrent Neural Network Control Strategy: A Feasibility Study	Jufei Wang, Nanjing Agricultural University, China
10:50-11:00	Coffee Break	
Chaired by Prof. Maria Goula and Prof. Kai Guo		
11:00-11:20	KC4-Keynote Lecture: The Art of Designing Multifunctional Catalysts for Added-Valued Products	Kyriaki Polychronopoulou, Khalifa University, UAE
11:20-11:40	KC5-Keynote Lecture: Renewable of Fischer-Tropsch synthesis using iron-based catalyst: effect of syngas composition from power-to-X technology to post-biomass gasification	Pascal Fongarland, ESCPE Lyon, France
11:40-11:55	IC3-Invited Lecture: Effect of reaction conditions and pretreatment protocol on CO_2 hydrogenation to light olefins over Layered Double Hydroxide catalysts	Georgios Marnellos, University of Western Macedonia, Greece

11:55-12:10	IC4-Invited Lecture: Rational strain and enzyme engineering for biochemicals green manufacturing	Bo Yu, Institute of Microbiology, Chinese Academy of Sciences, China
12:10-12:20	OC3-Oral Lecture: Bimetallic Ni-Ru exsolved $LaNi_{0.9}Ru_{0.1}O_3$ perovskites and their catalytic performance for CO_2 methanation	Ayesha AlKhoori, Khalifa University, UAE
12:20-12:30	OC4-Oral Lecture: Crystalline porous frameworks for efficient CO_2 separation	Ziman Chen, Beijing University of Chemical Technology, China
12:30-12:40	OC5-Oral Lecture: Adsorption of emitted CO_2 using Al_2O_3-supported alkaline sorbents	Anastasios Tsiotsias, University of Western Macedonia, Greece
12:30-14:00	Lunch (Location: Golden Age) Poster Session (Location: Erato)	

Session IV: MIXed plastics biodegradation and UPcycling Location: Sapfo Tuesday, July 25, 2023		
Chaired by Prof. Konstantinos Kalogiannis and Prof. Yun Chen		
9:00-9:20	KD1-Keynote Lecture: Microbial and enzymatic degradation of plastic wastes and its UPcycling	Min Jiang, Nanjing Tech University, China
9:20-9:35	ID1-Invited Lecture: Design of new-to-nature PET hydrolases using deep learning	Yifei Zhang, Beijing University of Chemical Technology, China
9:35-9:50	ID2-Invited Lecture: Quantum mechanics study on Plastics degradation mechanism	Luo Liu, Beijing University of Chemical Technology, China
9:50-10:05	ID3-Invited Lecture: Enzymatic Depolymerization of PU Plastics for Recycling	Weiliang Dong, Nanjing Tech University, China
10:05-10:15	OD1-Oral Lecture: Upcycling of plastic using engineered enzymes and microbes	Till Tiso, RWTH Aachen University, Germany
10:15-10:25	OD2-Oral Lecture: Enzymatic Plastic Transformation for a Sustainable Green Transition	Ren Wei, University of Greifswald, Germany
10:25-10:35	OD3-Oral Lecture: Plastic waste biotransformation: A route to a circular economy	Georgios Taxeidis, National Technical University of Athens, Greece
10:35-11:00	Coffee Break	
Session V: Bioenergy / Hydrogen Location: Sapfo Tuesday, July 25, 2023		
Chaired by Prof. Savvas Douvartzidis and Prof. Xinshu Zhuang		
11:00-11:15	IE1-Invited Lecture: Organosolv pretreatment of lignocellulose on fractionation and enzymatic enhancement	Xinshu Zhuang, GIEC, China
11:15-11:30	IE2-Invited Lecture: Solid Oxide Fuel Cell plant fueled by pyrolytic gases	Savvas Douvartzidis, University of Western Macedonia, Greece
11:30-11:40	OE1-Oral Lecture: Biodiesel from a Mucor circinelloides biomass based integrated biorefinery	Johnson Zininga, Durban University of Technology, South Africa

11:40-11:50	OE2-Oral Lecture: Effects of different microbial pretreatments on the anaerobic digestion of lignocellulosic biomass under anaerobic and microaerobic conditions	Ligong Wang, Beijing University of Chemical Technology, China
11:50-12:00	OE3-Oral Lecture: Graphene-based catalysts for CO_2 valorisation	Mira Omar, Khalifa University, Greece
12:00-12:10	OE4-Oral Lecture: Density Functional Theory Investigation of MXenes as Electrocatalysts for Hydrogen Evolution Reaction	Louai Mahdi Maghrabi, Khalifa University, Greece
12:10-12:20	OE5-Oral Lecture: Compositional components and methane production potential of Field Residues of Fruits and Vegetables	Fanfan Cai, Beijing University of Chemical Technology, China
12:20-12:30	OE6-Oral Lecture: Effect of Fe-loading in iron-based catalysts for the CH4 decomposition to H2 and nanocarbons	Miao Yang, Beijing University of Chemical Technology, China
12:40-14:00	Lunch (Location: Golden Age) Poster Session (Location: Erato)	

Panel Discussion Session and Closing Ceremony
Location: Sirens 2
Tuesday, July 25, 2023

Chaired by Prof. Tianwei Tan		
14:00-15:30	**Panel Discussion on Future Collaboration** **Confirmed participants (Open for others interested):** • Mr. Georgios Kasapidis, Regional Governor of Western Macedonia, Greece • Prof. Theodoros Theodoulidis, Rector of the University of Western Macedonia, Greece • Prof. Dionissios Mantzavinos, Vice-Rector Academic & Int'l Affairs, University of Patras, Greece • Prof. Kyriaki Polychronopouilou, Director Center for Catalysis and Separations, Khalifa University of Science and Technology, UAE • Prof. Dion Vlachos, University of Delaware, USA • Prof. Shijie Liu, State University of New York, USA • Prof. Jan Baeyens, KU Leuven, Belgium • Prof. Ruihong Zhang, University of California, Davis, USA • Prof. Zisheng Zhang, University of Ottawa, Canada • Prof. Pascal Fongarland, ESCPE Lyon, France • Prof. Kai Guo, Nanjing Tech University, China • Prof. Irini Angelidaki, Technical University of Denmark, Denmark • Prof. Stefano Campanaro, University of Padua, Italy	
15:30-16:00	Declaration of Promoting a Global Alliance for Biorefinery and Biomanufacturing	
16:00-16:15	Coffee Break	
Plenary Session and Closing Ceremony **Location: Sirens 2**		
Chaired by Prof. Maria Goula and Prof. Vagelis Papadakis		
16:15-16:45	PL5-Plenary Lecture: Systems Metabolic Engineering of Microorganisms	Sang Yup Lee, KAIST, Republic of Korea
16:45-17:15	PL6-Plenary Lecture: From Biorefinery to Synthetic Biology and Integrated Bioengineering for Biomanufacturing	Anping Zeng, Westlake University, China
17:15-17:45	Closing Ceremony, Best Poster Award	

Wednesday, July 26, 2023
Visiting

Plenary Lectures

Volker F. Wendisch

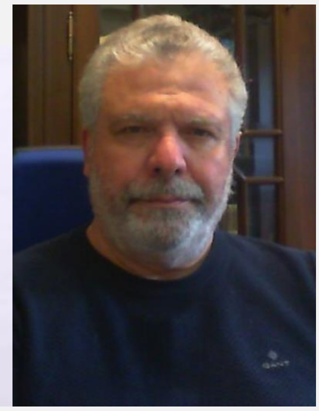
Genetics of Prokaryotes, Biology & CeBiTec, Bielefeld University, 33615 Bielefeld. Germany

Prof. Dr. Volker F. Wendisch holds the Chair of Genetics of Prokaryotes at the Faculty of Biology at Bielefeld University, Germany. He serves as deputy scientific director of its Center for Biotechnology CeBiTec and is member of the board of CLIB-Cluster, an international open innovation cluster of stakeholders active in biotechnology and bioeconomy from academic institutes and universities, investors, SMEs, and industry based in Düsseldorf, Germany.
Volker F. Wendisch received his diploma in biology from Cologne University, Germany, and completed his PhD at the Research Center Jülich in 1997. After a postdoc at the University of California, Berkeley, CA, USA, he was Professor for Metabolic Engineering at Münster University.

Synthetic and systems metabolic engineering of *Corynebacterium glutamicum* for bioprocesses:a focus on nitrogen

Industrial bioprocesses require strain development to meet the demand for high product titers, yields and productivities and the sustainability goal to replace the use of finite substrates by renewables without competing uses in food and feed applications [1]. Since more than 60 years, Corynebacterium glutamicum is an established host for the production of amino acids in the million-ton-scale and a flexible feedstock concept has been established to base production on sidestreams from agri- and aqua-culture [2]. Amino acid and amine overproducing C. glutamicum strains can thus be used to bridge the nitrogen gap [3], i.e., the underutilization of nitrogen in biorefineries that target mostly biofuels and carboxylic acids only (Fig. 1).
I will present strain development to enable production of amines functionalized by halogenation or N-alkylation since these molecules are sought after in pharma and agrochemical applications [2, 4]. For example, about 20% of all pharmaceutical small molecule drugs and around 30% of all active compounds in agrochemistry are halogenated. N-functionalized amines occur, for example, in the antibiotic vancomycin, the immunosuppressant cyclosporine, the cytostatic actinomycin, and they are used as building blocks in peptide drugs to stabilize them against proteolysis and to increase their membrane permeability. Moreover, I will present the use of sidestreams from agri- and aqua-culture as substrates for C. glutamicum bioprocesses [3].

Reviews: [1] Wendisch, 2020, Metab Eng 58: 17-34; [2] Mindt et al., 2020, Biotechnol J 15: e1900451; [3] Wendisch et al., 2022, Front Microbiol 13: 835131; [4] Irla & Wendisch, 2022, Microb Biotechnol 15:2145-2159.



Gerasimos Lyberatos

National Technical University of Athens, Greece

Dr.Gerasimos Lyberatos is full professor in the School of Chemical Engineering, National Technical University of Athens and a collaborating faculty member of the Institute of Chemical Engineering Sciences (FORTH/ICEHT). His research interests are in Biochemical Engineering and Environmental Technologies for liquid and solid waste treatment and valorization. He has over 240 publications in International refereed Journals, and over 400 participations in International Conferences, 9 Chapters in books and two books. He has supervised 45 PhD theses. He has organized three International Conferences. Prof. Lyberatos has been Editor for the Journal of Hazardous Materials (Elsevier), and Associate Editor of Waste and Biomass Valorization (Springer). He is also the Founder of the Hellenic Water Association, the Greek governing member of IWA.

Valorization of Food Waste

Food waste represents one of the most challenging environmental problems in our times. While its disposal to landfills is responsible for the emissions of potent green house gases, such as methane, to the atmosphere, if separately collected, it may be exploited to produce compost, biofuels and other added value products. Source separated and collected Household Food Waste may be directly led to anaerobic digestion or composting facilities for the production of biogas and/or compost. An interesting possibility is to dry and shred the food waste collected at the municipality level, generating a homogeneous, dry, biomass, called FORBI (Food Residue Biomass) that emits no bad odors, may be stored for prolonged periods of time without deterioration and used as a potential feedstock for alternative processes, such as the production of biogas (biomethane, biohydrogen and/or hythane, compost, alternative fuel for the cement industry, pellets for heating, activated carbon for water purification, animal feed etc. These possibilities are discussed in the light of the experiences gained from two relevant research programs in two Municipalities, Halandri and Andros.

Tianwei Tan

Beijing University of Chemical Technology, China
Member of Chinese Academy of Engineering
Chairman of Chinese Renewable Energy Association, China

Tianwei Tan is a full professor and the President of Beijing University of Chemical Technology (BUCT). Prof. Tan also serves as the Chairman of Chinese Renewable Energy Society and Vice President for the Chemical Industry and Engineering Society of China (CIESC). In 2011, he was elected to Chinese Academy of Engineering as an academician. He has authored or co-authored over 300 peer-reviewed articles in prestigious journals including PNAS, ACS catalysis, Biotechnology Advances, Green Chemistry and Chemical Communication, and co-edited 6 books. In addition, he was licensed about 60 patents.

Green Biomanufacturing

The production of biobased fuels and chemicals are fundamental to overcome the problems caused by global warming and climate changes. The sustainable production of fuels and chemicals based on biorefinery concept are on the top agenda of industry and the related researches. In recent years, our group come up with several biorefinery processes aiming to make biochemicals economically viable. We cooperated with COFCO for the fermentative production of ethanol from cassava. Based on the simulation result, an energy-saving ethanol production route was developed and took into practice. A plant with capacity of 200 kt/yr food/fuel ethanol from cassava was developed. In this process, the steam cost and recycle water cost were decreased by 30% and 10%, respectively. We also came up with novel biorefinery process for the conversion of sweet sorghum stalk. In 1 kt/yr pilot scale investigation, bioethanol, butanol and wood-plastic composite can be obtained simultaneously using the sugar contain juice, the cellulosic fibers and the bagasse after saccharification, respectively, and there were no waste solid remaining. In order to overcome the bottleneck of high energy cost in the downstream process of butanol fermentation. Novel pervaporation membrane was prepared based on solvent free method, after bridging the fermentation and distillation unit, the overall energy cost of ABE production can be reduced by 70%. To further improve the economic competitiveness of the second-generation biorefinery process, biological and chemical catalysis processes was integrated. After in situ separation ethanol and butanol from fermentation broth, the condensate with high water content was successfully converted into different types of valuable chemicals, such as bio-plasticizer, BDO and jet fuel. Our group also developed several processes for the conversion of natural lipids into fuels and chemicals. Novel lipase fermentation process was established. The activity of the lipase in the liquor phase reached 16000 U/mL. Based on full-cells catalysis and alternative bioreactor, solvent free esterification process was established. Aliphatic ester, bio-plasticizer, polyol ester and phytosterol ester have already industrialization. We also use waste oil for the production of biodiesel by lipase catalysis. A plant with capacity of 30 kt/yr was took into practice. The biodiesel production can be further converted into bio-jet fuels by hydrogenation using bifunctional catalysts. Glycerol, the by-product of biodiesel, was effectively converted into 1,3-PDO using genetic modified *Klebsiella* sp. A brief description of the main research programs of our group for biological fuels and chemicals production will be presented.

Dionisios G. Vlachos

Unidel Dan Rich Chair in Energy Professor of Chemical & Biomolecular Engineering

Director, Catalysis Center for Energy Innovation (CCEI)

Director, Delaware Energy Institute (DEI), USA

Dionisios (Dion) G. Vlachos is the Unidel Dan Rich Chair in Energy Professor of Chemical & Biomolecular Engineering, a Professor of Physics and Astronomy at the University of Delaware, the Director of the University of Delaware Energy Institute (UDEI), of the UD node of the manufacturing institute RAPID, and the Catalysis Center for Energy Innovation (CCEI), an Energy Frontier Research Center (EFRC). He is the ExxonMobil Visiting Chair Professor, National University of Singapore, Singapore, 2018-2021.

Sustainable Biorefinery for the Energy Transition

The increased greenhouse gas emissions and waste streams threaten the environment and humanity. The chemical industry is a major contributor to carbon release in gas or solid form. Decarbonization from the air and the environment are essential to protect future generations. Lignocellulosic biomass and related waste streams can provide renewable carbon and minimize methane emissions. Over the past two decades, there has been tremendous progress in converting lignocellulosic biomass. The initial focus has been on replacement molecules, introducing new catalysts, understanding reaction mechanisms and solvent effects, and improving catalyst selectivity. The production of value-added molecules and products from biomass is imperative to compensate for the higher cost of raw materials. Waste streams, such as food waste, provide additional possibilities for making new molecules. We present an overview of our recent work on (1) making new molecules for key applications, such as lubricants, neoacids, and insecticides, (2) extracting molecules from waste streams, and their chemical recycling and upcycling, (3) improved pathways to detergents, and (4) hybrid renewable and recyclable materials. The talk will also address how to make the manufacturing of biomass processing sustainable and how to scale up the processes to enable future biorefineries.

Sang Yup Lee

Korea Advanced Institute of Science and Technology, Korea
Senior Vice President for Research, KAIST, Korea
President, Korean Society for Biotechnology and Bioengineering

Sang Yup Lee has pioneered systems metabolic engineering, and has published more than 730 journal papers and holds >800 patents. He is elected member or fellow of Korean Academy of Science and Technology, National Academy of Engineering Korea, American Academy of Microbiology, American Institute of Medical and Biological Engineering, World Academy of Sciences, and National Academy of Inventors USA. He is also an International Member of both National Academy of Sciences USA and National Academy of Engineering USA, and a Foreign Member of Royal Society UK. He received numerous awards and prizes.

Systems Metabolic Engineering of Microorganisms

Systems metabolic engineering integrates traditional metabolic engineering with systems biology, synthetic biology and evolutionary engineering for more efficient development of microbial cell factories. In this lecture, I will describe the tools and strategies for developing microbial cell factories by systems metabolic engineering. Various example products including bulk chemicals, fine chemicals, fuels, polymers, and natural products will be showcased. Also, emerging tools and strategies including artificial intelligence will be discussed together with future prospects.

