AGF

Arbeitsgemeinschaft Getreideforschung e. V.

in cooperation with

Max Rubner-Institute

Institute of Safety and Quality of Cereal

and the

Institute for Food Technology

- Fermentation Technology- in Hohenheim

70th Starch Convention
&
15th European Bioethanol and Bioconversion Technology Meeting

April 9th – 10th 2019
in Detmold, Germany

Tuesday, April 9th 2019

07^{30} – 08^{00} Registration

70th Starch Convention

08^{00} **Opening Remarks and review "70 years starch"** by the President of the Association of Cereal Research, **Götz Kröner**, Ibbenbüren (Germany)

Outlook and future for Starch**, Jamie Fortescue,** Brussels (Belgium)

1. Market

08^{45} 1.1. **Stephan Reimelt,** Frankfurt
Digital transformation and the impact on the starch industry

2. Raw material

09^{10} 2.1. **Andreas Blennow,** Frederiksberg (Denmark)
Alternative crops for a traditional potato starch producer

09^{35} 2.2. **Claude Quettier,** Lestrem (France)
Pea starch properties and benchmark with other feedstocks

10^{00} Communication Break

3. Starch structure, properties, and functionality

10^{30} 3.1. **Robert G. Gilbert**, Brisbane (Australia)
New ways of learning about genetics/structure/property relations through amylose molecular characterization

10^{55} 3.2. **Qioaquan Liu**, Yangzhou Province (P.R. China)
Underlying reasons for natural variation of starch biosynthesis in rice to improve cooking and eating quality

11^{20} 3.3. **Yong-Cheng Shi**, Kansas (USA)
Structure, digestibility, and hypoglycemic effects of pyrodextrins

11^{55} 3.4. **Anton Huber**, Graz (Austria)
Characterization of dissolved and hydrocdolloidal dispersed materials by analytical separation techniques

12^{20} Lunch Break

13^{20} 3.5. **Veronica Nessi**, Nantes (France)
Multi-Scale characterization of thermoplastic starch structure using second harmonic generation imaging (shgi) an NMR

13^{45} 3.6. **Yong-Cheng Shi**, Kansas (USA)
Settling volume and morphology changes in native and modified normal wheat, waxy wheat, and waxy maize starches in relation to their pasting properties

4. Modification

14^{10} 4.1. **Tatiana Budtova**, Sophia Antipolis (France)
Starch aerogels

14^{35} Communication Break

15^{05} 4.2. **Guy Della Valle,** Nantes (France)
How does temperature govern mechanisms of starch changes during extrusion?

15^{30} 4.3. **Cathy MacNamee**, Ueda-shi, Nagano-ken (Japan)
Physical properties of films of starch particles at air/aqueous interfaces

15^{55} 4.4 **Ben van den Broek,** Wageningen (Netherlands)
Analysis and modification of pectin

5. Application

16^{20} 5.1. **Mario Martinez,** Guelph (Canada)
Specific ratio of a- to b-type wheat starch granules improves the quality of gluten-free breads: optimizing dough viscosity and pickering stabilization

16^{45} **Exhibitor's Forum** – short term presentations

Lunch

Lunch will be served in the exhibition hall:

The menu:

Tuesday, April 9th 2019

Lentil stew with smoked little things

Tomato cream soup with ginger

Canapes with herb cream cheese

Canapes Hawaii with rum

Canapes with pork sausage

Canapes with fine liver sausage

Dessert: Pasture land JIO Kurt with various topics

Wednesday, April 10th 2019

Party soup

Asparagus Cream Soup

Pizza donut with mushrooms and tomatoes

Chicken Teriyaki - skewers

mini fritters with salmon

Dessert: Pasture land JIO Kurt with various topics

Beverages:

Mineral water

Coca-Cola

Orange juice

Apple Spritzer

Bon appétit
and interesting conversations!

Evening Program

Monday, April 09th 2019

19^{30} **Welcome Evening** at the **Convention Hall**, Detmold, Schuetzenberg 10

Tuesday, April 10th 2019

18^{00} Departure by bus at Schützenberg 10, Detmold

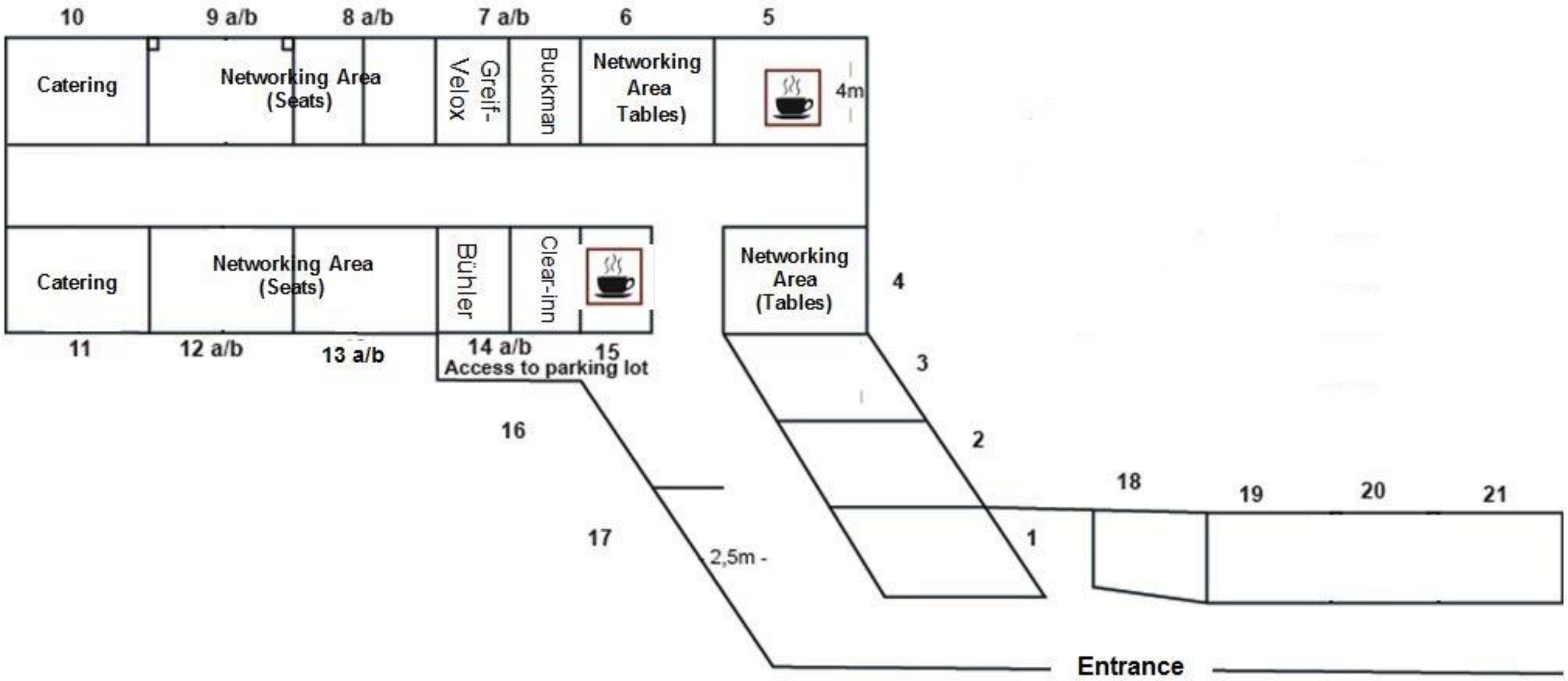
Social gathering: Dinnerbuffet with gin tasting at the restaurant "Gutshof Brennerei Begatal", Dörentrup

22^{00} Arrival by bus at Schützenberg 10, Detmold

Exhibition Hall Association of Cereal Research

Stand allocation

70th Starch Convention and 15th Bioethanol and Bioconversion Technology Meeting from April 09th – 10th 2019



Exhibition

Bühler GmbH, Braunschweig (Germany)

Buckman Laboratories, Gent (Belgium)

Clear-in-food, Waalwijk (Netherlands)

GREIF-VELOX Maschinenfabrik GmbH, Lübeck (Germany)

Participants

Effective April 2nd 2019, 1.30 p.m.