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Anping Zeng

Center of Synthetic Biology and Integrated Bioengineering, Westlake University, China

Formerly, Hamburg University of Technology, Institute of Bioprocess and Biosystems Engineering, Germany

Anping Zeng is a Chair Professor for Synthetic Biology and Bioengineering at Westlake University and Director of the Westlake Center of Synthetic Biology and Integrated Bioengineering. From 2006 - 2022 he was Chair Professor and Director of the Institute of Bioprocess and Biosystems Engineering at the Hamburg University of Technology in Germany. He got a PhD degree (1990) in Biochemical Engineering from Technical University of Braunschweig and worked in Germany, Australia, USA and China, among others as group leader in the former German Research Center for Biotechnology (GBF, now Helmholtz Center for Infection Research). He is member of the German National Academy of Science and Engineering (acatech).
His research covers a wide range of topics in biochemical and bioprocess engineering, systems and synthetic biology and focuses now on (1) C1-Cx Synthetic Biology for the use of CO2 and other C1-feedstocks (Green Biomanufacturing) and (2) Soft-Matter Synthetic Biology for biopharmaceutical and biomedical engineering. He has published 320+ papers, edited 5 books and filed about 30 patents. He is Editor-in-Chief of “Engineering in Life Sciences” and “Synthetic Biology and Engineering”.
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From Biorefinery to Synthetic Biology and Integrated Bioengineering for Biomanufacturing

Biomanufacturing is gaining great importance and worldwide attention in view of the grand challenges our world is facing such as resource shortage, climate change and aging populations. In the last decades biorefinery and more recently synthetic biology have been proposed and explored to push biomanufacturing forward. Despite the great potential of these approaches biomanufacturing has progressed much behind the promises. In this presentation I will first briefly reflect on some of our experience and lessons gained from several national and international collaborative projects of biorefinery for biomass utilization. The promises of scientific advances (e.g. synthetic biology) and new bioproduction systems (e.g. electricity-driven biosynthesis) in tackling some of the bottlenecks and challenges in this regard will then be discussed. With examples of biosynthesis of diols and organic acids I would especially emphasize the importance of downstream processing and the concept “process by product design” in integrated development of industrial bioprocesses. Finally, our recent efforts in using C1 carbons (CO2，formic acid and methanol) for biomanufacturing of commodity chemicals will be highlighted.

Keywords: Synthetic biology; biofuels; fatty acids; chemicals

Keynote Lectures

Shijie Liu

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Prof. Dr. Shijie Liu is a Fellow of AIChE. He serves as the Director of Bioprocess Engineering Collaborations at the Department of Chemical Engineering at SUNY ESF, Editor-In-Chief of the Journal of Biobased Materials and Bioenergy.
Shijie Liu received his PhD in Chemical Engineering from the University of Alberta and BS in Chemical Engineering from Chengdu University of Science and Technology (now Sichuan University), China.

Circular Biocompatible, Biodegradable and Biobased Plastics

Woody biomass has become an attractive source of renewable energy, chemicals and materials. Woody biomass is a complex material that is composed of multiple sugar carbohydrates besides nearly 40% of other chemicals. The mixed sugars present a challenge to bioconversion. While hot-water extraction of woodchips can be a beneficial technique to pretreat woody biomass for more efficient conversion to glucose, the extraction liquor can also be employed to produce chemicals and materials that glucose normally do. Hot water wood extract hydrolysate contains a mixture of sugars: xylose, glucose, galactose, mannose, arabinose and rhamnose. For example, lactic acid (LA), 3-hydroxybutyric acid, and PHA can be fermented from the mixed sugar. PHA is a biodegradable and biocompatible polymer that has many applications. Extracellular production of the hydroxyl acids is advantageous as compared with direct fermentation to PHA, in that the conversion efficiency is improved and the product properties can be tailored for different needs via controlling the polymerization of the 3-hydroxybutyric acids. The used PHA can be hydrolyzed by acid, base, or enzyme to hydroxyacid. The whole process renders the biodegradable and biocompatible polymer to be recyclable, or circular.

Jan Baeyens

KU Leuven, Belgium

Beijing University of Chemical Technology, China

Prof. Jan Baeyens studied Nuclear Engineering (Brussels) and Chemical Engineering (Leuven). He obtained his Ph.D. at the University of Bradford-U.K. After 13 years of employment in engineering divisions of various Belgian companies, he became a part-time professor at the University of Leuven (B) and worked as a process and project consultant in Europe and overseas. In 2003. He started the Faculty of Bio-engineering at the University of Antwerp. In 2005, he moved to the University of Birmingham (U.K.) and the University of Warwick (U.K.), where he lectured on process design, sustainable development, renewable energy and powder technology, while also co-ordinating research in these fields. He has contributed to over 260 publications in international journals, is author/editor of 12 books, and is a regular speaker at international congresses. His h-factor is 60, and citations exceed 20,000. Since 2010, he is Visiting Professor at the Beijing University of Chemical Technology.

“Green”H2 to Decarbonize Energy and Chemicals’Systems

Air jet milling (AJM) by spiral jet mills is widely applied in the pharmaceutical catalyst and ceramic industry for the production of ultrafine powders in the µm-size range, with small-scale equipment used in R&D, and large-scale AJM commonly used in the production itself. Ultrafine particles are indeed offering high catalytic activity, are effective ad/absorbents and can be used to modify the viscosity and heat capacity of bio-fuels. The performance of an air jet mill is determined to a large extent by a limited number of parameters, including the diameter of the milling chamber (D), the geometry and number (n) of the grinding nozzles, the grinding gas mass flow rate (G) and the solid feed mass flow rate (F). The present paper assesses the performance of a small-scale (D = 0.1 m) and a large-scale (D = 0.4 m) spiral jet mill towards their milling efficiency and the effects of both solid feed and grinding gas kinetic energy. Lactose of known and constant properties was used as a model compound. Air jet milling experiments have been performed in both mills at combined settings of both G and F. The particle size distribution (PSD) and the derived specific surface area (*SSA*) of the milled product have been determined by wet dispersion laser diffraction (*LD*). The milling efficiency (*ME*), defined as the ratio of the newly created surface area to the applied solid feed kinetic energy, was used as primary parameter, and expressed in terms of the operational variables. The ME of both mills is a linear function, expressed as $ME = a/E_{gas} + b$, with E_{gas} being the kinetic energy of the grinding gas after sonic expansion into the milling chamber, and a and b being system-dependent empirical constants. The change in specific surface area (ΔSSA) of milled lactose can be expressed in terms of the normalized kinetic energy of the feed material ($NE_{\mathrm{feed}} = E_{\mathrm{feed}}/F$) and ME. Here, E_{feed} is the kinetic energy of the solid feed with mass flow rate F. The research further demonstrates that different air jet mills, used to meet pre-specified identical size distributions (and associated specific surface area) of the milled product, can be scaled-up provided $E_{\mathrm{feed}}/F \times ME$ equals the required ΔSSA.

Zhongli Pan

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Dr. Zhongli Pan is an Adjunct Professor in the Department of Biological and Agricultural Engineering, University of California, Davis, CEO and Founder of AIVision FoodHe has led many international cooperation activities and research projects through his academic and research career. He is an internationally recognized leader and outstanding food engineer and scholar in the field of food and agricultural product processing engineering with more than 30 years of distinguished service in government, academia, and industry. He has made significant contribution in the research and development of new food and agricultural processing and postharvest technologies for sustainably producing nutritious, healthy and safe foods. He authored more than 400 scientific publications and 3 books. Dr. Pan received multiple prestigious awards, including International Food Engineering Award – ASABE, Presidential Early Career Award for Scientists and Engineers, Award for Outstanding Commercialization Success - Federal Laboratory Consortium (Far West), Technology Transfer Award – Pacific West Area, USDA-ARS, and IFT Research and Development Award.

Integrated Extraction and Anaerobic Digestion Process for Recovery of Nutraceuticals and Biogas Production from Pomegranate Marcs

Fruit and vegetable processing generates large amounts of pomaces. Valuable compounds, such as lipid, fiber, protein, and antioxidant can be recovered from these waste materials and converted into food ingredients. The residues could be a good feedstock for energy production. Pomegranate marcs (PM), a by-product from pomegranate juice processing, has not been fully utilized. This research was to study an integrated extraction and anaerobic digestion process for recovery of nutraceuticals and biogas production from pomegranate marcs. The specific objectives of this study were to (1) determine the yields and properties of antioxidants and oil extracted from various dry and wet constituents of PM, including peels, seeds and mixture and (2) evaluate the anaerobic digestibility and biogas production potential of PM before and after antioxidant extraction (AE) and oil extraction (OE). Water and petroleum ether were used as solvents in the extraction of antioxidants and oil respectively. The anaerobic digestion tests were conducted at 35 ± 2 ºC with feedstock to microorganism ratio of 0.5 on volatile solid (VS) basis under two initial organic loadings of 3.0 and 5.0 gVS L-1. According to the results, both dry and wet PM extracts had similar extraction efficiency and functionality. The wet PM extract had antioxidant content of 23.0% which corresponded to antioxidant yield of 106 kg per ton of PM peel on dry basis (d.b. The DPPH scavenging activities of antioxidants were 6.5-6.6 g g-1 (d.b.). The oil yield from the dry PM seeds was 138 kg ton-1 (d.b.). Compared to the low initial organic loading, the high initial organic loading improved methane contents (55.1-67.5%), but not biogas yield. The extracted residuals of peel, seeds and mixture had methane yields of 148, 183 and 161 mL gVS-1, respectively, which were lower than that from the raw PM. Because the integrated process of extraction followed by anaerobic digestion can produce high functional antioxidants and high quality oil and biogas from the PM, it is recommended as a value-added utilization method for the by-product.

Zacharias Frontistis

University of Western Macedonia, Greece

Dr. Zacharias Frontistis is an Associate Professor of Water and Wastewater Process Engineering at the Department of Chemical Engineering, University of Western Macedonia. He has served as chairman of the departments of Environmental Engineering (2018-2019) and Chemical Engineering (2019-2021) at the University of Western Macedonia. His research interests focus on catalysis for environmental and energy applications, the development of new physicochemical processes for water treatment, the combination of physicochemical and biological processes for agro-industrial wastewater treatment and the simulation of these processes. He has supervised or co-supervised a large number of diploma and postgraduate theses. He has published a large number of articles both in high impact international journals (>130 articles, h index>40) and in international conference proceedings (>60) and is author of 2 chapters of books on advance wastewater treatment and reuse. He is a reviewer in more than 50 high-impact scientific journals for >600 papers and is part of the editorial board of 5 international journals and has been guest editor in 11 special issues in his fields of interest.

The Role of Biochars in Environmental Remediation: From Adsorption to Catalysis

In recent years, biochars have attracted the scientific community's attention as an intriguing option for designing sustainable environmental remediation solutions. This work aims to provide a comprehensive and critical review of the multifaceted roles of biochars in mitigating environmental pollutants, emphasizing recent trends in environmental catalytic applications.

The complex physicochemical properties of biochars, such as porosity, large surface area, and the presence of various functional groups on their surface, initially led to their use as an inexpensive adsorbent for numerous organic compounds, metals, and greenhouse gases, yielding promising results.

Several research groups have gone a step further than mere adsorption, demonstrating that biochar can act as a carbocatalyst and activate oxidants like hydrogen peroxide and persulfates, thus producing reactive oxygen species like sulfate and hydroxyl radicals.

Consequently, biochars have the potential to be important vehicles for the application of advanced oxidation processes in the liquid phase, using agro-industrial residues as feedstock for catalysts instead of expensive and rare earth elements.

Currently, the functionalization and tailoring of carbocatalysts is a concern for several researchers, with numerous studies attempting to correlate the physicochemical properties of biochars with observed efficiencies and process mechanisms.

The efficiency observed is strongly dependent on the source of the biomass and the pyrolysis conditions, as well as the system's operating parameters.In addition, new applications of biochars for environmental purification are demonstrated, such as their use as catalysts in the presence of ultrasound irradiation (sonocatalysis) and as particle electrodes which can significantly enhance efficiency in 3D electrochemical systems.

In conclusion, the drawbacks of using biochars as catalytic materials are discussed, along with various methods for their enhancement, such as the development of hybrid processes. Furthermore, potential directions for future research are suggested.

Guangqing Liu

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Guangqing Liu is a full professor and Director of Biomass Energy and Environmental Engineering Research Center of Beijing University of Chemical Technology (BUCT). His research topics is biomass energy converting and organic waster treatment. He has authored or co-authored over 200 peer-reviewed academic articles in EST, CEJ, Bioresources Technology,, and co-edited 5 books and was licensed about 30 patents. As a PI, he has undertaken more than 30 projects funded by China government, World Bank, Asia Clean Air etc..

Clean Biomass Heating in China

China possesses abundant biomass resources, with a total quantity of approximately 4.5 billion tons. Among them, agricultural crop straw accounts for about 790 million tons, forestry residues approximately 340 million tons, and livestock and poultry manure around 3.1 billion tons. These types of biomass waste can be utilized for heating purposes as a substitute for fossil fuels through direct combustion, biogasification, pyrolysis, gasification, and other methods。By the end of 2022, the space heated by biomass in China exceeded 300 million square meters, with an annual production of approximately 24 million tons of biomass briquettes. The main technologies employed for biomass clean heating include biomass cogeneration for centralized heating, direct combustion of straw bales for centralized heating, centralized heating using biomass pellet boilers, and household heating using biomass pellet stoves. The substitution of coal with biomass for heating purposes has reached approximately 10 million tons, resulting in a reduction of approximately 26 million tons of carbon dioxide emissions and achieving significant overall benefits.To promote the development of biomass clean heating, the Chinese government has formulated a series of policy documents, such as the "Renewable Energy 14th Five-Year Plan" and the "Agriculture and Rural Areas Carbon Reduction and Carbon Sequestration Implementation Plan," clearly expressing support for the sector's advancement. Additionally, national standards and industry standards system regarding biomass solid fuel and biomass clean stoves and boilers have been established.However, there still exist certain obstacles at the technological and policy levels for biomass clean heating in China. This paper will analyze these barriers and provide recommendations for development.

Ruiong Zhang

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Dr. Ruihong Zhang is a Professor in Department of Biological and Agricultural Engineering at University of California, Davis (UC Davis) and a leading expert in the fields of bioprocessing and bioenvironmental engineering. Dr. Zhang's innovation in the fields of bioenergy and organic waste valorization has been recognized with many awards and has been widely reported by the news media. She has successfully developed and transferred new technologies from her laboratory to commercial companies and participated in several start-up companies. She has over 400 scientific publications and seven patents. She served as Chief Technology Advisor for CleanWorld and other companies. She has over 400 scientific publications and seven patents. She was recognized as the Phenomenal Faculty and Engineering Innovator at UC Davis. Dr. Zhang received many awards, including Environmental Award from US Environmental Protection Agency, Achievement Award from California Bioresources Alliance.

Transforming Dairy Byproducts and Food Waste into Bioplastics to Address Plastic Pollution

Global plastic production was estimated at 391 million metric tons. Only about 9% of plastics are recycled globally each year, with the rest ending up in landfill or incinerated. Additionally, each year 4.8 to 12.7 million tons of plastic enters the ocean. If no action is taken, global production of plastic is expected to triple by 2060. To solve plastic pollution problems, the use of biodegradable plastics is part of the answer. Polyhydroxyalkanoates (PHA) are biodegradable bioplastics with similar properties to thermoplastics that can be used in a wide range of applications including packaging film and containers. PHA is the fastest growing biodegradable bioplastic with its production capacity expected to increase 9-fold by 2025 and its global bioplastic market share to expand to 11.5%. A novel technology for producing PHA bioplastic from low value dairy streams containing lactose, such as whey permeate and delactosed permeate, has been developed at University of California, Davis. The new technology is expected to reduce the production costs of PHA and make the PHA more competitive in the bioplastics market by: decreasing feedstock costs, lowering pretreatment costs, increasing PHA production yield, reducing downstream processing costs, and potentially producing a valuable natural pigment co-product. The halophilic microbe *Haloferax mediterranei is used to convert dairy and other food waste into* PHBV, a high-value co-polymer widely used for making elastic thermoplastic products such as films, containers, or cutlery.

A techno-economic analysis model was developed and used to analyze an industrial-scale PHA production system for the material flows and economics. Byproduct streams from a cheese plant, with an input of 168.7 metric ton/day (MT/day) lactose, were used as the feedstock. Three scenarios with different processes for the treatments of used enzyme and spent medium were investigated and the major factors that influence the overall economics were identified. The simulated system produces 9,700 MT/year PHBV with an assumed yield of 0.2 g PHBV/g lactose and an overall process efficiency of 87%. The breakeven price was found to be the most sensitive to the lactose cost. The scenario with enzyme reuse and spent medium recycling achieved the lowest breakeven price among others, which can be less than 4 $/kg PHA. The results show that utilizing dairy derived feedstocks has the potential to make PHA competitive in the bioplastic market.

Kai Guo

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Kai Guo is a full professor and the Vice-President of Nanjing Tech University (NJTECH). Professor Guo has been focused on microflow chemistry and its application in green synthesis of bio-based materials since returning from the University of Sheffield to China in 2010. He has published over 200 peer-reviewed and been licensed over 220 patents, including over 20 PCT patents. He has received multiple awards, including Second Class Prizes of The State Scientific and Technological Progress Award (2017), International Award for Outstanding Young Chemical Engineer (2021), Qingshan Technology Award (2021), Feng Xinde Polymer Prize (2017) and 8 other provincial and ministerial level rewards.

The Key Manufacturing Technologies for Bio-based Polyurethanes

Polyurethane has been known as "the fifth largest plastic", with a global market of about 30 million tons/year and a domestic market exceeding 14 million tons/year. On one hand, the raw materials of polyurethane obtained from the polymerization of polyol and isocyanate are heavily dependent on petrochemical resources. In addition, high-end polyurethane coatings, soft foam and adhesives have a high import dependency. The development of bio-based polyurethane (BioPU) and bio-based polyurethane polyol (BioPL) have become an international hot topics. The relevant products can complement petrochemical products, achieving highly efficient carbon sequestration.

Due to unclear conformational relationships, the lack of key manufacturing technologies of BioPL and inefficient polymerization technologies of BioPU within the entire industrial chain of BioPU, some difficulties still remained in the development of new high-performance BioPL monomers and high-end BioPU materials. To address these drawbacks, the main work of our group were carried out: (1) elucidate the structure-activity relationship and develop new high-performance products of BioPL monomers; (2) regulate the micro-scale effect and exploit key manufacturing technology for BioPL monomers; (3) analyze the polymerization mechanism and develop controlled polymerization technology for high-end BioPU materials. The application in some significant fields such as engineering anticorrosion, building material adhesive, railway tunnel construction, electronic component sealing, home medical care, have been realized in recent years, solving the bottleneck application problem in dynamic impact resistance anticorrosion and railway tunnel insulation and waterproofing, etc.

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Dr Christakis Paraskeva, Chemical Engineer, is a full professor at the University of Patras and collaborating faculty member of ICE/HT- FORTH. He has authored or co-authored over 70 refereed journal, 9 papers in books, 60 papers in proceedings of international conferences, 50 papers in proceedings of national conferences and 1 patent. He participated in more than 50 European, national and industrial research projects. His specialization is in the scientific area of Separation Processes, Transport phenomena and Unit Operations.

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Valorization of Agroindustrial liquid and solid wastes; Treatment of agroindustrial wastes & Separation, isolation and purification of phenolic substances, with antioxidant activity and high added value

Phenols are compounds found in agricultural products and by-products, with high antioxidant activity and positive impact on human health. As a result, their isolation and purification is of high interest and these compounds and can be used in cosmetics, nutritional and pharmaceutical supplements. Recently a preliminary design of a treatment plant was presented by the researchers of our laboratory, based on experiments carried out with different materials rich in phenolic compounds but the focus was paid mainly to the treatment of wastes and not to the isolation of phenols. This design was based in a long-term experimental research study performed during the last 15 years in our laboratory. The proposed processes that we have used so far included physicochemical methods such as solvent solid-liquid extraction, membrane filtration, adsorption/desorption on specific resins and vacuum evaporation, and have been proved very effective for the separation and purification of phenols contained in agro-industrial by-products. The raw materials tested were olive mill wastewater (OMW), grape marc and olive leaves and espresso coffee residuals. The final products of the proposed process were rich in phenolic compounds, with the OMW final concentrate containing 378 g/L phenols in gallic acid equivalents (38%), 84.8 g/L being hydroxytyrosol. The final concentrate of olive leaf extract contained 98 g/L phenols in gallic acid equivalents (10%), and the final concentrate of grape marc phenols 190 g/L in gallic acid equivalents (19%), containing 4.7 g/L catechin. The results for the separation, isolation, and purification of the phenolic content of the four plant materials or by-products, rich in phenolic compounds were used for the design of a complete treatment process and recovery of phenolics at relatively low purities. Three are the main objectives of the current work: 1) to develop an integrated scheme for the complete exploitation of agro-industrial wastes including the remaining biomass after the extraction of phenolic content; 2) the isolation and purification of compounds with high added value at high purities (>80%) from agroindustrial wastes as the olive leaves; 3) to perform tests in pilot plants, to develop a new physicochemical treatment scheme enriched with new physicochemical methods, and to conclude with a final design and feasibility analysis of the process, including all suggested steps and by comparing different pathways to reach the final solutions with the highest purity. The final target is to bring to the market an integrated method to obtain phenolic compounds from olive leaves at the maximum possible high purities at the lower possible cost. It is expected that commercialization of phenols can make a significant contribution to reduction of the cost of the proposed process and provide a good profit for the stakeholders.

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Dept. of Chemical and Biochemical Engineering

Irini Angelidaki is a full professor and the Head of the BioConversions Center at the Chemical and Biochemical Engineering department at DTU. Prof. Irini Angelidaki has expertise in biotechnological processes for valorisation of wastes and wastewaters to high value products, chemicals and energy. She has authored or co-authored over 500 peer-reviewed articles in prestigious journals including Energy and Environment, Microbiome, Chemical Engineering Journal, Biotechnology Advances, a.o. In addition, she was been awarded several prestigious prizes and Awards such as Grundfos prize and received an ERC advanced grant.

Microbes assisting the Green Transition

Microbes, including bacteria, fungi, and algae, play a crucial role in facilitating the green transition towards sustainable and eco-friendly practices. This abstract explores the diverse ways in which microbes contribute to environmental sustainability and the mitigation of climate change. Firstly, microbes are involved in bioremediation, where they break down and detoxify pollutants in contaminated sites, helping restore ecosystems affected by human activities. Additionally, certain microbes possess the ability to produce biofuels and biochemicals, offering a renewable alternative to fossil fuels and reducing greenhouse gas emissions. Furthermore, microorganisms contribute to the process of organic waste decomposition and composting, anaerobic digestion, promoting efficient recycling and nutrient cycling. Microbial research and biotechnology advancements have led to the development of innovative solutions, such as microbial fuel cells and microbial-based sensors, contributing to sustainable energy production and environmental monitoring. Harnessing the potential of these microscopic organisms can significantly assist in the global transition towards a greener and more sustainable future. In this presentation

In this presenation I will show potential applications from biogas to biomethane which can be applied as vehicle fuel or supplied to the natural gas grid. Methane can also be used as substrate for cultivation of methanotrophic bacterial with high protein content (up to 70% of DW) with good aminoacids composition. This proteinous biomass can with advantage be provided as animal feed. Additional products can be obtained from the intermediates of the AD process, such as PHAs or specific volatile fatty acids (eg. which at a second stage can be converted to useful alcohols for producion of biofuels), lactic acids which is a precursor for lactides. Results of several of these alternative to heat and electricity will be presented. Challenges and opportunities will be discussed.

Xingyu Jiang

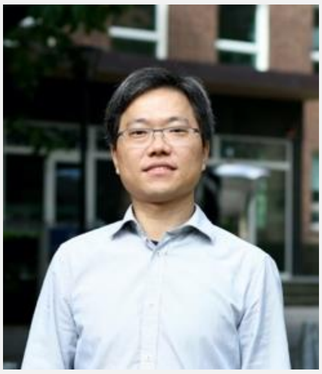
Southern University of Science and Technology, China

Xingyu Jiang is a Chair Professor of the Southern University of Science and Technology (SUSTech), Shenzhen, China. He obtained his B.S. at the University of Chicago in 1999 and his Ph.D. at Harvard University in 2004. In 2005, he began to start his own lab at the National Center for Nanoscience and Technology (an affiliate of the Chinese Academy of Sciences). In 2018, he was appointed the Head and Chair Professor at the Department of Biomedical Engineering of SUSTech. He has published more than 390 peer-reviewed papers. His research has been recognized by many awards and supported by a number of prestigious funding, including "Hundred Talents Plan" of the Chinese Academy of Sciences, the National Science Foundation of China's Distinguished Young Scholars Award, the Scopus Young Researcher Gold Award, and the Human Frontier Science Program Young Investigator Award. He is a Fellow of the Royal Society of Chemistry (UK) and the American Institute of Medical and Biological Engineering.

DNA Data Storage

As an emerging data storage medium, DNA offers substantial advantages over conventional media, including ultra-high data storage density (theoretically 106 times higher than existing technology), low energy consumption, and long lifetime (up to several hundred thousand years in theory), and has great potential applications in the future.

Here we combined microfluidics and synthetic chemistry to implement miniaturized systems for DNA storage. We report a DNA micro-library that can be encapsulated by metal-organic frameworks (MOFs) within 10 min and extracted (5 min) in a single microfluidic chip for automated and integrated DNA-based data storage.The DNA micro-library@ MOFs enhances the stability of data-encoded DNA against harsh environments. The encoded information can be read out perfectly after accelerated aging. We develop a compact disk-like microfluidic chip modified with nanoparticles for accurate fluid flow control. These nanoparticle coating turns microchannels into valves or pumps, which reduces the error in fluidic control from 62% to 6%.We present a microfluidic platform for automated storage and retrieval of data-encoding oligonucleotide samples enabled by a microvalve network architecture.



Yun Chen

Chalmers University of Technology, Sweden

Yun Chen is a Docent of Systems Metabolic Engineering and holds a position as Group Leader at Chalmers University of Technology, Sweden. He has many years of experience in metabolic engineering and systems biology of yeast. He has co-authored 60 papers (h-index 32) and is co-inventor of 4 patents (2 issued). His research focus is on reprogramming cellular metabolism to build novel cell factories for production of biochemicals, fuels and pharmaeuceticals.

Advancing biochemicals production via systems metabolic engineering

To mitigate the effects of climate change, we need to move away from fossil-dependent processes. Biobased processes offer a promising solution, as it can convert renewable raw material into chemicals, materials, and fuels that used in our daily life today. The so-called first-generation feedstocks mainly comprises of sugar, such as glucose, which is derived from corn and sugarcane, this has raised concerns about food security and biodiversity in a boarder context. So, to establish a sustainable circular carbon economy, we need to explore all kinds of renewable resources, to equip the cell factory capability ready to use different feedstocks. In this talk, I will first introduce how we expand substrate range of yeast via systems biology and adaptive evolution. Furthermore, I will present strategies how we can use our platform to advance different chmeicals production in yeast.

Jason Z. Zhang

Immobilization of Lipase on PDA-Modified Magnetic Microparticles with Different Length PEI

Prof. Dr. Jason Z. Zhang is a professor in the Faculty of Engineering, University of Ottawa, Canada. He sits in the editorial board of Biotechnology Advances and Chinese Journal of Chemical Engineering, with over 200 published articles in referred professional journals and also world level expertise in photoreactor design for value-added products and environmental applications.

Jason Z. Zhang received his Bachelor's degree in Chemical Process Equipment and Control from Hebei University of Technology, China and doctoral degree from the University of Waterloo, Canada. Since 2000, he has been working as a lecturer, professor, vice-dean, and Dean at the University of Alberta, University of New Brunswick, University of Ottawa, and Hebei University of Technology.

Immobilization of Lipase on PDA-Modified Magnetic Microparticles with Different Length PEI

Lipase plays a crucial role in various industries, including food, pharmaceutical and biofuels production. Lipases can be employed in biorefinery processes to catalyze the hydrolysis of triglycerides, such as animal and plant oils, leading to the breakdown into glycerol and fatty acids. These resulting products can be further utilized to produce biofuels and cosmetics. Immobilization of enzymes on solid supports offers several advantages over their free forms, such as enhanced stability, reusability, and ease of separation. Among the different methods of enzyme immobilization, the use of magnetic microparticles as carriers has gained significant attention due to their unique properties, including separation with an external magnetic field.

In this study, we report the immobilization of lipase on polydopamine (PDA) modified magnetic microparticles with different length polyethyleneimine (PEI) and investigate the effects of immobilization conditions on the enzymatic performance. We found that the PEI with a molecular weight of 600 Da was the most effective in immobilizing lipase, while the PEI with a molecular weight of 1800 Da maintained higher total activity and specific activity of the enzyme. We optimized the immobilization conditions by varying the initial lipase concentration, pH, time, and temperature, and identified the best conditions as follows: lipase concentration of 4.25 mg/ml, pH 6, immobilization time of 5 hours, and immobilization temperature of 10° C. We then studied the enzymatic performance of the immobilized lipase and found that it had a wider optimal pH range and better thermal stability compared to the free lipase. The immobilized lipase also maintained 50% of its activity after being used 10 times. These findings demonstrate the potential of PDA-modified magnetic microparticles with PEI as a carrier for immobilizing lipase and improving its performance for various industrial applications.

Qipeng Yuan

Beijing University of Chemical Technology, China

Qipeng Yuan is a full professor in Beijing University of Chemical Technology, also a Distinguished professor of Changjiang Scholars of the Ministry of Education. His main research areas are large-scale preparation and purification of natural products and construction of microbial cell factories for biosynthesis of value-added compounds. He published more than 300 SCI papers in journals such as Chem. Soc. Rev. , Angew. Chem. Int. Ed. , Nat. Commun. , Metab. Eng. He has been cited more than 17,000 times, H-factor 66, and has authorized 60 PCT and Chinese invention patents. By cooperating with companies, he constructed industrial production lines for the synthesis of arbutin, inositol, soy isoflavone and so on.

The Strategies for the Construction of Highly Efficient Cell Factory in Synthetic Biology

Synthetic biology has made a lot of progress so far, but there are still many problems that have not been solved. The production of natural products by using synthetic biology strategies currently has challenged by the lack of key enzymes and biosynthetic pathways, and the low efficiency of cell factories. By design and creation of new biosynthetic pathways, fine-tuning of the metabolic pathways, we successfully constructed platform strains for high-level production of aromatic compounds and glycoside compounds. On this basis, we achieved heterologous biosynthesis of more than 20 important chemicals and natural products. In addition, by illustrating the mechanism of quorum sensing system, we have created a library of quorum sensing circuits that can spontaneously control multiple metabolic fluxes in one cell. Using these tools to regulate the biosynthesis of salicylic acid and 4-hydroxycoumarin, the titers were greatly improved. Finally, we designed a stable and self-regulated microbial by use of multi-metabolite cross-feeding (MMCF) to establish a close correlation between the strains. With an intermediate-responsive biosensor, the population of the microbial coculture is autonomously balanced to minimize intermediate accumulation. This static-dynamic strategy is extendable to three-strain cocultures, as demonstrated with de novo biosynthesis of silybin/isosilybin. Our work has provided a systematic and comprehensive research basis for the construction of microbial cell factories to synthesize high value-added products.

Stefano Campanaro

University of Padova, Italy
Member of Interuniversity Center for Biotechnologies (CIB), Italy

Stefano Campanaro is an associate professor at the University of Padova (Italy). Prof. Campanaro research activity is mainly focused on the analysis of the anaerobic digestion system using metagenomics and bioinformatics. He served as director of the Interdepartmental Center for Biotechnologies from 2019 to 2022. He has authored or co-authored more than 140 peer-reviewed articles in prestigious journals including Nature, Science, Cell Reports Methods, Microbiome, Chemical Engineering Journal, etc.. https://sites.google.com/site/stefanocampanaro/home

Using genome-centric metagenomics and metabolic flux balance analysis to investigate biogas upgrading and CO_2 methanation

Anaerobes in natural and engineered systems are the main responsible for organic matter degradation, a process leading to the release of several compounds, including methane and CO2. Genome-centric metagenomics enables the creation of comprehensive databases of metagenome-derived genomes and provides detailed predictions of their relevant metabolic pathways. Unravelling these pathways further clarifies crucial steps in anaerobic digestion by linking biotic and environmental factors to microbial dynamics. By using high-quality genomes reconstructed from over 300 samples, a deep understanding of the process was achieved through extensive genome-scale metabolic models. The metabolic flux balance approach offers novel insights into interspecies interactions and metabolic exchanges within the anaerobic digestion microbiome. The effect of feedstock and its influence on members of the community behaviour, as well as the mutualistic, parasitic and commensalistic interactions were explored. Condition-specific community genome-scale models were also developed by incorporating metatranscriptomics in the pipeline, allowing a mechanistic contextualization of multi-omics data. Real-case studies involving batch experiments and bioreactors were conducted in the context of LIFE CO2toCH4 project to investigate the behaviour and metabolic exchanges within specific microbial communities engaged in biogas upgrading and CO2 methanation.

Maria A. Goula

University of Western Macedonia, Chemical Engineering Department, Greece

Founding Director, Laboratory of Alternative Fuels and Environmental Catalysis

Maria A. Goula is Professor in the Department of Chemical Engineering and Director of the Laboratory of Alternative Fuels and Environmental Catalysis (LAFEC), of the University of Western Macedonia (UOWM). She is author or co-author of more than 105 research publications in Peer Reviewed International Journals, which have received over 4000 citations (Scopus), giving her a Hirsch (h)-index= 35. Prof. M.A. Goula has been included in the top 2% of scientists worldwide in 2019, 2020 and 2021 for her impact in the scientific field Energy/Physical Chemistry (Baas, Boyak, Ioannidis, University of Stanford). The total budget of the projects in which she has acted as Coordinator or Team Leader is ≈2,500,000€. Her research interests are focused on the fields of Heterogeneous Catalysis and, especially, in materials synthesis and characterization, catalyst development and evaluation, and investigation of reaction kinetics and mechanisms.