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Wiege, Berthold, Dr.
Willenberg, Ina, Dr.
Wolf, Klaus

Summaries

1. Market

1.1. **Stephan Reimelt**, Frankfurt
Digital transformation and the impact on the starch industry

Detailed information will be presented at the convention.

***Prof. Dr.-Ing. Stephan Reimelt**, b. 9th July 1957 in Frankfurt / Main, German, married, 3 children, 01/2018 - today Partner / Senior Advisor Cerberus Deutschland Beteiligungsberatung GmbH, 07/2016 - 12/2017 President & CEO, GE Germany & Austria General Electric Germany Holding GmbH , 2015 - 2016 President & CEO GE Power Conversion GE Power Conversion Group SAS, France (Global Business Focus), 2014 - 2015 President & CEO GE Europe | CEO GE Germany General Electric Germany Holding GmbH, Germany, 2011 - 2014 Chief Executive Officer General Electric Energy Germany GmbH, Frankfurt, 2010 - 2011 Member of the Executive Board Ferrostaal AG, Essen, 2007 - 2010 Member of the Executive Board MAN Ferrostaal AG, Essen, 2005 - 2007 Member of the Management Board*
Lurgi AG, Frankfurt, 2004 - 2004 Senior Executive Vice President Lurgi AG, Frankfurt, 2001 - 2004 Managing Director Lurgi Life Science GmbH, Frankfurt / Chemnitz, 2000 - 2001 Managing Director Reimelt GmbH, Rödermark near Frankfurt, 1989 - 2000 Managing PartnerDietrich Reimelt KG, RödermarkMedical Company for machinery and
Plant Engineering for the Food and Chemical Industries, 1984 - 1988 President and Founder "Reimelt Corporation", Tampa / Florida, Education / Qualifications:
2011 Honorary professor at the Technical University of Berlin, since 2001 teaching at the Technical University Berlin, subject "factory planning" in the field of process sciences
1984 Dissertation Dr.-Ing., Technical University Berlin Topic: "Investigation of the parameters influencing the pneumatic mixing of bulk solids" (Prof. H. Baumgarten / Prof. Dr. Dr. F. Meuser), 1978 - 1982 Studies of Economics Technical University Berlin Degree: "Diplom-Ingenieur", 1978 graduation Schloss Salem (boarding), Lake Constance

2. Raw material

2.1. **Andreas Blennow,** Frederiksberg (Denmark)
Alternative crops for a traditional potato starch producer

Potato is the major non-cereal food crop with an annual global production growth of 4.5%. Potato starch, as compared to most other starches, has unique properties that are directly attributed to its granular and molecular structures, including very large and smooth granules, a high content of covalently linked phosphate, long amylopectin chains, and high-molecular weight amylose. These characteristics combined make potato starch a tremendous source of functional biopolymer for food and materials science e.g. for wet end high-quality paper and for the generation of viscous hydrocolloid systems. Potato starch granules have well-ordered and dense rendering it resistant to enzymatic degradation by hydrolytic enzymes.
Like most other starch synthesising organisms, potato starch biosynthesis involves a multitude of different enzyme activities are requires include activation of the glucose residue, elongation of the glucan chain by starch synthases (SS), especially granule bound starch synthase (GBSS) for amylose biosynthesis, and transfer of linear backbone chains forming branched structures by starch branching enzymes (SBE) and debranching enzymes (DBE) for efficient linearization of segments to form crystalline starch. However, potato starch biosynthesis also performs an extraordinarily high rate of starch phosphorylation catalysed by the glucan water dikinase, GWD.

Potato breeders and related stakeholders face significant challenges in relation to potato production and starch quality. The complex genetics of potato has resulted in slow and unreliable traditional breeding e.g. hindering meeting demands for high quality and safe foods. NBT can short-cut some of these obstacles for specific traits while maintaining the overall optimised performance of the original cultivar. This is not possible using classical breeding. Among traits related to starch that are important, we recognise the content of low glycemic slowly digestible starch (SDS) and prebiotic non-digestible starch (RS) with the prospect of generating health-promoting potato tubers. Process stable amylopectin starch is another important functionality. To this end, mainly transgenic potatoes and potato genotypes with rather suboptimal agricultural performance, have been demonstrated to harbour these important traits.

New Breeding Technologies (NBT), and especially the precise genetic engineering system CRISPR/Cas9, is now taking off at overwhelming pace. However, for starch bioengineering, this system is still in its infancy. We have generated an amylopectin-only potato starch in a Danish elite cultivar and using the barley system, we have generated amylose-only starch. The levels of starch-phosphate can also be controlled. Inspired by these data, we can now see the enormous potential of generating structurally homogeneous potato starch with health-promoting and process stable functionalities using the CRISPR/Cas9 genome editing system.

Carciofi, M, Blennow A., Jensen, S.L., Shaik, S.S, Henriksen, A., Buléon, A., Holm, P.B., Hebelstrup, K.H. (2012) Concerted suppression of all starch branching enzyme genes in barley produces amylose-only starch granules BMC Plant Biol. 12, 223, 1-16.
Johansen IE, Liu Y, Jørgensen B, Nielsen KL, Andreasson E, Bennett EP, Nielsen Blennow A, Petersen BL. (2019) High efficacy full allelic CRISPR/Cas9 gene editing in tetraploid potato. Submitted.
Viksø-Nielsen, A., Blennow, A., Kristensen, K.H., Jensen, A. and Møller, B.L. (2001) Structural, Physicochemical, and Pasting Properties of Starches from Potato Plants with Repressed *r1*-Gene. Biomacromolecules 3, 836-841.

***Andreas Blennow**, received his MSc in 1987 and PhD in 1992, at Lund University, Sweden with research on starch metabolism and structure. Postdoctoral studies were carried out at Plant Science Centre, RSBS, ANU, Canberra, Australia on starch enzymology and crop bioengineering. He continued the research activities at the Royal Veterinary and Agricultural University, now University of Copenhagen, on research involving bioengineering of starch to generate functional and health-promoting starch. Blennow has since headed a research group active within plant-based foods and human nutrition, starch and glycan bioegineering, polysaccharide-based bioplastics and fundamentals of starch structure and metabolism. AB has close cooperation with industry and is cofounder of the spinnoff company PlantCarb ApS for the design of amylose-only health-promoting starch crops. He is now heading a team to implement and optimize New Breeding Technologies, CRISPR/Cas9 in plants with complex and high ploidy genomes for starch bioengineering. He has published 140 scientific articles and book chapters and contributed to more than 200 conferences.*

2.2. **Claude Quettier,** Lestrem (France)
Pea starch properties and benchmark with other feedstocks

Detailed information will be presented at the convention.