Novel Pathways for Hydrogen Production and Utilization through Thermo-catalytic Processes

Hydrogen has come to the fore in recent years as a clean fuel in the path towards decarbonization and energy transition. Besides electrolysis-produced H_2, hydrogen can also be derived from waste biomass sources (incl. biogas and crude glycerol), as well as underutilized hydrocarbons (i.e., ethane) via steam/dry reforming processes. The co-utilization of CO_2 (i.e., dry reforming) provides the additional benefit of lowering the carbon footprint of these energy-intensive processes. The produced clean H_2 can then find interesting applications, like in the fields of CO_2 hydrogenation to fuels and value-added products, as well as in the hydroprocessing of fatty acids to produce green diesel for heavy-duty vehicles. All these processes necessitate the development of active and durable heterogeneous catalysts with properties tailored towards the needs of each catalytic reaction (incl. surface area, acid/base properties, reducibility, metal dispersion, metal-support interaction etc.). The application of novel synthesis methods and new catalyst formulations via incorporating suitable promoter elements, as well as the development of bimetallic catalysts, can aid us towards achieving this objective.

Guifang Wu

Novozymes (China) Investment Co. Ltd

Guifang Wu is Technology & Innovation Director in Agricultural & Industrial Bio-solutions of APAC. Since she joined Novozymes with a PhD degree in Biochemical Engineering from Tsinghua University, Dr. Wu has been devoted in enzyme and application process innovation starting from conceptual ideas to lab, pilot, demonstration and production scale validation, for industries ranging from Grain, Food, Textile, Bioenergy, Biomass conversion, Oils & Fats, and more recently Animal Health & Nutrition, BioAg. She is co-inventor of several patents concerning transformative application of novel enzymes in various industrial processes which have enabled significant sustainability benefits for the end users, for consumers and for the society.

A Biotechnology-Powered Net-Zero Future

In today's reality, majority of production of energy and chemicals are based on petroleum, while the food/feed ingredient production is based on food resources. Biotech has been applied broadly for agri-product processing, it plays an even more critical role to convert sustainable raw materials (e.g. biomass, waste and by-products, and CO2) to energy, chemicals, and food/feed ingredients across the agricultural and industrial value chain, including:

•Sustainable agriculture for higher productivity through nutrition and health enhancement

•Converting non-food based agricultural resource (corn stover, corn cob) to future fuel (SAF, hydrogen, etc.)

•Converting carbons to biochemicals and specialty ingredients via synthetic biology and fermentation

•Sustainable and flexible manufacture of surfactants from plant based materials using enzymes

•Recycling and reuse of plastics

•Carbon capture & utilization

Each area will be exemplified how biotechnology can contribute to the sustainability transformation of those processes.

Key words: Biotechnology, Sustainability, Enzyme

Runduo Zhang

Beijing University of Chemical Technology, China
Director of Beijing Key Laboratory of Energy Environmental Catalysis

Runduo Zhang is a full professor of Beijing University of Chemical Technology (BUCT). Prof. Zhang was awarded as New Century Talent of Ministry of Education in 2009 and worked as a specialist-in-chief of National High Tech Program in 2013 and became a vice director of Energy & Environmental professional committee of China Energy Society. He has authored or co-authored over 150 peer-reviewed articles in prestigious journals including Chem Rev, Appl Catal B: Environ, J Catal, Environ Sci Technol, Chem Commun, and J Mater Chem A, and one Chinese book and 4 English book Chapters. In addition, he was licensed about 20 patents.

Catalytic pyrolysis of bio-plastics into carbon nanotubes and hydrogen and downstream methanol to olefin

Bio-based plastics can partially alleviate the intensive usage of petroleum resources. Unfortunately, the disposal of these bio-plastics might bring new risk and challenge. The Waste-to-Energy incineration is one of the options, but the release of greenhouse gases and pollutants will do harm to the environment and human health. As a result, applying thermocatalytic approaches to upgrade plastics into valuable chain products such as carbon nanotubes (CNTs), hydrogen, and other light carbon-containing organic matters to achieve better circular economy of plastics is more desirable. Meanwhile, the downstream product methanol can be further resourcefully utilized as high value-added light olefins.

Pyrolysis and in-line catalytic technology were employed to converting polyethylene plastics to CNTs and hydrogen. To improve the catalytic performance of Ni–Mg system, high-valency and refractory tungsten as a promoter was introduced. The sample with W/Ni atomic ratio of 1/7 exhibited the mixed phase of $MgNiO_2$ and $MgWO_4$ and showed the highest yields of CNTs and hydrogen. The highest yields of CNTs with average diameter of 11 ± 2 nm (0.21 g/g) and hydrogen (26 mmol/g) when the reaction temperature was 800°C. The modulating strategy enabled the partial electron transfer from Ni to W, creating the abundant quantities of active Ni nanoparticles with high stability and catalytic activity towards the hydrocarbon decomposition. Simultaneously, the interaction between Ni and W_2C regulated the carbon concentration surrounding Ni to ensure the growth of CNTs. These findings would be conducive to the reasonable design of highly efficient catalysts maximizing the yields of CNTs and hydrogen produced from plastics.

The downstream methanol-to-olefin (MTO) process is important for sustainable production of light olefin from biomass via fermentation or chemical conversion in the future. Small-pore silicoaluminophosphate (SAPO) molecular sieves are effective catalysts for MTO reaction due to their unique shape-selectivity and moderate acidity. We reported on the facile synthesis of SAPO-LTA structure, an interesting candidate catalyst, through ionothermal approach in imidazolium-based ionic liquids. By using several characterization techniques, including XRD, SEM, NMR, BET, ICP, NH_3-TPD, physicochemical properties of SAPO-LTA prepared with different amount of silicon added in the initial reactants has been studied. SAPO-LTA catalyst showed an obviously improved catalytic activity with the increasing of silicon content, high light olefins selectivity (~ 75%) and better $C^{4=}$ selectivity than industrialized SAPO-34 catalyst.

Kyriaki Polychronopoulou

Khalifa University of Science and Technology, Abu Dhabi
Member of Mohammed Bin Rashid Academy of Scientists (MBRAS), United Arab Emirates
Founding Director, Center for Catalysis and Separations, Abu Dhabi

Kyriaki Polychronopoulou is currently Full Prof. of Mechanical Engineering and Director of the Center for Catalysis and Separations (CeCaS) at Khalifa University of Science and Technology (KU, UAE), and Visiting Professor at ETH-Zurich. She holds a PhD in Chemistry from the University of Cyprus (2005). Before, she was Postdoctoral Fellow at Northwestern University (IL, USA) and University of Illinois at Urbana-Champaign (IL, USA). She has been listed in the Stanford University List of World's Top 2% Scientists for the years 2020 & 2021; She has also been invited in the Task force for setting the first-ever UAE R&D Priorities and Policies by the Ministry of Industry and Advanced Technology (MoIAT). Her research is focused on catalysis for decarbonization, hydrogen economy and fuels.

The Art of Designing Multifunctional Catalysts for Added-Valued Products

Catalysis is in the heart and forefront of any fuel-related deployment technology. In particular, the use of catalysis in the transformation of wastes into energy and fuels is a sector with a revenue forecast in 2027 of USD 54.8 billion and a Growth Rate CAGR of 7.4% from 2020 to 2027. This research is of strategic priority for the United Arab Emirates as it has been stated in the UAE Energy Vision 2050. Wastes can be in the gas, liquid or solid state. In this talk some case studies of how catalysis and surface science principles are applied onto transforming certain waste feeds (CO2, bio-oil) into added-value products are discussed. The design criteria of catalysts for CO2 methanation, dry reforming of methane and bio-oil hydrodeoxygenation are discussed from the perspective of how to achieve a paradigm shift.

Pascal Fongarland

Université Claude-Bernard Lyon 1, France
Laboratory of Catalysis, Polymers, Processes and Materials, France

Pascal Fongarland is a full professor of Université Claude Bernard Lyon 1 (UCBL). Prof. Fongarland is also deputy director of the laboratory CP2M (Catalysis, Polymers, Processes and Materials), a joint unit between UCBL, CPE-Lyon and CNRS. His field of expertises is catalytic processes including kinetics, reactor modeling, process intensification via structuration and coupling between reaction and separation like reactive distillation or sorption-enhanced reaction process. With more than 85 papers, he is involved in many projects for syngas conversion (Fischer-Tropsch synthesis, methanol, OxZeo …) or biomass and wastes conversion (lignocellulosic fractions and wastes hydrothermal liquefaction) .

Renewable of Fischer-Tropsch synthesis using iron-based catalyst: effect of syngas composition from power-to-X technology to biomass gasification

As everybody knows, there is a crucial demand to find alternative routes to produce chemicals and fuels for the substitution of carbon fossil resources. Some promising ways are currently under investigation to obtain valuable hydrocarbons like olefins, paraffins, alcohols starting from "green" resources like biomass, sequestrated carbon or renewable energy. Among all possibilities, syngas, a mixture of CO, CO_2 and H_2, is used a "reactant" to produce different kind of hydrocarbons as methane, methanol, olefins or distribution of hydrocarbons via Fischer-Tropsch synthesis. This approach combining deconstruction-reconstruction can be very versatile where the target molecules can be tuned by the choice of specific catalyst (Ni, Fe, Co, Cu-based etc …) and operating conditions. The basic statement remains in the use of non-fossil carbon and hydrogen to produce sustainable syngas and then products. For example, power-to-x technology deals with the use of a decarbonated hydrogen (from water electrolysis coupled with a "zero-carbon" power source) and CO_2 collected from industry emissions); syngas can also be produced biomass (mainly by the well-known gasification process) where the composition is mainly distributed between H_2, CO and CO_2.
Due to capacity to manage syngas containing CO_2 specie, Fischer-Tropsch synthesis based on iron catalysts has been raised again with interest to produce (e-)fuels. This one-century reaction has been widely developed in the past to produce fuels from methane steam-reforming with a syngas composed by CO/H_2. If in this case, process industrialization is well established, using CO_2 as part of the syngas is still very challenging due to its low reactivity. An alterative exists consisting in using RWGS reaction to convert CO_2 to CO and facilitates the syngas conversion but this is not appropriate for intermittent energy (power-to-X). The issue is then to couple RWGS and FTS in the same process to decrease the process cost thanks to Fe-based catalyst able to catalyze both. Our work is then focused on the study of this coupling and the influence of the syngas composition in the yield in different products. We are developing different approach to model the kinetic of these reactions via a macro-scale modeling to improve process simulation and a micro-kinetic model to better understand complex catalytic reaction mechanisms and interactions with active-sites (mono-sites vs dual-sites on iron surface).

Min Jiang

Nanjing Tech University, China
National High-Level Personnel of Special Support Program

Min Jiang is a full professor and the Dean of the Academy of Sciences, Nanjing Tech University (NJTech). Prof. Jiang's group mainly focused on bulk chemicals and biofuels production from waste carbon resources. He has chaired more than 30 national and provincial research programs including the National Key R&D Program of China, National Natural Science Foundation of China (regional) cooperation and exchange projects, etc. He has published more than 200 SCI papers in Trends Biotechnol, Green Chem, ACS Synth Biol etc, 4 books and 3 book chapters. He has applied for 52 Chinese invention patents with 26 authorized patents, 1 US authorized patent and 1 US public patent. He also obtained 4 provincial and ministerial awards.

Microbial and enzymatic degradation of plastic wastes and UPcycling

Almost 350 million tonnes of plastics are produced world-wide and a staggering 800 million tonnes are forecasted to be produced by 2050. By way of contrast, only a small fraction of that plastic is recycled. The result: valuable resources get lost, and our environment is polluted. The European Commission (EC) has set the goal of transforming the EU into a resource-efficient economy with an emphasis on plastic waste treatment. In early 2020, the National Development and Reform Commission (NDRC) and the Ministry of Ecology and Environment (MEE) of P. R. China also put forward new policies and implementation programme in further strengthening plastic pollution control. This transformation of linear value chains towards a circular bioeconomy is a far-reaching change in the plastic strategy for both Europe and China with MIX-UP born out of this vision – because plastic itself is a valuable product, we simply deal with it the wrong way. We, the participants of the MIX-UP project, make a strong commitment to helping the EC and China realise this vision by researching new ways to an efficiently use of mixed plastic waste streams.

Biotechnological plastic recycling has emerged as a promising research area in recent years. However, several challenges hinder its further application, including the lack of degrading elements, low degradation efficiency, and low efficiency for degradant utilization. In this study, we aim to address these challenges through three research topics. Identification of the complete plastic biodegradation pathway and discovery of key plastic-degrading enzymes responsible for plastics degradation. Construction of stable, controllable, and efficient systems, including microbial consortia and enzyme cocktails systems, and optimization of the match between different plastic degradation enzymes. Design and construction of metabolic pathways for different plastic degradants, which will be further used for the synthesis of high-value products. Ultimately, we aim to achieve efficient degradation of waste plastics and further biorefinery of mixed plastic degradants. By establishing technology platforms for the biodegradation of waste plastics and further high-value utilization, we will develop new theoretical foundations and key technologies for the recycling utilization of waste plastics, which are disposed of in huge amounts annually.

Invited Lectures

Stelios Stefanidis

Centre for Research and Technology Hellas, Greece
Collaborating Researcher

Dr. Stelios Stefanidis obtained his PhD in 2016 on the topic of the Catalytic Pyrolysis of Biomass for the Production of Alternative Biofuels and Chemical Products. In 2018, he was awarded a Marie Skłodowska-Curie Individual Fellowship to work on the design of heterogeneous catalysts for the conversion of biomass-derived molecules at Aston University in Birmingham, UK. Since 2020, he has been a Collaborating Researcher at CPERI-CERTH working on the valorization of biomass and waste resources. His research interests include the thermochemical and thermocatalytic conversion of biomass and wastes towards energy carriers, chemical products and materials, the fractionation of lignocellulosic biomass and catalytic hydrothermal processes for the conversion of biomolecules to high added value chemical products.

Combining solid acid catalysis and oxidative organosolv pretreatment to fractionate agricultural residues

Wheat straw is an agricultural residue that is typically utilised as low-value animal feed. Because of its low selling price, it is often abandoned in the fields. However, its cellulose, hemicellulose and lignin can be isolated and utilised to produce high-added value products. CERTH has developed an oxidative organosolv process (OxiOrganosolv) for the fractionation of lignocellulosic biomass feeds, such as wheat straw, that replaces the soluble acid catalysts typically used in organosolv with a pressurised oxygen atmosphere, resulting in a process that is more environmentally friendly and produces fewer byproducts and high purity cellulose-rich pulps that are more suitable for enzymatic and microbial processes.

In this work the OxiOrganosolv process was developed further by incorporating heterogeneous catalysts to achieve the efficient fractionation of lignocellulosic feeds at lower reaction temperature (150 ºC instead of 175 ºC), aiming in this way at the reduction of the operating costs and the environmental footprint of the process. Several catalysts were screened for the fractionation of wheat straw at 150 ºC, such as various zeolites and Cu/Fe metal oxides. While all catalysts exhibited activity, one of the most effective catalysts was a Y zeolite with a low Si/Al ratio, and therefore, high acidity, which increased the delignification degree (DD) from 42% without catalyst to 58%. Y zeolites with higher Si/Al ratios led to lower DDs; this indicated that the acidity of the catalyst played a key role in its catalytic performance. The catalyst-to-feed (C/F) ratio was then optimised with the Y zeolite by changing the catalyst loading in the reactor to achieve C/F ratios from 0.2 to 1. The optimal C/F ratio was found to be 0.6, at which a DD of 69% was achieved. The cellulose content of the produced pulp increased from 56% at C/F=0 and 64% at C/F=0.2 to 83% at C/F=0.6, similar to the cellulose content of pulps produced at 175 ºC with no catalyst. Gas analysis showed that, despite the higher DDs achieved, oxygen consumption increased marginally. This indicated that the main effect of the catalyst was the hydrolysis of the hemicellulose, catalysed by its acidity, while the impact of the catalyst on the oxidation of lignin was minimal.

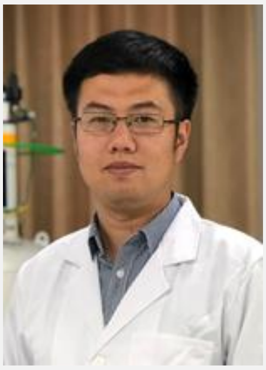
Konstantinos Kalogiannis

University of Western Macedonia (UOWM), Greece
Assistant Professor

Konstantinos Kalogiannis is an assistant professor in UOWM. He has worked as a researcher since 2007 in the filed of biofuels and biorefineries; from 2020 till 2022 he worked in the European Commission as a project manager of research projects under Horizon – Energy and was elected as an assistant professor in July 2022. He has authored or co-authored over 50 peer-reviewed articles in prestigious journals including Bioresource Technology, Environmental Catalysis B, Green Chemistry and has also co-authored 5 book chapters.

Production of Chemicals and Fuel from Biomass

The key step to the successful valorization of lignocellulosic biomass lies in its fractionation towards its three main building blocks, cellulose, hemicellulose and lignin. In this work we developed a novel organosolv pretreatment by replacing the commonly used inorganic acids, such as sulfuric acid, with O_2 gas; this resulted in low yield of degradation byproducts while achieving high delignification degrees (DD) and good quality biomass fractions. We investigated several different process parameters such as solvent, temperature, O_2 addition and use of polyoxometalates (POMs) that can enhance oxidative delignification in an effort to optimize the process. The derived cellulose-rich pulp was subsequently enzymatically hydrolysed to sugars and converted to various different products such as D-lactic acid by lactic acid bacteria of Lactobacillus species, docosahexaenoic acid (DHA) in the cells of heterotrophic marine microalga or ethanol; this proved the flexibility of the pretreatment method and the quality of the produced pulps. We found that higher temperatures, 175 °C compared to 150 °C and higher treatment times were beneficial as they yielded pulps with low lignin content (down to 1 wt.%) while maintaining high cellulose and hemicellulose recoveries (100% and 40% respectively in the solid pulp); the rest of the hemicellulose was recovered as oligo- sugars that had not degraded due to the absence of organic acids. Different solvents were tested; water-soluble acetone and ethanol, as well as water immiscible ones that allowed the easy separation of the different fractions. The pretreatment efficiently delignified hardwood (beech) and softwood (pine, up to 97% DD), a common weakness of organosolv processes. Finally, the addition of a POM, allowed the decrease of the processing temperature down to 150 °C while maintaining very high DD (up to 96%).



Ning Zhu

Nanjing Tech University, China

Dr. Ning Zhu is a full professor of College of Biotechnology and Pharmaceutical Engineering, Nanjing Tech University. His current research interests are focused on design, synthesis, and applications of bio-based materials. Chemo-bio catalysis and flow chemistry are investigated for biomass transformation into polymer materials. In the last 5 years, 36 papers were published on peer-reviewed journals, including *Nature Materials*, *Progress in Polymer Science*, *Advanced Functional Materials*, *Chemical Engineering Journal*, *Chemical Science*. He serves as Chief Editor for *Advances in Polymer Technology*, and Youth Editorial Board Member for *Chinese Chemical Letters*, *Bioresources and Bioprocessing*, and *Green Synthesis and Catalysis*.

Design and manufacturing of bio-based functional materials

Bio-based polymer materials have attracted global interest. In China, total production of petroleum-based polymers was over 0.17 billion tons per year. Meanwhile, there are abundant biomass resources in China, but which are not utilized very well. So the development of bio-based polymer materials have attracted growing interests from both academia and industry. Recently, we carried out the research work about structure design of bio-based functional materials, development of microreactor-based continuous flow synthetic method, and the scale up strategy. For example, plant oil polyols were obtained by epoxidation of double bonds in the plant oil, and then ring-opened of epoxy. Polymerizations of plant oil polyols and commercial isocyanate produced bio-based polyurethanes. By investigating the structure-property relationship, the key parameters of bio-based polyurethanes were better than the petroleum counterparts. In order to high efficiently and precisely build the target structure, microreactor-based continuous flow synthetic method was explored. By controlling the parameter of the microreactor, plant oils containing varied double bonds contents resulted in almost the same epoxy values, and the reaction time was reduced with decreased side reactions. Moreover, we presented the scale up strategy of microreactor for manufacturing of bio-based functional materials. By introducing the designed internals into reactor, the feature sizes of microreactors were successfully expanded into centimeter while almost keeping the microscale effect. Industrial production of plant oil polyols was achieved based on the microreactor scale up strategy.

Ioannis Zuburtikudis

Abu Dhabi University, U.A.E
Professor & ChE Dept. Chair
Senior Member of AIChE

Ioannis Zuburtikudis is Professor and Chair of the Chemical Engineering Department of Abu Dhabi University. He studied Chemical Engineering in Greece and in the USA, where he worked as a Research Scientist before joining the Greek Academia and establishing the NanoMaterials & Manufacturing Processes Laboratory (www.nanohybrid.eu). His research lies in the nexus of nanotechnology, reaction engineering, soft-matter and sustainability. He has been granted various research grants by Greek, EU, and UAE agencies. He has authored over two hundred articles in refereed journals and conference proceedings and has co-organized European and Greek conferences, while he is a reviewer of grant proposals and a judge in research competitions.

Bio-based polymer (nano)composite materials for application X: A paradigm towards the integrated bio-refinery

Polymer nanocomposites constitute a class of materials that combine the properties of the polymer matrix with the unique properties of dispersed nanoparticles. Within this broad category of hybrid materials, there exists a subclass known as biopolymer-based nanocomposites. In our research, we have obtained results using Poly(Lactic acid) (PLA), an aliphatic polyester renowned for its biodegradability and versatility, Poly(3-hydroxybutyrate) (PHB), derived from the poly(hydroxyalkanoates) (PHAs) family, known for its exceptional thermoplastic and biocompatible properties. and PBSA, a copolyester comprising succinic acid (S), adipic acid (A), and 1,4-butanediol (B), which exhibits remarkable biodegradability and thermal stability. By incorporating nanoparticles in various forms including spherical, tubular, and disk (platelet-like) shapes, our research has primarily focused on the utilization of widely studied and commonly employed silicate clays. The incorporation of nanoparticles within the polymer matrix has led to notable improvements in key characteristics such as mechanical strength, thermal stability, flame retardancy, barrier properties, electrical conductivity, and many others. These enhancements stem from the unique attributes exhibited by the dispersed nanoparticles, including their high aspect ratio, expansive surface area, and exceptional interfacial interactions with the polymer matrix, which contribute to synergistic effects and tailored material properties. The potential applications of these materials span across a vast array of industries and sectors, encompassing packaging, automotive, aerospace, electronics, and biomedical fields, among others. The significance of our findings extends beyond technological advancements, as they exemplify how the conversion of biomass into diverse biopolymers can play a pivotal role in resource valorization and the realization of an "integrated biorefinery" concept. In conclusion, the synthesis and utilization of biopolymer-based nanocomposites mark a remarkable milestone in the pursuit of sustainable materials and resource management. Through meticulous material design, innovative manufacturing processes, and the integration of renewable bio-resources, we have embarked upon a transformative journey towards a more sustainable future. The outcome of our research provides a solid foundation for further exploration, technological breakthroughs, and the realization of a circular economy, where the valorization of resources and the principles of sustainability converge harmoniously.

Wen Wang

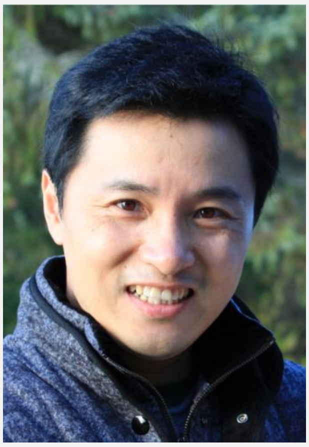
Beijing University of Chemical Technology, China

Member of the IWA Young Water Professionals China Chapter

Wen Wang is a full professor at Beijing University of Chemical Technology (BUCT). Prof. Wen Wang has expertise in biotechnology for sustainable water treatment, resource recovery, CO_2 capture and utilization. She was licensed about 20 patents, and has authored or co-authored over 60 peer-reviewed articles in prestigious journals including ACS catalysis, Water Research, Chemical Engineering Journal, Renewable and Sustainable Energy Reviews, etc...

Catalyst- microbiome hybrids enable highly selective chain elongation of syngas into n-caproic acid

Medium chain carboxylic acids synthesis (MCCAs) from syngas provides a promising route for coal/organic waste/natural gas converting into high value-added chemicals. However, neither purely chemical synthesis methods nor purely biological approaches seem poised to realize the potential of syngas-to-MCCAs. Hereby, we developed a hybrids approach and created an alternative pathway for C1 chain elongation to C6, which altered common recognition of carbon fixation. We combined the efficient carbon fixing of heterogeneous catalysts with the high specificity, low cost and self-adaptation of anaerobic microbiomes. In the hybrids system, inorganic carbon fixation into organic carbon (adsorbed pyruvic acid) was accomplished by the heterogeneous Pt/Fe2O3 catalysts, the adsorbed pyruvic acid was subsequently metabolized by the anaerobic microbiome. This hybrids system significantly improved CO conversion and n-caproic acid production (6600 mg COD/L), which was 50-190% higher than observed in previous studies. The interactions were revealed by macro-omics and in-situ DRIFTS, demonstrating a manipulated inorganic carbon-to-chemical fixation route. More importantly, this proposed hybrid modular platform allows for the production of various molecular targets, without any setup change in the components for carbon capture and production of other chemicals, by varying only the downstream microorganisms.



Mingjie Jin

Nanjing University of Science and Technology, China

Mingjie Jin is a full professor of Nanjing University of Science and Technology (NJUST). He obtained his Ph.D. in Chemical Engineering at Michigan State University. Prof. Jin is mainly engaged in the research of biorefining lignocellulosic biomass to fuel ethanol, microbial lipid, lactic acid and other bio-chemical products, which is supported by funding agencies, such as National Key R&D Program of China, National Natural Science Foundation of China, etc. He has published over 130 peer-reviewed articles in prestigious journals (e.g. Energy & Environmental Science, Science Advances) and has obtained 15 authorized patents. He serves as the editorial board member for journals, such as Biofuels, Bioproducts and Biorefining.

DLC lignocellulosic sugar platform for biofuels and biochemicals production

Bioconversion of lignocellulosic biomass to fermentable sugars and establishment of lignocellulosic sugar platform for biofuels and biochemicals production will benefit both environmental sustainability and social sustainability. Nevertheless, there are several issues impeding the implementation of lignocellulosic biorefinery. For instance, lignocellulosic biomass is dispersed, seasonal, and of low bulk density, which makes it difficult for logistics. Furthermore, traditional biomass pretreatment methods typically employ severe conditions and generate many toxic degradation products, which leads to low fermentability of pretreated biomass. To address these issues, we invented a novel pretreatment method: Densifying Lignocellulosic biomass with alkaline/acidic Chemicals (DLC), which is of low-cost and easy to implement. The pretreated biomass is of high density, high durability, with microbial contamination prevented, which greatly facilitates biomass logistics. DLC biomass also owns high enzymatic digestibility and high fermentability. The DLC based sugar platform provides high potential for biofuels and biochemical production. With the microbial strains developed in our lab, an ethanol titer over 85 g/L, a microbial lipid titer over 38 g/L, a lactic acid titer over 200 g/L were achieved on this sugar platform, without washing or detoxifying pretreated biomass. The promising results demonstrated great potential of DLC sugar platform for lignocellulosic biorefinery.

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Jifeng Yuan

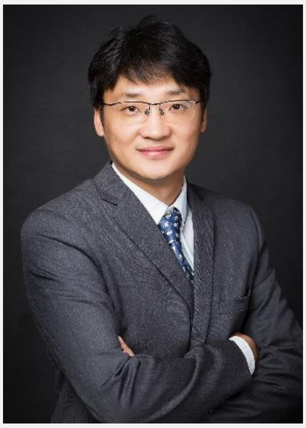
Xiamen University, China

Dr. Jifeng Yuan is a full professor of Xiamen University (XMU). He obtained Ph.D. degree in Biomedical Engineering from Nanyang Technological University in 2012. Prior to joining Xiamen University, he worked as a research scientist at National University of Singapore (2012–2016), senior research fellow at Agency for Science, Technology and Research (A*STAR) (2016–2017), and research fellow at National University of Singapore (2017–2018). His research mainly focuses on implementing synthetic biology principles to build microbial cell factories for synthesis of natural products and value-added chemicals. In the past five years, Prof. Yuan has more than 30 first-authored or corresponding authored papers in prestigious journals including ACS Synthetic Biology, Natural Product Reports, and Green Chemistry.

Engineering *Saccharomyces cerevisiae* for synthesis and accumulation of aldehydes

Microbial synthesis of aldehyde from renewable feedstocks is limited by the host native metabolism with rapid degradation to alcohol and acid. Here, we report that the capability of *Saccharomyces cerevisiae* for synthesis and accumulation of aldehydes could be dramatically improved by systematic deletion of genes involved in aldehyde reduction and oxidation. Based on the reduced aromatic aldehyde reduction (RARE) yeast platform, we examined *de novo* synthesis of retinal and vanillin in yeast. For instance, we devised a dual coenzyme-A free pathway for vanillin overproduction in yeast. Systematic engineering to optimize the supply of cofactors (NADPH and S-adenosylmethionine) together with metabolic reconfiguration of precursor supply enabled the engineered strain to produce 365.56 ± 7.42 mg l^{-1} under shake-flasks, which represents the highest vanillin titer from glucose achieved to date.

Taken together, the performance criteria of aldehyde productivity are adequate for potential industrial implementation. We also envision that the engineered aldehyde-accumulating yeast platform might be applicable for synthesizing other aldehyde-related compounds such as alkaloids and fragrances.



Qiang Fei

School of Chemical Engineering and Technology, Xi'an Jiaotong University

Prof. Fei earned his PhD in Biochem Eng at KAIST in 2011 under the supervision of Prof. Ho Nam Chang. From 2011-2016, he was serving as a postdoc and staff engineer at MIT and the National Renewable Energy Laboratory (NREL), respectively. Prof. Fei joined Xi'an Jiaotong University as a PI in 2016 leading a research team working on the construction and development of biocatalysts for biofuel production including lipids, biodiesel, isobutanol, and single cell protein. His group has been funded by more than ten projects, including National Key R&D Programs of China, NSFC, Key R&D Program of Shaanxi Province and etc. As the first author or corresponding author, Prof. Fei has published more than 50 peer-reviewed research papers in Biotechnol Adv, Biotechnol Biofuel, Bioresour Technol, Energ Convers Manage, etc. Currently, he is focusing on developing fermentation processes using C1 gaseous substrates and lignocellulosic biomass for the production of lipids, chemicals and nutrients as well as related techno-economic analysis (TEA) and life cycle analysis (LCA)

A carbon-neutralizing bioroute for sustainable aviation fuel production from greenhouse gases

Massive food waste generated is responsible for approximately 10% of global greenhouse gas emissions. To reduce carbon losses and environmental issues, a carbon-neutralizing bio-route has been proposed for upgrading food wastes in a carbon-neutralizing and economical fashion. In this study, both CH4 and CO2 in biogas derived from food wastes was sequentially bio-converted into sustainable aviation fuel (SAF) by microorganisms. A life cycle assessment and techno-economic analysis of this bio-route were estimated. Because of lower operating temperature and pressure of the reactor, the bioroute-based SAF production presents lower environmental impacts, compared with the traditional route of hydrothermal liquefaction. The capital and operating expenditure were calculated to show the proof-of-concept under state-of-art technologies. Finally, our economic results show that the lowest selling price of bioroute-based SAF is around US$0.81 kg-1, considering as a potential substitution of the petroleum-based jet fuel.

Ying Zhang

Synthetic Biology Research Centre
University of Nottingham, UK

Ying Zhang is an Assistant Professor working in the School of Life Sciences University of Nottingham, with strong research interests in microbial engineering biology and synthetic biology for medical and industrial applications. She has been working with several commercially valuable bacteria, using metabolic engineering and synthetic biology approaches to generate novel strains with advanced properties such as enhanced products yield and selectivity. Her group routinely handle and genetic modify “difficult” bacteria including expertise in the genetics and genomics of methane oxidising methanotroph. Her lab has made major improvements in genetic systems for industrially relevant Clostridia (e.g. DOI 10.1371/journal.pone.0122411) and engineering of Parageobacillus thermoglucosidasius for utilisation of wheat straw as a sustainable carbon source (DOI 10.1186/s13068-019-1540-6).

Genetic tools development in novel Methylotrophs

Methylotrophs are a diverse group of microorganisms that can use reduced one-carbon compounds, such as methanol or methane. Methane (CH4) is an important greenhouse gas and a source of energy for heating, lighting and generation of electricity. CH4 also serves as a source of carbon and energy for methane-oxidizing bacteria - methanotrophs. In addition to bioremediation properties and balancing CH4 levels in the environment, methanotrophs can be used to produce platform chemicals like lactate; biopolymers such as poly-3-hydroxybutyrate (PHB) and animal feed in the form of single cell protein. To harness their industrial and environmental potential, it is important to establish methods for genetic engineering of this group of organisms. We have developed an armoury of forward and reverse genetic tools to facilitate gene function studies, identify essential genes, and engineer the organisms for desired traits.

- Tn5 based transposon random mutagenesis system was implemented and used for TraDIS (transposon-directed insertion site sequencing) to identify essential genes and genes crucial for niche specific condition.
- CRISPR technology for rapid generation of clean gene deletions and DNA cargo insertions in methanotrophs, demonstrating CRISPR-Cas9 genome editing in industrially relevant *Methylococcus capsulatus* and *Methylocystis parvus* species.

Xueping Guo

Chief Scientist of Bloomage Biotechnology

Professor of Shandong University

Xueping Guo is the first person to research the production of Sodium Hyaluronate by fermentation in China from 1990. His work ended the history of hyaluronic acid production only by extraction from animal tissue, and started the new era of the fermentation production of Sodium Hyaluronate in China. Now Bloomage Biotechnology Co., Ltd., which Dr. Guo works for, is the largest manufacturer and supplier of Sodium Hyaluronate in the world. He also developed a series of hyaluronan products related to the fields of ophthalmology, orthopedics, plastic surgery and wound care, including a national new drug, two active pharmaceutical ingredients, a pharmaceutical excipient, eight medical device products. Among them, the cross-linked sodium hyaluronate gel was the first domestic soft tissue filler approved by CFDA in China.