3. Starch structure, properties, and functionality

3.1. **Robert G. Gilbert**, Brisbane (Australia)
New ways of learning about genetics/structure/property relations through amylose molecular characterization

Haiteng Li,[1] Sharif S Nada,[1] Michael J Gidley,[1] Huaxin Han,[2] Enpeng Li,[2] Robert G Gilbert[1,2]

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Many functional properties of starch-based foods depend on amylose, in a number of ways. Such dependences are almost always expressed only as correlations with overall amylose content. However, it is known (starting with work by Bruce Hamaker and colleagues) that such dependences are more subtle than that, and depend on various aspects of amylose molecular structure. One of the most important of these is the chain-length distribution, but this is made complex by the fact that currently the CLD of amylose can only be obtained by size-exclusion chromatography (SEC, a type of GPC). SEC suffers unavoidably from band broadening, which distorts the shape of the distribution. A method of overcoming this problem has been developed [Nada, …, Gilbert, *Analytical Bioanal. Chem.* **409** 6813 2017), which enables SEC data to be fitted by biologically meaningful parameters. Good SEC data for the amylose CLD shows that there is more than one feature present, and each feature can be ascribed to an enzyme set comprising a starch synthase (usually but not necessarily GBSS) and an SBE. The data fitting yields the ratio of the activities of the SBE and the SS in that set, and the overall activity of the SS. This enables these CLDs to be used to find statistically valid correlations between properties of interest and underlying biosynthetic processes. Using data from high-amylose rices and wheats reveals that some SBEs influence both amylopectin and amylose CLDs. It is also found that different regions of amylose CLDs affect various functional properties, including digestion rates (important for nutrition) and sensory properties (important for consumer appeal), not to mention properties of importance for brewing. The same holds true for rheological properties. For rice, where sequences of the cereal variety are available, this has revealed the genes controlling different amylose enzyme sets. This methodology (e.g. W Yu *et al. Carbohydrate Polymers* **206** 583 2019) provides a new tool for choosing cereal varieties with advantageous properties for different applications.

Bob Gilbert *did his PhD at the Australian National University and a postdoc at MIT. After many years at the University of Sydney, in 2006 he moved to the University of Queensland to pursue his interests in complex branched glucose polymers. He is a Research Professor both at the University of Queensland (Australia) and at Yangzhou University (China). He is author of about 480 papers, and a Fellow of the Australian Academy of Science. His research interests are in the relations between biosynthesis and biodegradation, molecular structure and functional properties of starch and of glycogen, especially with regard to how these relate to obesity, diabetes and colo-rectal cancers, and to food properties.*

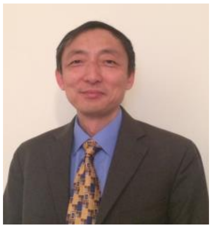
3.2. **Qioaquan Liu**, Yangzhou Province (P.R. China)
Underlying reasons for natural variation of starch biosynthesis in rice to improve cooking and eating quality

Rice is one of the most important foods in the oriental world, and more peoples prefer to consume rice with good sensory and health characteristics. Starch is the major component of rice endosperm, and the composition and structure of starch play a dominant role in the quality of the rice grains, as well as their industry application. In the world, especially in China, there are abundant rice germplasms, including lots of local landraces, and the grain quality variation occurred widely among these landraces. Thus, it is very important to mine novel alleles of starch quality-related genes for rice quality improvement. In our studies, we focused on the starch-synthesis related genes (SSRGs), and carried out to mine novel alleles for quality improvement of both *japonica* and *indica* rice cultivars. By using the approaches of re-sequencing and genic molecular markers, the allelic variation of SSRGs among lots of rice germplasms were analyzed and several new alleles were mined. The results showed that there was different combination of these alleles in current cultivars. In order to investigate of the effects of these genes and their alleles on grain quality in rice, a lot of near isogenic lines (NILs) and transgenic lines were developed, and their backgrounds were nearly the same to the receptors. Through determining and comparison of the physiochemical properties of rice grains and the fine structure of starches between the NILs/transgenic lines and their parents, the results showed that there has a certain impact of the allelic variations on grain quality. The resulted and related materials resulted from this study will be very useful not only to rice breeding on quality improvement, but also to understand the genetic diversity of grain quality in rice

Prof. & Dr. Qiao-Quan LIU *is the Director of the Key Laboratory of Crop Genomics and Molecular Breeding, College of Agriculture at Yangzhou University, China. Prof. LIU's laboratory is mainly interested in molecular genetics and improvement of rice grain quality. He has published more than 150 papers on Nature Communications, PNAS, Plant Physiology, Plant Biotech J, etc.*

3.3. **Yong-Cheng Shi**, Kansas (USA)
Structure, digestibility, and hypoglycemic effects of pyrodextrins

Structural changes during the conversion of insoluble waxy maize starch granules to cold water–soluble pyrodextrin were investigated. Starch granules were suspended in water and the pH of the slurry was adjusted to 2.5–3.0 by 0.5M HCl. The air-dried starch was heated for different time intervals at 160 and 170 °C for 0.5 to 4 h. The pyrodextrins obtained had cold water solubility from 21 to 100%. Structural changes of starch granules during dextrinization were determined by multiple techniques. Starch molecular size, crystal size as well as its melting enthalpy decreased as pyrodextrin solubility increased. Pyrodextrins had a granular shape identical to the native starch when observed in glycerol under a light microscope and showed strong birefringence under polarized light, suggesting that starch molecules were hydrolyzed into small molecular fractions but remained in a radial arrangement. ^{1}H and ^{13}C-NMR spectra of pyrodextrin were assigned with the assistance of 2D techniques. New glycosyl linkages were formed and transglucosidation occurred during dextrinization. The resulted pyrodextrin was highly branched and more resistant to enzyme digestion. Pyrodextrin shares some properties of resistant starch which is metabolically beneficial. Oral administration of pyrodextrin (50 mg/kg/d for 7 weeks) decreased the blood glucose (e.g. from 9.18±1.47 to 7.67±0.42 mmol/L), serum hemoglobin A1c (HbA1c), body weight (e.g. from 24.4±1.2 to 22.5±1.2 g), triglycerides and adipocyte size in high-fat diet induced obese mice. The western blotting analysis suggested that pyrodextrins decreased intestinal sodium-glucose transporter 1 (SGLT-1) expression to ~70% of the obese control to slow down glucose transportation from gut into blood, and increased the hepatic expression of p-insulin receptor substrate (p-IRS) by more than 1.2-fold to promote hepatic insulin sensitivity. Moreover, pyrodextrins with lower molecular weight (44 kD versus 127 kD), more branched structure and increased non-digestible linkages (46.2±0.3% versus 28.5±0.1%) showed stronger hypoglycemic activity. This work provides important information for developing functional food and dietary supplement for management of obesity and diabetes.