Advances in synbiology study of hyaluronan

The linear acidic mucopolysaccharide hyaluronan (HA), commonly referred to as hyaluronic acid, is extensively employed in ophthalmology, orthopedics, aesthetic medicine, cosmetics, food, and other areas. After the discovery that Streptococcus can also make HA in 1937， the extraction of hyaluronic acid from chicken crowns was eventually supplanted by fermentation, which is now the primary process employed by manufacturers of HA around the world.

With the development of synthetic biology, the use of various chassis bacteria to generate hyaluronic acid with a better yield has become a research focus. The researchers used Bacillus subtilis, Corynebacterium glutamicum, Lactococcus lactis, etc. as the chassis cells to construct the hyaluronic acid synthesis pathway, so that the hyaluronic acid yield reached 19.4 g/L, 74.1 g/L, and 4.6 g/L respectively. By employing its own strain of Streptococcus zooepidemicus for the transformation of metabolic pathways, Bloomage Biotechnology Corporation Limited has achieved homologous recombination and developed CRISPR-Cas9 editing tools and editing techniques. By bolstering the synthesis path, it will continue to carry out genome-level alteration, driving more carbon flux into HA biosynthesis and balancing yield and molecular weight.

Xiaodong Wang

Chemical Engineering, Lancaster University, UK

Xiaodong Wang is an Associate Professor in Chemical Engineering at Lancaster University. Prior to this, he was an Assistant Professor in Chemical Engineering at the University of Aberdeen. He obtained his PhD at Heriot-Watt University (2014) and completed both MS and BE studies at Tianjin University. Xiaodong's research is mainly in the areas of heterogeneous catalysis and process systems; his recent work focuses on the innovative application of heterogeneous catalysts (*e.g.*, supported metals) in enzymatic transformations *via* cofactor regeneration. The developed systems based on integrated inorganic-enzymatic materials/processes have been used for energy and sustainability applications (*e.g.*, H_2 production and CO_2 abatement). He is currently PI of two consecutive EPSRC New Horizons awards.

Heterogeneous Catalysis Mediated Cofactor Regeneration for Biomanufacturing

Biotechnology has been widely used in the chemical and pharmaceutical industries, where synthesis using enzymes plays a significant role. Oxidoreductases, as one of the largest classes of enzymes (~25% of all enzymes), are essential for enzymatic redox reactions that in turn are key steps in the manufacture of products ranging from specialty to commodity chemicals. Enzymatic reduction typically requires the stoichiometric consumption of an expensive cofactor, NAD(P)H (the reduced form of nicotinamide adenine dinucleotide), which acts as a hydride/electron donor and is oxidised to its oxidised form, *i.e.*, $NAD(P)^+$. NAD(P)H must be regenerated (*i.e.*, $NAD(P)^+$ reduction to NAD(P)H) in situ to make the entire process viable. Similarly, enzymatic oxidation reactions depend on the stoichiometric use of $NAD(P)^+$, as a hydride/electron acceptor, which is reduced to NAD(P)H. Due to the high cost, in situ oxidation of NAD(P)H back to $NAD(P)^+$, namely regeneration, is a must. We have recently established the utilisation of heterogeneous catalysis in such regeneration reactions accompanied by the consumption and generation of molecular hydrogen. A heterogeneous catalyst is preferred over other regeneration methods because it is easy for downstream separation, catalyst recycling/reuse and scaling up, decreasing cost and energy demand.

Results have shown that for NAD(P)H regeneration, catalyst surface charge plays a key role in controlling the activity of supported Pt and the most selective heterogeneous catalyst (*i.e.*, PtSn alloy on a silica carrier) obtaining a 90% selectivity to 1,4-NADH (at full conversion) can be established. The exceptional selectivity can be attributed to Sn disturbing the Pt ensemble, altering the mode of NAD^+ adsorption and directing the reduction to the 1,4-position of the nicotinamide ring. For its reverse reaction, i.e., $NAD(P)^+$ regeneration, the order of turnover frequencies (Pt > Pd > Cu > Au, Ni and Co), governed by hydrogen binging energy, coincides with those otherwise observed in electrochemical hydrogen evolution reactions. A Pt/activated carbon system has been established with turnover frequencies that are an order of magnitude higher than those of Pt/oxide, a result due to the electron transfer/transportation capacity of activated carbons. Both regeneration methods are compatible with corresponding enzymatic reduction and oxidation reactions for biomanufacturing.

Yongqin Lv

National Energy Research and Development Center for Biorefinery, Beijing Key Laboratory of Bioprocess, College of Life Science and Technology, Beijing University of Chemical Technology, Beijing, 100029, China

Prof. Yongqin Lv is a professor at College of Life Science and Technology at Beijing University of Chemical Technology and deputy director of Beijing Key Laboratory of Bioprocess. Her research interests include CO_2 separation and fixation, biocatalysis, and engineering of artificial antibody for different applications. She has published 70 papers in SCI-index journals including *J. Am. Chem. Soc.*、*Adv. Sci.*、*Prog. Energ. Combust.*、*Biotechnol. Adv.*, and applied more than 20 patents.

Boosted Activity by Engineering the Enzyme Microenvironment

As biocatalysts, enzymes involve in almost every biochemical reaction essential for life. For successful industrial applications, high activity and stability are the necessary characteristics for enzymes. However, the industrial operational conditions are often quite different from the natural environment of enzymes (e.g. pH-value, temperature, and organic co-solvents) causing the severe loss of enzyme activities. Protein engineering such as site-directed mutagenesis and directed evolution provides a straightforward approach to improve enzyme activity and stability generally by regulating the enzyme active sites or the diffusion channel of substrates and products. Immobilization of enzymes on heterogeneous supports or carriers is another effective strategy to stabilize enzymes, and enable their easy recovery and continuous use. However, a decreased apparent activity is usually observed for the conventional immobilized enzymes compared with its native counterpart due to the distortion of tertiary structure and blockage of substrate accessing during the immobilization process.

Herein, we have designed new enzyme immobilization carriers that can boost enzyme activity and at the same time function as “artificial” chaperones to assist refolding of denatured enzymes. To provide the required specific interactions between solid carriers and substrates, molecular imprinting technology was employed to synthesize molecularly imprinted polymer nanoparticles (nanoMIPs) using the whole enzyme protein as the template. By engineering the local chemical microenvironment of enzymes via varying the formulations of nanoMIPs, the enzyme stability and activity were remarkably enhanced by maintaining the native conformational structures of enzymes. Moreover, the nanoMIPs assisted enzyme renaturation by promoting refolding of denatured enzymes.

Georgios Marnellos

University of Western Macedonia (UoWM), Greece
BoD Member of the Cluster of Bioeconomy & Environment of Western Macedonia (CluBE)
Associate Editor of the MDPI Hydrogen journal

Georgios Marnellos is a full professor at the Department of Mechanical Engineering of the UoWM. He is active in a wide range of applications related to the environmental impacts of energy production and use, the renewable and alternative energy sources and the development and evaluation of innovative energy materials, devices and systems for P2X technologies. Subjects such as electrochemical engineering (SOFC/SOEC, cell reactors), heterogeneous catalysis (H_2 production, CO_2 hydrogenation, VOCs abatement, DeNOX), solid fuels thermochemical conversion, process system engineering & optimization are at the forefront of his interests.

Effect of reaction conditions and pretreatment protocol on CO_2 hydrogenation to light olefins over Layered Double Hydroxide catalysts

The increasing CO_2 emissions are a stressing challenge, requiring immediate plans to reduce them in order to protect the ecosystem and human life. In this context, the Green Deal strategy foresees the large-scale deployment of variable renewables and alternative fuels in the energy mix as the main approaches to reach the ambitious targets for carbon neutrality. However, due to the intermittent character of solar and wind power, there is a need for energy storage technologies with the ability to store large amounts of energy over high time periods as is the case of chemical storage to hydrogen or synthetic fuels and chemicals. In the latter case, industrially captured CO_2 emissions are combined with solar electrolytic hydrogen and a variety of fuels and chemicals can be produced. CO_2 hydrogenation to light olefins offers a unique solution to detach the petrochemical industry from carbon emissions. To convert CO_2 into lower olefins, a multi-step process is commonly followed, involving the modified Fischer-Tropsch synthesis (MFTS) catalytic route. One of the main challenges of this route is associated with the distribution of products, which follows the Anderson-Schulz-Flory (ASF) law, limiting the obtained selectivity towards light olefins. To address this challenge, researchers are focusing on optimizing the reaction conditions in order to favor the production of olefins as well as to develop active, selective and stable multi-functional catalysts that can bypass the ASF distribution and provide high yields for light olefins. In the present work, Layered Double Hydroxide (LDH) derived catalysts were synthesized, characterized and evaluated in the reaction of CO_2 hydrogenation to light olefins. Preliminary experiments were elaborated to define the optimum reaction conditions (temperature, pressure and WHSV) and pretreatment atmosphere. ZnFeAl LDH-derived catalysts revealed the optimum behavior with light olefins yield approximately equal to 10% at 350 ^oC and 20 bars.

Bo Yu

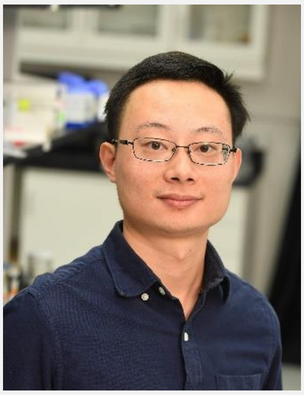
Institute of Microbiology, Chinese Academy of Sciences
Deputy director, CAS Key Laboratory of Microbial Physiological and Metabolic Engineering, IMCAS

Dr. Bo Yu is a full professor and group leader at Institute of Microbiology, Chinese Academy of Sciences (IMCAS). He also serves as the executive director, CAS-TWAS Centre of Excellence for Biotechnology, which the center is focusing international collaboration on industrial biotechnology. His research interest is on synthetic biotechnology, especially in the aspect of systems metabolic engineering of strains for production of bio-based chemicals. Dr. Yu is the member of Editorial abroad of journals <Applied and Environmental Microbiology> & <Environmental Microbiology>. He has authored or co-authored over 90 peer-reviewed article and to date, five patented techniques in his lab have been transferred to industry.

Rationally engineering strain and enzyme for green manufacturing of biochemicals

Biomanufacturing is a green production method that utilizes biological functions for material processing and synthesis, and is expected to change the world industrial manufacturing pattern in fields such as energy, chemicals and medicine. Metabolic engineering aims at modifying the endogenous metabolic network of an organism to harness it for a useful biotechnological task, for example, production of a value-added compound. With the assistance of synthetic biology, including the rapidly developed enabling techniques as molecular genetics, computational biology and protein design, we will no longer be limited to existing pathways and enzymes but be able to design entirely novel pathways in a rational fashion and thereby greatly broaden our capacity towards chemicals and fuel biomanufacturing.

This report will introduce the progress made by our research team in the design of biosynthetic pathways as well as optimization of cell factories for production of high-value chemicals and pharmaceutical chiral intermediates.



Yifei Zhang

Beijing Advanced Innovation Center for Soft Matter Science and Engineering, Beijing University of Chemical Technology, People's Republic of China

Yifei Zhang is a Professor at the Beijing Advanced Innovation Center for Soft Matter Science and Engineering, Beijing University of Chemical Technology, China. He earned his Ph.D. degree in 2015 from Tsinghua University and completed his postdoctoral training at Columbia University in the City of New York. He has published more than 40 peer-reviewed journal papers, some of which have appeared in Nature Catalysis, Nature Communications, ACS Catalysis, Nano Letters, ACS Nano, etc. He was recognized as a finalist of the 2020 Blavatnik Regional Awards for Young Scientists. His current research interests include enzyme engineering, green biocatalysis, and synthetic biology.

Design of new-to-nature PET hydrolases using deep learning

The accumulation of waste plastics has become a severe environmental problem due to their great recalcitrance. Among all kinds of plastics, poly(ethylene terephthalate), also known as PET, is one of the most widely manufactured polyester plastics. Enzymatic degradation is a promising approach for the depolymerization and upcycling of PET. The currently known PET hydrolases are all the result of evolution, with or without a few residues artificially mutated. The limited diversity of PET hydrolases significantly restricts the industrialization of PET upcycling. In this presentation, we will introduce our current work focusing on the de novo design of PET hydrolases based on known catalytic mechanisms and artificial intelligence (AI)-enabled protein scaffolding technology. We create a library of hallucination PET hydrolases by using deep learning algorithms to computationally build up new protein scaffolds to underpin the key catalytic sites in place. We screen reasonable hallucination enzymes by using Alphafold 2 and molecular dynamics simulations. Finally, we test the protein expressibility and activities toward the simulated substrate and PET. This presentation will also briefly discuss our current understanding of the mechanism of PET hydrolysis. Our study considerably widens the protein repertoire for enzyme mining and reengineering, providing an avenue for the design of new-to-nature PET hydrolases.

Luo Liu
Beijing University of Chemical Technology, China
College of Life Science and Technology

He studied technical biology at Institute for Technical Biochemistry, University of Stuttgart. Now he is associate professor at Beijing University of Chemical Technology. He is focusing on molecular evolution of enzymes. He is principal researcher of 3 national projects and 3 subprojects, he has more than 70 peer-reviewed articles including ACS catalysis, etc.

Quantum mechanics study on Plastics degradation mechanism

Plastics are favored synthetic materials for many civil and industrial applications due to their low cost, light weight and good water resistance. However, the improper management of plastic waste coupled with the poor degradability of certain petrochemical plastics has resulted in the accumulation of plastic debris in natural environments, leading to severe pollution. As a result, there is an urgent requirement to develop effective and environmentally friendly methods for breaking down the carbon skeleton structure of plastics. Biodegradation, which offers a sustainable and economical approach, holds great promise in the treatment of plastic waste. In recent years, various strains with PE degradation potential have been screened, including Microbulbifer hydrolyticus IRE-31 strain, Bacillus velezensis C5 strain, etc. Furthermore, key enzymes for the biodegradation were proposed, containing laccase, cytochrome P450, etc. Nevertheless, the biodegradation mechanism of PE has not yet been thoroughly studied. The oxidative scission of the C–C backbone may be the initial step of the biodegradation of PE. Therefore, a quantum mechanical calculation was used to investigate it thoroughly. Here, we studied the reaction path of C–C bond oxidation via hydroxyl radical in PE. The flexible force constants and fuzzy bond orders of the C–C bonds were calculated in the presence of one or more carbocations in the same PE carbon chain. By comparison, the strength of the C–C bond decreased when carbocation density increased. However, the higher the density of carbocations, the higher the total energy of the molecule and the more difficult it was to be generated. The results revealed that PE oxidized to alcohol and other products, such as carboxylic acid, aldehyde and ketone, etc. Moreover, the presence of carbocations was seen to promote the cleavage of C–C backbones in the absence of oxygen.

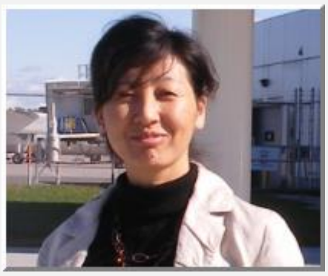
Weiliang Dong

Nanjing Tech University, China

Weiliang Dong is a full professor in NJTech and the President of the New Rural Development and Research Institute. Prof. Dong focus on ① Biodegradation and biotransformation of environmental pollutant, such as plastics, pesticide; and ② Screening of novel catalysts and protein engineering, such as esterase, amidase, oxidordeuctase. In recent years, researches on upcycling of low-value substrates, including lignocellulose and plastics. The research results have been published in Trends. Biotechnol.、Biotechnol. Adv.、Appl. Environ. Microbiol. He has published 65 SCI articles and more than 7 chinese papers. Participated in 2 Chinese treatises writing and 1 English treatise translation.

Enzymatic Depolymerization of PU Plastics for Recycling

Polyurethane (PU), a polyester composed of segmented co-polymers with both hard (polyols) and soft segments (polyisocynates), is extensively utilized in plastic production and has accumulated globally as environmental waste. Bio-based degradation and recycling methods using microorganisms or enzymes have emerged as a promising option in this context due to the mild and environmentally friendly reaction conditions required, as opposed to mechanical and chemical recycling. Compared to PET plastic, the research on PU polymer is still in its initial stage, and there are still issues such as a lack of enzyme components, low efficiency of degrading elements, and unclear degradation mechanisms. In this study, we utilized high-throughput screening methods to obtain several PU-degrading strains, among which the fungus P7 exhibited the strongest degradation ability. We further elucidated the metabolic pathway of P7 in degrading polyester-type polyurethane and cloned the key enzyme CpCut1 involved in the degradation process. We also achieved efficient degradation of polyether-type polyurethane using yellow mealworms and analyzed the structural changes in their gut microbiota. Additionally, we characterized the depolymerization ability of CpCut on polyester-type polyurethane and constructed a dual-enzyme system to enhance the depolymerization efficiency. By hydrolyzing the ester bonds or the urethane bonds, the complete depolymerization of polyester-PU can be promoted, ultimately achieving enzymatic depolymerization and recycling of PU.Furthermore, we achieved complete depolymerization and recovery of both polyester-type polyurethane and polyether-type polyurethane through the construction of a chemical-biological cascade process. We also constructed a microbial strain that efficiently utilizes small-molecule monomer 1,4-butanediol. In the future, through synthetic biology technology, the strain can be modified to achieve high-value conversion of waste plastics.



Xinshu Zhuang

Guangzhou Institute of Energy Conversion, CAS, China

Xinshu Zhuang is a full professor of Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences(GIEC-CAS). She has authored or co-authored over 160 peer-reviewed articles in journals including Green Chemistry, Progress in Energy and Combustion Science， ACS Sustainable Chemistry & Engineering, Journal of Cleaner Production，Journal of Biological Macromolecules，Fuel，Cellulose and Bioresource technology etc., and she was licensed about 50 patents.

A novel alkaline lignin stable fractionation of lignocellulose using biocompatibility triethylene glycol

Efficient fractionation of lignocellulose to generate high-reactivity lignin and highly digestible holocellulose remains challenging. Herein, a novel “lignin first” strategy under alkaline conditions was proposed, as recyclable bio-based biocompatibility alkali-assisted co-solvent systems composed of water and triethylene glycol(TEG/H2O) is first developed, which provide a lignin removal ~80% with the desired lignin “stabilization” effect while reserving most of the holocellulose (~90%) under the optimal condition. The residue exhibits excellent enzymatic saccharification efficiency (~90%), and more impressively, even without the washing process, the yield of glucose and xylose after enzymatic hydrolysis was more than 80%. Compared with cellulolytic enzyme lignin (CEL), the lignin recovered after TEG/H2O pretreatment(TEGL) displays excellent β-O-4 bond retention and almost equal aromatic product yield with higher selectivity during catalytic-free pyrolysis. The proportion of the main aromatic compounds in TEGL pyrolysis products was higher than that of CEL, accounting for ~81% and ~60%, respectively. We further calculated the yield of aromatic compounds through effective carbon number(ECN). The yields of aromatic monomers are ~20% and ~19% for CEL and TEGL, respectively. Compared with CEL (~65%), the content of G-type and S-type in TEGL accounted for ~78%. Moreover, the recyclability experiment of the TEG/H2O solution showed that the pretreatment efficiency (delignification and enzymatic saccharification) was maintained after the recycling process. Compared with the fresh solvent pretreatment, after the third cycle pretreatment with the solvent regenerated after lignin precipitating, the lignin removal increased by 3%, and the retention of holocellulose was only reduced by 3%. Finally, the interaction between TEG and lignin was revealed by quantum chemical calculation, indicating that the interaction between TEG and G-unit was the strongest. Overall, this work developed a mild biomass pretreatment method with high biocompatibility TEG/H2O promising for a green and closed-loop biorefinery concept for converting lignocellulosic biomass into high-quality lignin and fermentable sugars without washing process.

Savvas Douvartzides

Department of Mechanical Engineering, University of Western Macedonia, ZEP, Kozani, 50100, Greece.

Savvas Douvartzides is Associate Professor in the Department of Mechanical Engineering of the University of Western Macedonia (UOWM). He obtained his diploma (Mechanical Engineering) in (1997) and his Ph.D. (Electrochemistry/Fuel Cells) in 2004, from the University of Thessaly (UOT). He also worked as a post doc in UOT between 2005-2006. Between 2005-2011 he worked as an Adjunct Assistant Professor in the Mechanical Engineering Department of TEIWM where he was elected as an Assistant Professor in 2014. He became an academic member of UOWM in 2019 and was elected as Associate Professor in the same year. Dr S. Douvartzides is author of more than 37 research publications in Peer Reviewed International Journals, which have received over 1276 citations (Scopus), giving him an h-index = 15.

Modeling of a biogas-fueled combined heat and power (CHP) Solid Oxide Fuel Cell plant for building and district heating applicationsg

The poly-generation of simultaneous energy outputs from sustainable energy sources is a promising technical perspective for building and local microgrids especially where sufficient energy intensity justify investments in smart grids and district heating networks. In situ anaerobic digestion of biomass and organic waste has the potential to provide sustainable distributed generation of electric power together with a viable solution for the disposal of municipal solid wastes. To this end, a biogas-fueled Solid Oxide Fuel Cell (SOFC) plant can be designed as a perfect waste-to-energy example for the efficient production of electricity and heat for building or district heating applications. In the present study, a SOFC stack was assumed to consist of individual cathode-supported tubular SOFC cells operating with direct biogas supply with internal biogas reforming. The electrochemical modelling of the combined power and heat (CHP) biogas-fueled SOFC plant is provided together with a thorough parametric analysis on the effect of temperature, pressure and biogas chemical composition on the electrical and thermal efficiencies of the plant.

#1 Establishment of a novel high-throughput screening method for amtimicrobial peptides based on SpyCatcher/SpyTag system
Sai Wen, Jin Li

#2 Metabolic engineering of Escherichia coli Nissle 1917 for the biosynthesis of heparosan
Ruiji Wu, Zheng-jun Li

#3 Construction of a software platform for automated biological experiments based on hardware integration
Yijing Chen, Wenlong Zhu, Yusheng Shao, Tianwei Tan

#4 Establishment of efficient Agrobacterium and PEG-mediated transformation in Naematelia aurantialba NX-20 using comprehensive optimization
Yuhang Ma, Hong Xv, Rui Wang, Yibin Qiu, Liang Sun, Sha Li, Peng Lei

#5 Rapid screening and synthesis of abiotic synthetic receptors for selective bacterial recognition
Shao Shengnan, Gao Shuang, Li Yuan, Lv Yongqin

#6 CO2 hydrogenation for the production of methanol using Pt/ZrO2 catalysts: The effect of support modification
A.I. Latsiou, M. Pliaka, N.D. Charisiou, A. Bansode, M.A. Goula

#7 CARBON DOTS-TITANIUM DIOXIDE NANOCOMPOSITES FOR PHOTOCATALYTIC HYDROGEN PRODUCTION VIA ORGANIC COMPOUND DECOMPOSITION
Pinelopi P Falara, Maria Antoniadou, Konstantinos Kordatos

#8 Trends in the biotechnology, human wellbeing and climate transition nexus in Africa: the case of Cameroon By Liliane Flore Entcheu Tiemenie
ENTCHEU TIEMENI LILIANE FLORE

#9 CO_2 hydrogenation at high pressure over Rh-based catalysts prepared by modified wet impregnation
A.I. Latsiou, N.D. Charisiou, A. Bansode, M.A. Goula

#10 CO_2 methanation over Ni/Pr-CeO_2 catalysts prepared via co-precipitation
Anastasios I. Tsiotsias, Georgios I. Siakavelas, Victor Sebastian, Ayesha A. AlKhoori, Nikolaos D. Charisiou, Kyriaki Polychronopoulou, Maria A. Goula

#11 CO_2 hydrogenation for the production of methanol using Pt-based catalysts
Pliaka Maria, Latsiou Aggeliki, Siakavelas Giorgos, Charisiou Nikolaos, Goula Maria

#12 Customized optimization of lignocellulolytic enzyme cocktails for efficient conversion of plant biomass residues
Liwei Gao, Peng Zhang

#13 Steam reforming of acetone over Ni based catalysts
Marmanidis Konstantinos, Siakavelas Giorgos, Charisiou Nikolaos, Goula Maria

#14 Biomolecular Condensates of Multi-enzyme System Induced by Metal Ions with Coenzyme Regeneration
Yuxin Chen, Zhehui Ji, Shizhen Wang

#15 Research on the Design and Process Enhancement of 3D Printing Stirrer for Biopolymer Fermentation Applications
Qian Chen, Quanfei Li, Peng Lei, Yian Gu, Liang Sun, Yibin Qiu, Sha Li, Rui Wang, Hong Xu

#16 Lignin valorization via biological conversion routes
Zhaoxian Xu, Pingping Li, Huarong Zhou, Jie Li, Mingjie Jin

#17 The Fabrication of Defective UiO-67 for Improving Activity of Carbonic Anhydrase
Zhao Rui, Wenhui Yang, Pengyan Yang, Fenghuan Wang

#18 Protein engineering of a thermophilic PET hydrolase to enhance the depolymerization of post-consumer PET
Chaofeng Shao, Biqiang Chen, Tianwei Tan

#19 Overexpression of Phospholipase D in Trehalase-deficient Escherichia coli
Shaofeng Chen, Yinghua Lu, Xueping Ling

#20 Strategies for high cell-density cultivation of Akkermansia muciniphila and its potential metabolism
Haiting Wu, Ruixiong Yang, Xueping Ling

#21 Comprehensive utilization and clean production technology from food waste resources
Liao Yonghong, Wang Fenghuan, Feng Xudong

#22 Enhancing energy metabolism of central carbon metabolic flow of engineering pichia pastoris to promote protein high-yield
Hao Shi, Lu Li, Hui Cao, TianWei Tan

#23 Redesign of the rate-limiting enzyme, enoate reductase, in the adipic acid biosynthetic pathway
Zhang Shiding, Zhu Yushan, Tianwei Tan

#24 Production of Fuel Ethanol by Continuous Enzymatic hydrolysis and Fermentation from pretreated corn stalks
Zhang Quan, Li Lanpeng, Gao Huipeng, Wang Meng

#25 Discovery of a highly active and assembly competent Rubisco from the deep sea with potential for carbon dioxide capture
Guoxia Liu, Junli Zhang, Alonso I. Carvajal, Robert H. Wilson, Zhen Cai, Yin Li

#26 Metabolic Engineering of Pseudomonas putida for Fermentative Production of a Flavor Compound from Green Tea
Leonie Benninghaus, Volker F. Wendisch

#27 Improving the specific activity and stability of alkaline pectinase PEL3 through SpyTag/SpyCatcher cyclization
Chao Du, Siqin Tan, Lin Liu, Yuling Zhou, Pan Wu, Guimin Zhang

#28 Optimizing inoculation methods for co-fermentation by two H2-producing strains
Hanxiao Ma

#29 Production of bio-jet fuel with bio-butanol fermented by non-strict anaerobic symbiotic TSH06
Pengfei Wu, Jing Wu, Xiang Yan, Xuejing Qi, Zhangnan Lin, Kuan Li, Genyu Wang, Yujie Zhou, Hongjuan Liu, Keke Cheng, Jianan Zhang

#30 Impact of D-Limonene in the technical and economic feasibility of the anaerobic digestion applied in biorefineries
Jose Fanny Biowa AHEHEHINNOU

#31 Ferrocene-modified Metal–organic Layered Materials and the Application in Glucose Detection
Yu Xiong, Linlin Dong, Dongping Zhan, Shizhen Wang

#32 Substrate specific modification of enzymes to promote sugar biosynthesis
Wan Song, Yuyao Wang, Jiangang Yang, Yuanxia Sun

#33 Study on the Enzyme Catalytic Decoupling Mechanism of Lignin Carbohydrate Complex
Yan Men, Zhiyou Zong, Peng Chen, Yuanxia Sun

#34 Metabolic engineering of Saccharomyces cerevisiae for caffeic acid biosynthesis
Yuanzi Li, Huimin Guo, Yonghong Liao, Fenghuan Wang

#35 Biomass carbon quantum dots as fluorescence probes for high-sensitivity detection of tyramine
Yuhua Zhang, Dianwei Zhang

#36 Green diesel via microalgae oil hydrotreatment
Athanasios Dimitriadis, Loukia Chrysikou, Vasiliki Dagonikou, Vasileios Marios Vasdekis, Nikolaos Tourlakidis, Dimitris Liakos, Stella Bezergianni

#37 Sugar beet residues conversion to saccharides via hydrothermal and acid pre-treatment
Dimitris Liakos, Loukia Chrysikou, Christos Kekes, George Meletidis, Konstantinos Triantafyllidis, Stella Bezergianni

#38 Exploration of polyurethane degrading hydrolases and study on catalytic depolymerization
Weiiang Dong

#39 Protease activated transcription (PAT) signal amplifier for universally improving the performance of microbial sensors
Zhang Faying, Li Yi, Guimin Zhang

#40 The research on genetic tools for novel halophilic bacterium Salinivibrio sp. TGB10
Nan Pu, Zheng-Jun Li

#41 Metabolic engineering of Escherichia coli Nissle 1917 for the biosynthesis of chondroitin
MengruWang, Fangqi Shao, Zheng-jun Li

#42 Modeling and optimization of microbial lipid fermentation by Rhodotorula glutinis based on machine learning
Xu Zhang

#43 C1 for biopolymers challenges: metabolic engineering of methanotrophs to optimize PHA accumulation
Alessandra Mauri, Hendrik Ballerstedt, Lars M. Blank

#44 Integration of electrocatalysis and bio-catalysis to produce biofuels from carbon dioxide
Xinyi Tan

#45 Polymeric membranes through the self-initiation, self-polymerization for high-performance bioethanol pervaporation
Zhihao Si, Chang Liu, Peiyong Qin

#46 Introduction of heterologous XlnR regulatory modules and AraRA731V into Penicillum oxallicum enhances cellulase activities and saccharification efficiency of corn straw
Hongliang Dong, Chengqiang Xia, Xin

#47 Research on the Algorithm of Raman Predictive Models for Fermentation Processes
Kaidi Ji, Zhen Li, Yinlan Ruan

#48 Ionizing radiation enhances the hot-compressed water pretreatment of rice straw for enzymatic hydrolysis
Shuai Lu, Xiyang Liu, Jinwen Guo, Guoce Yu, Junfeng Li, Jianlong Wang

#49 Recent progress in pervaporation membranes for furfural recovery: A mini review
Yan Zhuang, Zhihao Si, Peiyong Qin

#50 Polydimethylsiloxane based membranes for biofuels pervaporation
Zhihao Si, Peiyong Qin, Bart Van der Bruggen

#51 Photo-cured fabrication of PDMS hollow fiber membrane for the pervaporative separation of 1-butanol from water
Siyu Pang, Zhihao Si, Xinmiao Zhang, Peiyong Qin

#52 A Combinatorial Strategy for HRV 3C Protease Engineering to Achieve the N-terminal Free Cleavage
Meng Mei, Guimin Zhang

#53 Single Cobalt Atoms Immobilized on Palladium-Based Nanosheets as 2D Single-Atom Alloy for Efficient Hydrogen Evolution Reaction
Shuai Yang, Lu Lu, Buxing Han, Peiyong Qin

#54 Establishing a platform Escherichia coli strain to generate xylose-derived value-added products
Jia Wang, Xiaolin Shen

#55 Application of enzyme promiscuity to establish non-natural biosynthetic pathways for the production of phenolic compounds
Xiaolin Shen, Qipeng Yuan

#56 Microbial Production of L-Serine from Renewable Feedstocks
Zhang, GaoYujie, XuGuoqiang, LiHui, ShiJinsong, XuZhenghong

#57 Engineering of redox partners and cofactor NADPH supply of CYP68JX for efficient steroid two-step ordered selective hydroxylation activity
Hui Li, Xiaomei Zhang, Jinsong Shi, Zhenghong Xu

#58 Reduction wastewater discharge in second-generation ABE fermentation process by adsorptive removal of organic acid by-products towards the broth recycling system
Changwei Zhang, Tianwei tan

#59 Soluble expression and characterization of recombinant spider silk protein with different numbers of repeative units in E. coli
Mi Shen, Weiyu Zhu, Bixia Zhou, Baoyang Lin, Cheng Cheng

#60 Biofuel synthesis from carbon dioxide via a bio-electrocatalysis system: From 1st to 3rd generation
Haoran Bi, Tianwei Tan

#61 Efficient synthesis of small organic alcohols or acids via multi-strategy metabolic engineering
Yang Zhang, Mingda Li, Meng Liu, Bingqi Cai, Keqin He, Jingchuan, Tianwei Tan

#62 New Anaerobic Fermentation Technology for Treatment of High Protein Wastewater with Low BODCOD
Feng Xudong, Wang Ping, Zhu Qiufeng

#63 Spatial niche construction of a consortium-based consolidated bioprocessing system
Wenming Zhang, Hao Gao, Ziyi Yu, Fengxue Xin, Min Jiang

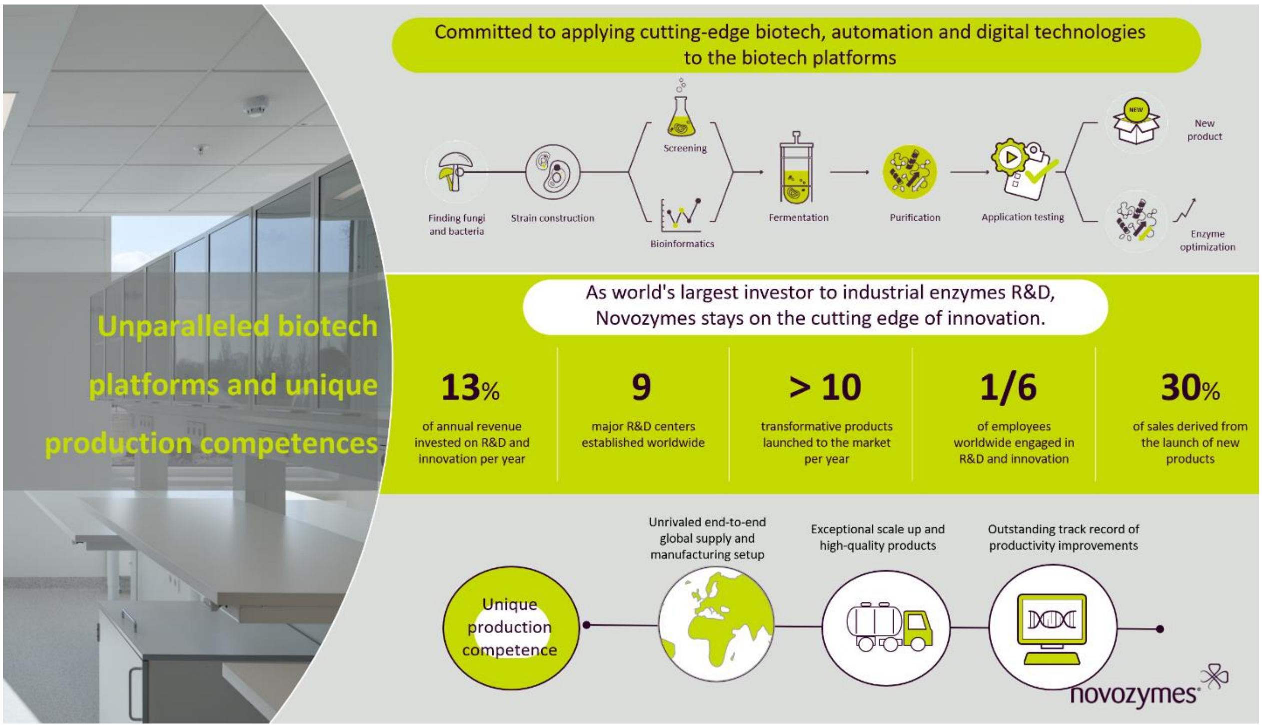
#64 Fine regulation in Corynebacterium glutamicum for high-yield ectoine production by plug-in repressor library
Meijuan Xu, Jiang An, Yunhai Song, Qing Wang, Zhiming Rao

#65 Vibro-fluidization of cohesive particles
Shuo Li, Jan Baeyens, Zehao Li, Yimin Deng, Huili Zhang

#66 Milling Energy and Efficiency in Air Jet Milling
Yimin Deng, Jan Baeyens, Miao Yang, Zehao Li, Huili Zhang, Shuo Li

Novozymes is the world's leading biotech powerhouse headquartered in Denmark, with 6,700 employees in total, over 700 products available in more than 130 countries and regions around the world and are widely used in more than 30 industries. We invest approximately 13% of our annual revenue in research and development every year, with 20 R&D centers and 16 manufacturing sites around the world, enabling us to better serve our customers worldwide.