Dr. Yong-Cheng Shi *is a professor in the Department of Grain Science and Industry at Kansas State University (KSU). He received his B.E. in Chemical Engineering from Zhejiang University, and MS and Ph.D. in Grain Science with an emphasis in starch chemistry from KSU. Prior to becoming a faculty at KSU in 2006, he worked for National Starch Food Innovation (Bridgewater, New Jersey, USA) from 1994 to 2005. His research areas include structure and function of cereal carbohydrates, physical, chemical, and enzymatic modifications of starches and flours, and developing technologies and products for food, nutrition, emulsion, encapsulation, and pharmaceutical applications. He has 16 granted US patents, numerous corresponding patents throughout the world, and more than 80 publications pertaining to starch and cereal carbohydrates. He co-edited a book with Dr. C. C. Maningat on Resistant Starch: Sources, Application and Health Benefits in 2013. He was an Associate Editor of Cereal Chemistry from 2006 to 2013 and currently sits on the Advisory Board of Starch and Food Digestion journals. Dr. Shi was the Belfort Lecturer at the Whistler Center for Carbohydrate Research, Purdue University in 2015. He received Phil Williams Applied Research Award from AACC (American Association of Cereal Chemist) International (AACCI) and was named AACCI Fellow in 2016.*

3.4. **Anton Huber**, Graz (Austria)
Characterization of dissolved and hydrocdolloidal dispersed materials by analytical separation techniques

Polysaccharides in aqueous media form a wide spectrum of dissolved and dispersed fractions with various molecule/particle dimensions, preferences of interaction and mobilities of coherent segments making them multi-purpose performance and adaptive systems. Overall characterization of such systems however is complicated as it includes as well analysis of homogeneously dissolved partitions as of heterogeneously dispersed hydrocolloidal fractions and the kinetics/dynamics of in-between transition states of gelling and phase-separating subsystems. Thereby, formation and stability for each of these states depend on composition (nature of components; width and shape of distributions), volume fraction / concentration of

components, dimension and conformation of objects, mobility of coherently acting units, applied conditions and the polysaccharides chemistry being rather easily prone to various modification: increasing hydrophobicity (e.g by methylation or reduction), changing charge-densities (introducing carboxylic groups) or modifying symmetries (modification of branching patterns).
In the case of starch, branching characteristics are a kind of fingerprint for specific sources of starch, and, simultaneously, represent a major tuning option to form or avoid certain glucan/water-partitions: long-chain branched (lcb; amylose type) glucans with preferences for intermolecular, and hence, aggregation-supporting interaction and short-chain branched (scb; amylopectin-type) glucans with preferences for intra-molecular stabilization. For comprehensive analysis of such 'polysaccharides in aqueous media'-systems at least an estimation of the ratio of homogeneous dissolved (primarily consisting of scb-glucans) and heterogeneous dispersed (dominantly lcb-glucans) partition is required before subsequent investigation of both pools: Separation techniques (e.g SEC for dissolved and AF4 for dispersed + dissolved glucans) to obtain information about distributions of object dimensions / affected volumes and in-line scattering data for information about apparent molar masses and packing densities. Resistance and mode of disintegration upon applied stress is supposed to tell about stability of various starch-glucan/water-systems, finally.

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Citizenship: Austrian, Current Position: Associate Professor, Physical Chemistry, Senior Research & Teaching Scientist @ IfC, Graz University / Austria
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1989 – 1999 Univ.Ass, IfC, Graz University - Research and Teaching Education 1999 Venia → Assoc. Prof. Physical Chemistry@Graz Univ Austria with thesis on: 'Dimensions, Conformation and Interactive Properties of Aqueous Dissolved Polymers'
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since 2009 Development, Maintenance and Administration of Bachelor- and Master Study Programmes within the Graz University framework 'Umweltsystemwissenschaften (USW) / Environmental System Sciences (ESS)', in particular: Bachelor Naturwissenschaften-Technologie (USW / NAWI-Tech) and Master Climate Change and Environmental Technology (EES / CCET)

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2004-2012 — *Austrian / Graz University coordinator within the EU-US Educational Activity 'Renewable Resources and Clean Technology Research and Curriculum Consortium' of Univ.Arkansas, Fayetteville / US, Iowa State Univ., Ames, Iowa / US, Kansas State Univ., Manhattan, Kansas / US, Univ. Gent / B, Graz Univ. / A, Inst.Nat. Polytech.Toulouse / F.*
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2002/2003 — *Development of a remote-control unit as add-on to a light scattering device KMX-6: hardware - Burr Brown A/D, D/A-converter / software - CODAwin32, CPCwin32*
1999-2002 — *Head of working group to establish and to maintain the IfC-website*
since 1994 — *CPCwin / CODAwin: Development of software-packages for chromatography-multiple detection experiments covering data acquisition (autosampler/batch-mode), basic and extended data processing based on Win3.11, Win95 and Win98;*
CPCwin32 and CODAwin32 for Win95, Win98 and Windows NT4.0;
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Teaching Experience
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2010-2014 — *Physical Chemistry I - Structure and Matter (Colloidal Systems)*
since 2008 — *Renewable Resources - Chemistry and Technology*
since 2008 — *Project Labs for Renewable Resources and Macromolecular Chemistry*
since-2001 — *Physical Chemistry Practical Course I:'Electrochemistry, Thermodynamics*
since 2003 — *Biopolymers / Polysaccharides*
within the Bachelor (Bsc) Study Programme 'Dietetics and Nutrition' @ FH Joanneum - University of Applied Sciences, Graz & Bad Gleichenberg / Austria

3.5. **Veronica Nessi**, Nantes (France)
Multi-Scale characterization of thermoplastic starch structure using second harmonic generation imaging (shgi) an NMR

The interest for thermoplastic starch as a biodegradable alternative for long-lasting synthetic polymeric materials is growing along with the development of non-food applications for starch. Starch-based matrices are particularly interesting because of their high biocompatibility and degradability, which in the last decades led to the development of several biomedical applications, for instance as a temporary support during tissue healing, or in the surgery of salivary duct [1], [2].

Our team (INRA-Biopolymers Interactions Assemblies (BIA) laboratory in Nantes, France) works with the specificities of starch and aims to develop starch-based materials to replace synthetic polymers. For example, depending on the process, the botanical origin of starch and the addition of non-aqueous plasticizers, extruded thermoplastic starch can present a very varied range of properties. The mechanical properties as well as the behaviour of the materials in physiological conditions can be controlled and adapted to different applications.

In order to control and optimize the properties of starch-based materials, a deeper understanding of the role of these factors and their interactions is critical. This topic has received much attention since the 80’s, however some important mechanisms remain unclear, such as the role of the plasticizer during processing and the structural changes of native starch [3]; besides, newer techniques now allow a more in-depth characterization and could complement previous findings.

In this work we investigate in which way the presence of the plasticizer glycerol has affected the thermoplastic starch (TPS) microstructure. Then we assess whether the heterogeneity of the microstructure prevents the formation of a polymer network that would ensure the cohesiveness of the TPS materials. This hypothesis could have important applications. Indeed, if heterogeneity does not prevent cohesiveness, the intrinsic properties of native starch granules can be partially conserved in the final material, with interesting effects on resistance to water intake or resistance to enzymatic degradation, especially when compared to fully disrupted granules.

To test this hypothesis, changes of structure occurring during the extrusion and storage of potato starch are assessed through comparisons between native starch, extruded starch (amorphous), extruded starch with storage at high relative humidity to induce recrystallization, and plasticized extruded starch (the plasticizer is glycerol). The samples structure is described at different scales. In particular, molecular-level ordering, such as chains conformations and paracrystallinity, is probed by nuclear magnetic resonance (NMR) spectroscopy. Second harmonic generation (SHG) imaging is employed as the main microscopy technique. It is a high-resolution nonlinear technique suitable for detecting and quantifying the crystalline microstructure and providing information about the molecular orientation of processed starch materials in a noninvasive way [4], [5].

The combination of analytical measurements and imaging allows the description on several scales of the TPS microstructure. Combined with measurements of samples swelling abilities, these results lead to a better understanding of process-induced modifications of starch occurring during extrusion and during storage.

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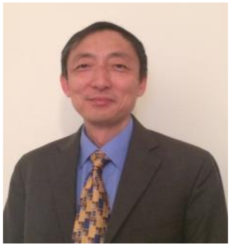
[5] S. Psilodimitrakopoulos, E. Gavgiotaki, K. Melessanaki, et al., *Microscopy and Microanalysis*, 22 (**2016**), 1072–1083.

***Veronica Nessi** is currently 3rd year PhD student at the French National Institute for Agricultural Research (INRA) in Nantes. There, she investigates the role of nanofillers on the structural organization of starch in nanocomposites, with the aim of designing materials with controlled degradation rates and improved functionality. Her findings could be applied in the medical, food and conditioning domain.*

“A food enthusiast, she loves traveling and discovering foreign culinary traditions”.

3.6. **Yong-Cheng Shi**, Kansas (USA)
Settling volume and morphology changes in native and modified normal wheat, waxy wheat, and waxy maize starches in relation to their pasting properties

To realize the full potential of waxy wheat in food applications, we have investigated (1) dry-milling of waxy wheat, (2) dough properties of waxy wheat flour, (3) pasting properties of waxy wheat flour as well as factors governing the pasting properties, (4) methods to improve functional properties of waxy wheat flour, (5) wet milling of hard waxy wheat flour into gluten and waxy wheat starch, (6) gelatinization and pasting properties of waxy wheat starch, (7) chemical modification of waxy wheat starch, and (8) applications of waxy wheat in bread and extruded products. Waxy starches are often cross-linked to eliminate their cohesive texture of cooked pastes. In this study, normal wheat, waxy wheat and waxy maize starches were cross-linked with 0.01, 0.03 and 0.06% (sb) phosphorus oxychloride. The objective was to correlate the morphology changes and settling volume to the pasting properties of those cross-linked and unmodified starches. Pasting and microscopic data for waxy maize starch and its cross-linked products was similar to waxy wheat starch, except changes occurred at ~5℃ higher in temperature. At 6% solids, waxy wheat starch cross-linked with 0.01% $POCl_3$ had a greater settling volume and a higher pasting viscosity than the cross-linked waxy maize starch, but at 7 and 8% solids, waxy maize starch cross-linked with 0.03% and 0.06% $POCl_3$ had a higher pasting viscosity. At 6% starch solids, particle volume fraction appeared to be the dominant factor controlling consistency, but at higher starch solids contents, the deformability (rigidity) of swollen granules became important in controlling viscosity. Cross-linked waxy wheat starch (WWS) gelatinized and cooked to a thick non-cohesive paste at a relatively lower temperature compared to cross-linked waxy maize starch (WMS), and its paste re-associated less than cross-linked WMS. Such properties increase the market potential of cross-linked WWS as a thickening agent. Modified WWS would offer better performance in frozen food products.



Dr. Yong-Cheng Shi *is a professor in the Department of Grain Science and Industry at Kansas State University (KSU). He received his B.E. in Chemical Engineering from Zhejiang University, and MS and Ph.D. in Grain Science with an emphasis in starch chemistry from KSU. Prior to becoming a faculty at KSU in 2006, he worked for National Starch Food Innovation (Bridgewater, New Jersey, USA) from 1994 to 2005. His research areas include structure and function of cereal carbohydrates, physical, chemical, and enzymatic modifications of starches and flours, and developing technologies and products for food, nutrition, emulsion, encapsulation, and pharmaceutical applications. He has 16 granted US patents, numerous corresponding patents throughout the world, and more than 80 publications pertaining to starch and cereal carbohydrates. He co-edited a book with Dr. C. C. Maningat on Resistant Starch: Sources, Application and Health Benefits in 2013. He was an Associate Editor of Cereal Chemistry from 2006 to 2013 and currently sits on the Advisory Board of Starch and Food Digestion journals. Dr. Shi was the Belfort Lecturer at the Whistler Center for Carbohydrate Research, Purdue University in 2015. He received Phil Williams Applied Research Award from AACC (American Association of Cereal Chemist) International (AACCI) and was named AACCI Fellow in 2016.*

4. Modification

4.1. **Tatiana Budtova**, Sophia Antipolis (France)
Starch aerogels

Lucile DRUEL[1], Richard BARDL[1], Waltraud VORVERG[2], Tatiana BUDTOVA[1]
[1] *Center for Materials Forming - CEMEF, MINES ParisTech, PSL Research University, UMR CNRS 7635, CS 10207, 06904 Sophia Antipolis, France*
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Aerogels are ultra-light weight and highly porous nanostructured materials, with open porosity and high specific surface area. They are synthesized via sol-gel route followed by solvent extraction with supercritical CO_2. Classical aerogels are based on silica or synthetic polymers (for example, polyurethanes).
Bio-aerogels are a new generation of aerogels made from polysaccharides; they are lightweight (density around 0.1 g/cm^3), with high specific surface area (200-600 m^2/g) and can be used as

matrices in controlled release, in engineering applications (for thermal super-insulation, pectin aerogels) and in electro-chemical (when pyrolysed, cellulose aerogels).
In this work we prepared starch aerogels from various starches (potato, waxy potato, pea, high amylose corn starch and also pure amylose) via polymer dissolution/gelatinisation, retrogradation, solvent to non-solvent exchange and drying with supercritical CO_2. The densities varied from 0.1 to 0.2 g/cm^3.
The influence of amylose to amylopectin ratio and of retrogradation time on starch aerogel morphology was studied in detail. For example, the increase in amylose content leads to a 3-fold increase in specific surface area, from 70 to 250 m^2/g. Mechanical properties of aerogels and their thermal conductivity were also investigated. We found that pea starch aerogel is thermal superinsulating material with thermal conductivity below that of air. A large variety of starch sources and starch derivatives open up the opportunity of making versatile functional materials with high value-added properties.

Tatiana Budtova *graduated from the Physical faculty of St. Petersburg State University, Russia and got her PhD in polymer science in the Institute of Macromolecular Compounds of Russian Academy of Sciences in 1992. In 1999 she got Habilitation in MINES ParisTech.*
Tatiana Budtova is leader of "Biobased Polymers and Composites" group in the Center for Material Forming of MINES ParisTech and she is also Finland Distinguished professor in Aalto University, Finland. She is one of editors of Carbohydrate Polymers journal.
Tatiana is expert in polymer chemical physics, in particular, in polymer solutions, gels and aerogels with the focus on biomass based polymers, and in composites with natural fibers. She is author of more than 130 scientific articles in peer-reviewed journals.

4.2. **Guy Della Valle,** Nantes (France)
How does temperature govern mechanisms of starch changes during extrusion?