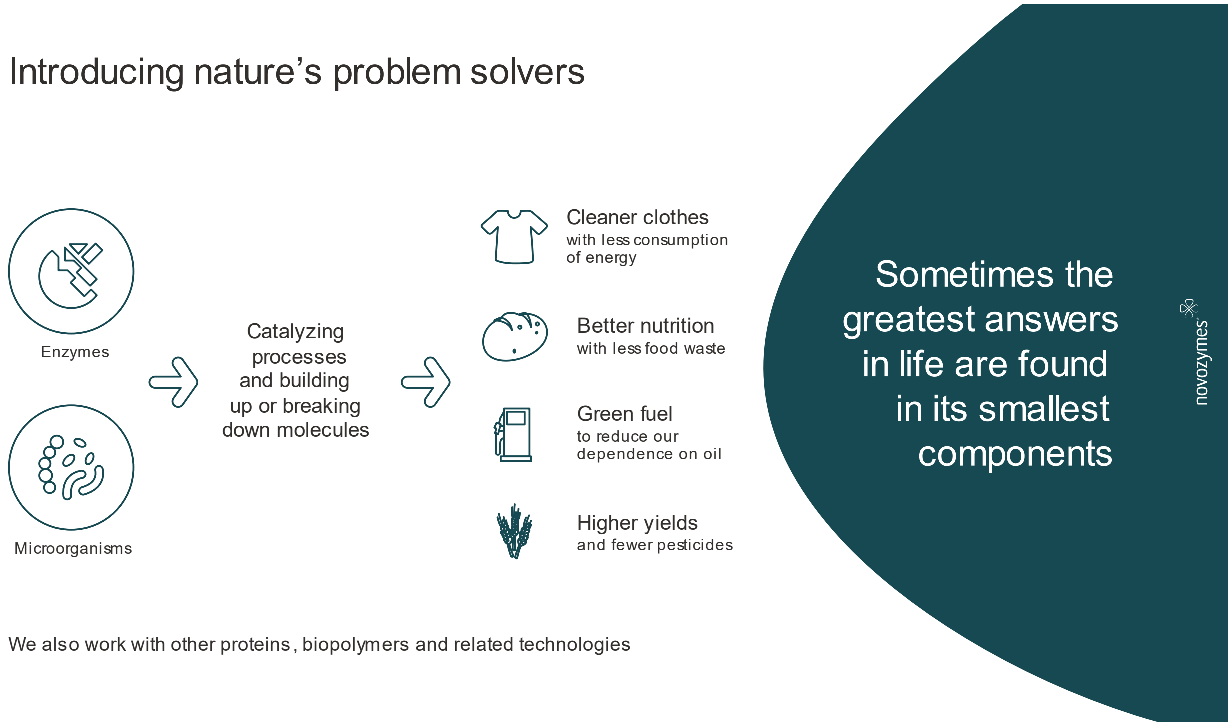
The building blocks in the Novozymes' technology come from a natural process - for example, the enzymes that catalyze processes in every living organism. It then takes insight, innovation, experience and capacity to be able to apply the enzymes in an industrial setting.



Novozymes has years of experience in finding and further developing enzymes and microorganisms. When the basic product is developed, one string of enzymes needs to become trillions in order to create an efficient solution for our customers. This demands extensive capacity for fermenting the enzymes and this is something that Novozymes excels at – we can create large, stable, high-quality solutions for industrial purposes. And we deliver on specification, on time, all over the world. The foundation for this is a global organization with production facilities spread over four continents.

Through technology platforms including enzymes, microorganisms and advanced proteins, Novozymes is committed to leverage the unique power of biotechnology to work with partners to address global challenges such as climate change, food crisis, and health issues, and to help customers in various industries increase agricultural output, improve food quality, reduce food waste, achieve low-temperature washing, reduce chemical use, optimize energy structure, reduce dependence on fossil energy, promote resource utilization of agricultural and kitchen waste, promote human, animal and plant health, and achieve sustainable growth.

Novozymes' business consists of three divisions: Consumer Biosolutions (including Household Care, Food & Beverage etc.), Agriculture & Industrial Biosolutions (including BioAg, Bioenergy, Animal Health & Nutrition, Starch Processing, Oil & Fat Processing, Grain Processing, Palm Oil Processing, distilling, Pharmaceutical Industry and Technical Industries such as Textile, Leather, Water Treatment and Pulp) and Human Health Biosolutions. In addition, Novozymes continues to expand its strategic opportunities in the advanced protein area.



With our biosolutions, you can achieve performance benefits for your products. Your consumer products can stay on top of new trends and help shape the next ones to win over more people. Your brand can build loyalty across supermarket shelves. At the same time, you can optimize process performance and save on costs in your operations. Novozymes' biosolutions replace chemicals, get more out of raw materials, create new value streams and save energy and water. You can minimize cost volatility and disruption in your supply.

Biosolutions also offer crucial sustainability advantages across performance and cost. As an integral part of your brand's value, they provide important sustainability claims, while delivering on your environmental targets for operations. Using biosolutions helps reduce the footprint of your business and meet increasingly demanding regulations.

SIRMET S.A. was founded in 1990 in Patras by a team of engineers and scientists with many years of experience in industry and research institutions. Their aim was to create a company that would provide essential support to companies attempting to establish themselves in the Greek market.

SIRMET S.A. has a long history of engagement with industry and public projects, in co-operation with research institutions. The company's customers are located throughout Greece and in other EU countries, where it co-operates with high technology companies, Technological Institutions and Polytechnics. SIRMET provides services to clients of the private and public sector (e.g., waste management operators, government bodies, local authorities, financial investors, institutions) the fields of:

a) Environmental Engineering (Wastewater and sewage treatment, Treatment of flue gases, Potable water and industrial water treatment/reuse),
b) Rational use of energy - **Renewable energy sources** (photovoltaics, clean energy production, **biomass, biogas production and usage**),
c) Industrial engineering.

The company delivers key solutions ensuring success in all project phases: planning/ Implementation/ Design/ Construction/ Operation. Sirmet is member of PRAXIS network, the biggest organization for R&D networking in Greece.

INDICATIVE R&D PROJECTS:

- BIOCATSYS «Purification system for the removal of hydrogen sulphide from biogas by development of a sophisticated cost efficient nanocatalyst».
- AGROWASTE «Energy Production from Anaerobic Treatment of Agroindustrial Waste».
- LEADERA «Energy production from Anaerobic Treatment of Agroindustrial Waste».
- ALTENER «Integrated Regional action Plan for the development and Exploitation os Small Hydropower and Biomass Energy Potential of Western Greece».
- MEDSPA «Recycling and solid waste Composting of Municipals Nafpaktos, Antirion, Rio and Aktaio».
- LIFE «Solid Waste Management and Treatment of MOTOR OIL Corinth Refineries SA».
- ENVIRONMENT «Optimization of ozonation process in industrial wastewater treatment».
- BRITE EURAM «Development of a Flexible Bioprocess for Handling and Recycling: Seasonal Industrial Process Liquid Effluents "FLEXIBLE"».

Fig. 1: Picture of an anaerobic wastewater treatment plant in the milk processing industry that SIRMET is designed, constructed and tested for LA FARM S.A. The unit was delivered in April 2017.

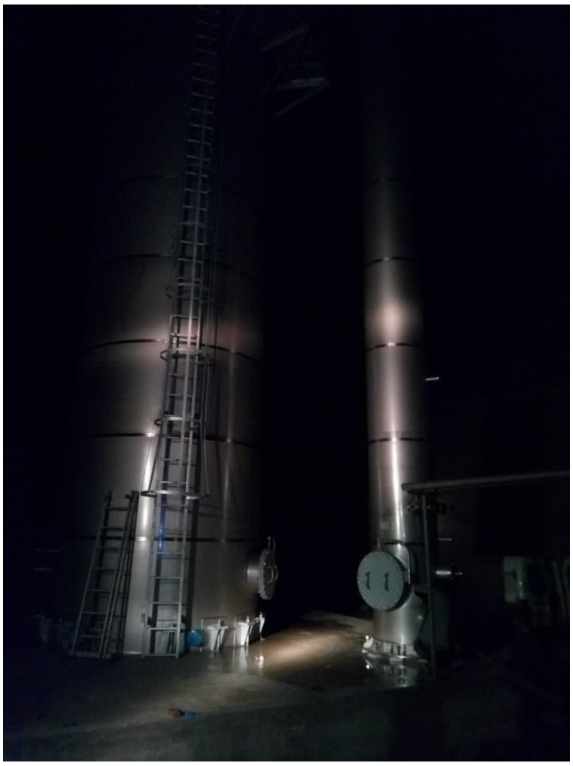


Fig. 2: Picture of an anaerobic wastewater treatment plant in the milk processing industry that SIRMET is constructing for EXARCHOS S.A. (SIRMET has also designed the plant, and will eventually test it). The project is under construction and will be delivered in May 2018.

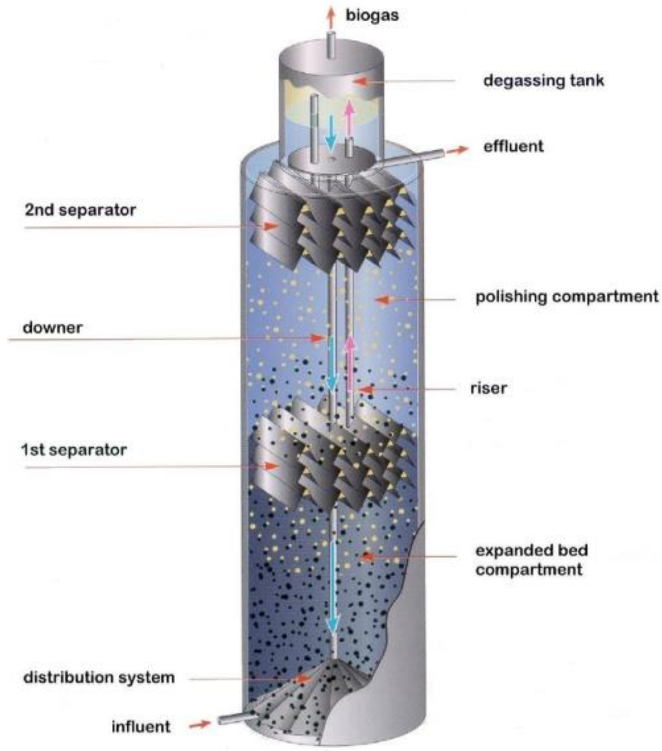


Fig. 3: Schematic representation of an anaerobic paper mill wastewater treatment plant that SIRMET is constructing (SIRMET has also designed the plant, and will eventually test it) for SONOCO ALCORE Hellas S.A. The project is underway and will be delivered in August 2018.

About us

As a world-renowned biotech company that produces bioactive materials, Bloomage Biotech (688363) stays committed to engendering good health and happiness in the lives of its customers through its diversified range of products.
Going forward, Bloomage Biotech will stay committed to sharpening its core competitiveness in technology, products and brand, by developing more high-quality bioactive raw materials and related end products, and playing a bigger role in supporting/engendering generally healthier, happier lives for people/it's customers/clients. Bloomage Biotech aims to become a company that Chinese take pride in, a company that is well-respected nationally/world-wide for its expertise and value.

WORLD HYALURONIC ACID MUSEUM


The World Hyaluronic acid Museum, located in the second plant of Bloomage Biotech in Jinan city, with a construction area of 4154㎡. is a great and panoramic display of HA knowledge and its various applications all along with the development process of HA industry.
The "Synthetic Biotechnology International Innovation Industrial Base" has been settled in Beijing, China, and put into use.

Certification

Global Presence

National "Green Factory"
Shandong Academician Workstation
Unicorn Enterprise in Shandong Province
Gold Medal of China Patent Award

ISO 9001 HACCP EFfCI ECOCERT VEGAN HALAL KOSHER GMP EHS ISO22000 FSSC 22000 COSMOS

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E-mail: customer@bloomagebioactive.com

INTERGEO Umwelttechnologie und Abfallwirtschaft GmbH was founded in 1987 in Austria for the purpose of providing a wide range of environmental services. INTERGEO today operates over 33 subsidiaries in 28 countries worldwide and t**he range of services and great expertise ranks INTERGEO among the top Environmental Technology companies in the world**.

INTERGEO HELLAS was founded in Thessaloniki in 1991 as an affiliate company of INTERGEO SALZBURG. The Company's goal is to provide **services in the fields of renewable, environmental and geotechnical sectors** and transfer know-how, as well as the international experience of the parent company in Greece. INTERGEO is certified according to: EN ISO 9001:2008, EN ISO 14001:2004, OHSAS 18001:2007, ELOT EN ISO/IEC 17025:2005 (Chemical Laboratory in Thermi, Thessaloniki). The scientific personnel of the Company consists of engineering geologists, hydrogeologists, environmental engineers, chemical engineers, chemists, process engineers, environmental engineers and civil engineers (total of 38 members of staff).

INTERGEO has provided services to some of the best known companies in Greece and Cyprus such as, Hellenic Petroleum, BP Hellas, Hellenic Fuels Company, Shell Hellas, Coral, Public Power Corporation, Motor Oil Hellas, Esso Oil, Mobil Oil Cyprus, Eκo Elda, Elinoil., Texaco, Athens International Airport, Egnatia Odos, Hellenic Fertilizers Elfe, Neochimiki, Arcon, Hellenic Xalyvourgia, Elais, Jet Oil, Tosoh Hellas, J&P Avax, Petrolina, Olympic Airways, Enterprises for Water Supply and Sewerage, Aegean Oil, OFC, Aget, Titan, Aldi, Gisco, Hafco, Hellenic Gold, Etva VI.PE., and International Airport "Makedonia". Some indicative projects are presented below:

2013-2014	**Hellenic Petroleum S.A.**, "Removal and management of hazardous asbestos wastes from the cooling tower of the refinery", 84.407,52 €
2009-2014	**Alfa Beta Roto S.A.**, "Management of hazardous wastes of the company «Alfa Beta Roto S.A", 180.698,24 €
2013	**Hellenic Petroleum S.A.**, "Management of waste spent PbO catalysts from Hellenic Petroleum refineries", 79.556,40 €
2012	**Missirian S.A.**, "Remediation works on a natural stream polluted by heavy oil accidentally discharged by the company", 172.200,00 €
2010-2012	**PPC S.A.**, "Disposal of wastes from various company locations", 397.225,00 €
2010-2011	**National Bank of Greece S.A.**, "Transportation, management and disposal of hazardous wastes derived from the company's money printing activities", 124.563,04 €
2010-2011	**Prufrock Management S.A.**, "Management of asbestos wastes", 12.300,00 €
2010	**Archelor Mital Constructions Hellas S.A.**, "Management of hazardous paint wastes" 75.075,33 €
2008-2010	**PPC S.A.**, "Disposal of wastes from various company locations", 494.067,27 €

Fig. The company's headquarters in Thessaloniki (left) and its chemical/research laboratory (right)

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