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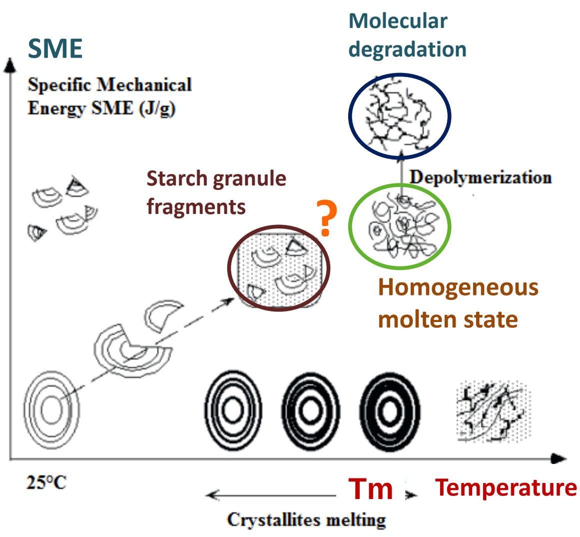
Extrusion is a complex but performing tool for starchy products processing, under low moisture content (<30%), high temperature and shear, for short residence time. During extrusion, starch undergoes several. At macroscopic level, these changes can be addressed by a transition from a powdery material to a viscous liquid, just like polymer melting. The behavior of this melt, submitted to high shear and temperature in the extruder can be described by rheological models. Then, at the die outlet of the extruder, the starch melt expands suddenly, due to sudden water vaporization and rapid material cooling, leading to a typical cellular – or porous – structure that will impart a brittle texture, due to starch glass transition. Again, the influence of starch structure, and macromolecular composition, on this phenomenon, may be addressed by the starchy matrix rheological properties.
In this presentation, we will first make a quick survey of scientific works on measurements of starch melt viscosity and how this property affects expansion.

Then we will focus on starch melting, which accurate mechanisms are less known, but involve structural changes at different levels of matter organization: loss of granular and crystalline structures, depolymerization. To ascertain these mechanisms, potato and pea starches were processed on a twin-screw extruder under conditions chosen to keep material temperature Te close to starch melting temperature, Tm, whilst avoiding die expansion. Extruded rods were analysed by asymmetrical flow field flow fractionation, X-ray diffraction, DSC, and light microscopy with image analysis.



What's going on during starch melting in an extruder ? (from Barron et al., 2002)

Molar mass of extruded materials decreased more for potato than for pea starch, when specific mechanical energy SME increased, likely because of larger amylopectin sensitivity to shear. No crystallinity was detected when $\Delta T=(Tm-Te) \leq 0$. Residual gelatinization enthalpy ΔHg decreased with ΔT. As illustrated by larger ΔT values for $\Delta Hg=0$, decreasing moisture favored melting, likely by increasing solid friction. The fraction of granular remnants of potato starch was inversely correlated to SME. By integrating these results we will strive to show that starch melting during extrusion can be considered as a suspension of solid particles embedded in a continuous amorphous matrix. Solid particles may be crystalline fragments, granular remnants, and their volumic fraction decreases during processing. This interpretation is comforted by rheological measurements performed on starches under similar thermomechanical conditions. However, the difference of behavior between starches of different botanical origins still raise question on the role of granule size, its mechanical and surface properties.

Barron C., Della Valle G., Colonna P, Vergnes B. Energy balance of low hydrated starches transition under shear. J. Food Sci., 67, 4, 1426-37, 2002.

Guy Della Valle *Engineer in Fluid Mechanics and PhD in Civil Engineering, I have studied grain foods processing and starch materials properties since 1984 at INRA. My work focused on the development of biopolymers foams, approached by material science, rheology and modelling. After managing a project on Novel Foods Aided Design in 2000s, I moved on the integration of scientific models with the expertise available in the food industry, using knowledge transfer tools.*

4.3. **Cathy MacNamee**, Ueda-shi, Nagano-ken (Japan)
Physical properties of films of starch particles at air/aqueous interfaces

Cathy E. McNamee[1,*], Yu Sato[1], Berthold Wiege[2], Ippei Furikado[3], Ali Marefati[4], Tommy Nylander[3], Michael Kappl[5], and Marilyn Rayner[4]
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[2] Max Rubner-Institut, Detmold, Germany.
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Oil in water (O/W) emulsions can be stabilized by adsorbing particles to the oil/water interface [1]. Starch particles have been used to stabilize O/W emulsions used in foods and drinks. This is because starch is a naturally occurring polysaccharide that is safe to use in foods [2-4]. Starch is also abundant, biodegradable and inexpensive [5].

Native (non-modified) starch particles are hydrophilic and therefore show only a low stability at hydrophobic/hydrophilic interfaces. The stability of starch stabilized O/W emulsions has been improved by modifying the structure of the starch particles to increase their hydrophobicity. Starch modified by esterification with dicarboxylic acids to give octenyl succinic anhydride (OSA) starch is an approved food additive that can be used to stabilize oil in water emulsions used in foods and drinks [6]. However, the effect of the OSA modification of the starch on the physical properties of such emulsions is not yet clear. Here, we determined how the OSA modification of rice starch particles affects the physical properties of starch stabilized emulsions by studying the effect of the degree of OSA modification of rice starch particles on the interactions and packing of films of rice starch particles at air (hydrophobic)/aqueous (hydrophilic) interfaces. This was achieved by using a combined Langmuir trough and optical microscope system to determine the packing of non-modified rice starch particles and rice starch particles modified with different degrees of OSAat air/water interfaces. The Monolayer Interaction Particle Apparatus was used to determine the strength of the films of non-modified rice starch particles ("N-RS") and OSA modified rice starch particles ("OSA-RS") at the air/water interface. As food and drinks often contain salts, the effect of adding salts to the water on the properties of the films of starch particles formed at the air/aqueous interface was also determined.

OSA modification of the starch particles was seen to decrease the large particle aggregates formed by the non-modified starch particles at the air/water interface (Fig. 1A). The packing of the particles in the film at the air/water interface improved as the degree of OSA modification was increased (Fig. 1B). An increase in the strength of the film was also observed with an increase in the degree of OSA modification. The addition of salt to the water was seen to increase the aggregation of the OSA modified starch particles and thereby worsen the packing of the particles in the film at the air/aqueous interface (Fig. 1C). The strength of the film of particles was also seen to decrease with the addition of salt, where the decrease in film strength became greater as the degree of OSA modification was increased. The optimal degree of the OSA modification was concluded to depend on the concentration of salt used in the applications.

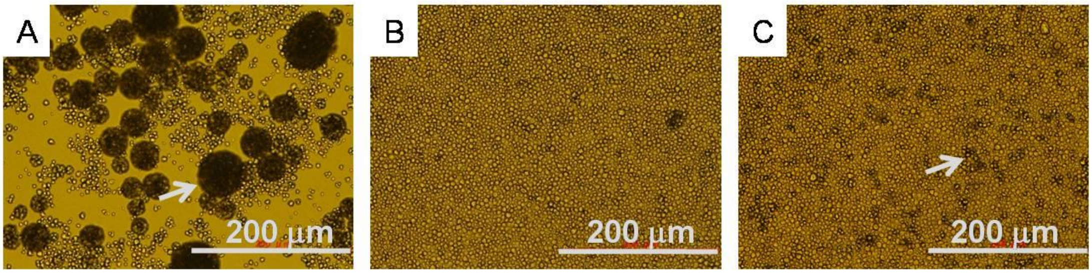

Fig. 1. Starch particles at air/aqueous interfaces. The arrows highlight the aggregates formed in the films of starch particles. (A) N-RS particles at an air/water interface. (B) OSA-RS particles at an air/water interface. C. OSA-RS particles at an air/100 mM NaCl interface.

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[5] Hui. R. et.al. *Food Chem.*, **2009**, 114, 81-86.
[6] Ovando-Martinez, M. et. al. J. *Food Process Preserv.*, **2017**, 41, 1745-4549.

Cathy McNamee *studied her Bachelor of Science (honours) at Queensland University (Australia). She then went to Kyoto University (Japan) to study her Doctor of Science on surface forces. After this time, she continued her study in colloid and interface science as a post-doctorial researcher at Ulm University (Germany), Lund University (Sweden), Kyoto University (Japan), and the Max Planck Institute for Polymer Research (Germany). She commenced her position at Shinshu University (Japan) in 2008, where she is currently an associate professor.*

4.4 **Ben van den Broek,** Wageningen (Netherlands)
Analysis and modification of pectin

Pectin is one of the major plant cell wall polysaccharides. It is present in the primary cell wall and middle lamella of the plant. The function of pectin is to strengthen the cell wall and "keeping" the cells together. The main commercial sources of pectin are from the peels of citrus fruits and apple pomace. Extraction is performed at acid conditions at elevated temperatures and often an alcohol precipitation is used to concentrate the pectin. The polysaccharide consist predominantly of a so-called "smooth region" containing galacturonic acid moieties that can be methyl esterified. In addition the homogalacturonan chains contain alternating "hairy regions" of rhamnogalacturonan that consists of rhamnose and galacturonic acid repeats which contain side chains of arabinan and/or galactan moieties. The latter is depending on the source. The main application of pectin is in the food industry where it is used as gelling agent, thickener and as stabilizer in beverages and ice creams.
In Europa sugar beets (*Beta vulgaris* L.) are used for the production of sucrose. A side product is sugar beet pulp that is obtained after sugar extraction. At yearly basis about 5-6 million tons dry matter sugar beet pulp is produced which is mainly used as feed. In order to increase the economic value a biorefinery is designed by Royal Cosun (The Netherlands) for the production of different value added components from sugar beet pulp. One of these components is sugar beet pectin. In contrast to pectin from citrus fruits and apple pomace, sugar beet pectin has a shorter length of the "smooth regions", a higher amount of "hairy regions" and a higher degree of acetylation. The combination of all these parameters result in poor gelling properties. In the project TKI-AF 17024 "Non-food applications of polysaccharides from sugar beet pulp" the properties of sugar beet pectin are determined. In addition the chemical and/or enzymatic modification of sugar beet pectin is performed to improve its properties.
Wageningen Food & Biobased Research determines the chemical structures and investigates the properties of the (modified) sugar beet pectins like foaming, viscosity, hydrophobicity, emulsification and surface tension. Based on the structure-function relation it can be predicted for what kind of application the sugar beet pectins and derivatives hereof can be used.
Other industrial partners involved in this project are, next to Royal Cosun, Dalli de Klok B.V. part of the Dalli Group, Smit & Zoon and Rodenburg Biopolymers. All companies are interested to increase the biobased content of their products by using sugar beet pectin in dishwasher tablets, chemicals for leather treatment and bioplastics, respectively. In addition to replacing components made from fossil resources the sugar beet pectin is analysed for its ability to improve the properties of the commercial end products.
This research was carried out by Wageningen Food & Biobased Research, commissioned and funded by TKI Agrifood, within the framework of the innovation resources made available by the Ministry of LNV for the Top Sector AF within the core theme of Circular. Project title: Non-food applications of polysaccharides from sugar beet pulp. Project number: AF-17024.

Dr. L.A.M. van den Broek *(1962) obtained his PhD at the Laboratory of Food Chemistry of Wageningen University, The Netherlands. He started in 2006 as scientist at Wageningen Food & Biobased Research. His interest is replacing materials made from fossil resources with materials derived from sustainable resources. The main topics he covers are biorefinery, chemical/enzymatic modification and analysis of biomolecules.*

4.5 **D.C. Saxena,** Punjab (India)
Modification of starch: How would it affect the flowability during bulk handling and processing

Detailed information will be presented at the convention.

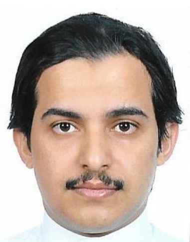
Dr.D.C. Saxena*, presently a Professor in the Department of Food Engineering & Technology of Sant Longowal Institute of Engg. & Technology, Longowal (INDIA).*

1. *Former Head of Department of Food Engineering & Technology*
2. *Former Dean (Planning & Development)*
3. *A visiting Faculty of Asian Institute of Technology, Bangkok (Thailand).*
4. *Chairman of the Mentor Council for Food Processing & Preservation Sector under Ministry of Labour and Employment, Govt. of India.*
5. *Member of Editorial Board of Journal of Food Science and Technology for many years.*
6. *Member of various Selection Committee*

4.6 **Saeed Amer Asiri,** Berlin (Germany)
Enzymatically modified starch with improved gelation behavior

Saeed A. Asiri, Marco Ulbrich, Eckhard Flöter
TU Berlin, Institut für Lebensmitteltechnologie und Lebensmittelchemie, Fachgebiet Lebensmittelverfahrenstechnik, Seestraße 13, 13353 Berlin

Because of their excellent gelation properties, specially converted starches have various applications in the production of confectionary. The formation of a firm starch-based gel-network requires ideally an intact amylose-fraction (AM; linear chains consisting of α-1,4-linked anhydroglucose units) on the one hand and a partially molecularly degraded amylopectin-fraction (AP; highly branched molecules having additionally α-1,6-glucosidic linkages) on the other hand. The preparation of conventional acid-thinned starches by means of mineral acid is actually randomly, and involves the degradation of both polysaccharide fractions. That is basically limiting the potential of a starch for gelation. A new approach is targeted on the specific molecular degradation of the starch polymers using a debranching enzyme. Pullulanase hydrolyzes exclusively the α-1,6-glucosidic linkages and hence preferential the AP. Regular potato starch (PS) was systematically modified in the granular state using different amounts of pullulanase (PromozymeD6®), and the modified samples were comprehensively characterized (e.g. thermal behavior using DSC, solubility, molecular properties using SEC-MALS-DRI technique, gel strength). In particular the molar mass of the enzymatically modified PS was systematically reduced from $38 \cdot 10^6$ g/mol (native starch) up to about $2 \cdot 10^6$ g/mol applying the highest enzyme dosage. According to the expectation, the gelation behavior increased with increasing degree of modification, most likely due to partial debranching of the AP. The AM-fraction was investigated in detail after processing the SEC-chromatograms using a special peak separation method (deconvolution). Surprisingly, the partial molecular degradation of the AM was proved. Possible reasons for that completely unexpected phenomenon are discussed, and continuative results with respect to morphological, physicochemical, and functional properties of the novel modified starches are presented.



Asiri, Saeed Amer*, Date of birth: 19 March 1986, Nationality: Saudi, Marital Status: married, three children, academic cereer: Since 01/2017 to now Ph.D. Student at Dept. Food Process Engineering- TU Berlin, Germany, 08/2014 – 05/2016 Master of Food Science and Technology (King Faisal University), 06/2005 – 03/2009 B.Sc. Food Science and Technology (King Faisal University), work experience: Lecturer at king Faisal University, Department of Food Sciences and Nutrition, Saudi Arabia, Responsibilities: Teaching the following courses: - Food science and nutrition - Technology of oils and fats - Technology of fruit and vegetable, skills: languages Arabic (mother language), English intermediate (B1)*

5. Application

5.1. **Gueba Agoda-Tandjawa**, Caen (France)
Starch-carrageenan interactions in aqueous media: role of each polysaccharide chemical and macromolecular characteristics

Detailed information will be presented at the convention.

5.2. **Gemma Gutiérrez**, Oviedo (Spain)
Encapsulation of resveratrol in emulsions stabilized by rice or quinoa starch particles

M. Matos[1], A. Marefati[2], M. Rayner[2], G. Gutiérrez[1]
[1]Department of Chemical and Environmental Engineering, University of Oviedo, Julián Clavería 8, 33006 Oviedo, Spain
[2]Department of Food Technology, Engineering, and Nutrition, Lund University, P.O. Box 124, SE 221 00 Lund, Sweden
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Resveratrol is a natural phenol with many positive effects for human health. However, it is a photosensitive molecule with geometric isomerism, easily oxidized with short biological half-life, and rapid metabolism and elimination. Thus, encapsulation of resveratrol is necessary. It has low solubility in water and in most of common oils. The goal of this work was to prepare oil-in-water emulsions stabilized by quinoa and rice starch granules containing resveratrol. Starch granules were modified with octenyl succinic anhydride (OSA) (degree of substitution 1.8%) to make them less hydrophilic. In order to compare starch effectivity as stabilizer, a common non-ionic surfactant Tween 20 was used to formulate surfactant stabilized emulsions. Mixtures of Miglyol 812 and Orange oil in a volume ratio 1:9 and 3:7 were used as dispersed phase in order to increase resveratrol solubility in the oily phase. Both types of emulsions were formulated in full and partial coverage conditions, i.e. creating droplets that were tightly and sparsely covering the oil-water droplet interface.
Rice starch granules were found to have a mean diameter of 7.3 µm while quinoa starch particles a mean diameter of 0.85 µm. These results are in good agreement with previous studies [1-2]. Full-coverage conditions were achieved at 700 mg/ml oil and 250 mg / ml oil for rice and quinoa respectively. These values were not significantly affected by the different ratios of oils used as internal phase [3]. Figure 1 shows an image of emulsions stabilized by quinoa, rice and Tween 20 containing resveratrol.
Pickering emulsions stabilized by quinoa starch granules were more stable against creaming phenomena than emulsions stabilized by rice starch granules. However, both starches performed better than emulsions stabilized by the Tween 20 surfactant.
Resveratrol encapsulation results revealed that formulations based on starch Pickering emulsions are an appropriate resveratrol carrier system for further use in functional food formulations, better than surfactant stabilized emulsions, leading to encapsulation efficiency (EE) values up to 98%, especially those stabilized by quinoa starch particles, compared to values up to 63 % obtained for emulsions stabilized by Tween 20.

(A) EE=98.3% (B) EE=88.8% (C) EE=63.4%

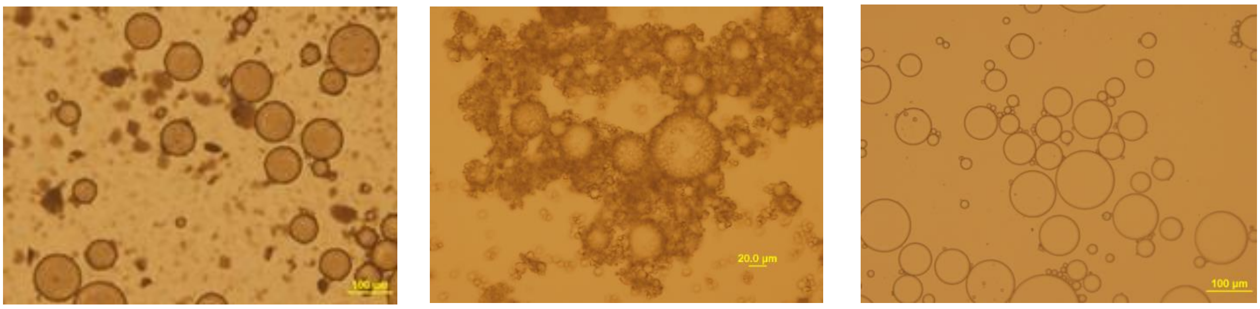

Figure 1: Emulsions Stabilized by Quinoa starch particles (A), Rice starch particles (B) and surfactant Tween 20 (C)

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Gemma Gutierrez *started in 2005 in the Group of Emulsions and Interfacial Phenomena from the University of Oviedo, supervised by Prof. José Coca and Mª del Carmen Pazos presenting my reseach Project tittled "Evaporation of oil in water emulsions from metallurgic industry" in the year 2007. My thesis entittled "Evaporation of surfactant solutions and emulsions oil in water" was presented in the year 2011 supervised by Prof. José Manuel Benito and Mª del Carmen Pazos Medina.*

The work done in my thesis was focused on the preparation, study of cycle life and treatment of waste oil in water emulsions from metalworking industries using several techniques such as coagulation, flocculation, centrifugation, ultrafiltration and vacuum evaporation.

During the phD I have done four short stays in several European Research Centers and Universities, such as, YKI Institute from Stockholm, University of Lund, University of Leeds and University ETH from Zurich.

In year 2007 I started my research on membrane emulsification technique using metallic and ceramic membranes with the main propose of obtained an oil in water emulsion with controlled drop size.

In year 2009, a new research line focused on the encapsulation of biocompounds in several colloidal systems. The systems used were high internal phase emulsions, double emulsions and colloidal vesicles.

In year 2013, a collaboration with the Nanobionalysis Group of Department of Analytical chemistry from the University of Oviedo with the main purpose of produce vesicles encapsulating different types of organic molecules to be used a novel biomarker. In 2018, the group Nanobiomem was funded together more researchers from Physics Department at University of Oviedo with the main objective of synthesis of nanoparticles/nanovesicles for the early and non-invasive diagnosis of colorectal cancer and also to break bad biofilms.

I have participated in international projects together with Prof. Marilyn Rayner from Lund University (Sweden) funded by Crafoord Foundation and Vinnova - The Swedish Innovation Agency related to starch stabilized Pickering emulsions.

During all these research years my research has been produced 30 research articles, 3 book chapters and the participation on 35 international conferences. I have supervised 17 MSc Thesis, 6 diploma works, one doctoral thesis (defended on 2013) and currently I supervise two more that are undergoing. I have also supervised two PhD external visiting students from Université de Bejaia (Algerie) and Noelia Machado from University of Córdoba (Argentina). I have participated in 15 important national and international research collaborations and projects within academia and have also cooperated in more than 11 research and industrial Projects in collaboration with companies being from 2015 main researcher in most of them.

5.3. **Mario Martinez,** Guelph (Canada)

Specific ratio of a- to b-type wheat starch granules improves the quality of gluten-free breads: optimizing dough viscosity and pickering stabilization

Specific volume and crumb hardness, cohesiveness and porosity of gluten-free breads (GFBs) are still far from consumers' expectations. Since additives are increasingly avoided by the consumers, a quality improvement of GFBs through the optimization of the starch source may provide important benefits. In particular, GFBs with high specific volume and crumb cohesiveness and low hardness are preferable over hard and low volume loaves. In this study, the effect of five different A-to B-type wheat starch ratios (100A-0B, 75A-25B, 50A-50B, 25A-75B, 0A-100B) on the quality of GFBs was investigated. The increase of the proportion of B-type granules (small ones) augmented the packing degree and uniformity of the continuous phase (starch-hydrocolloid matrix) as well as the Pickering effect (B-type granules being adsorbed onto the air-liquid interface), improving air bubble stabilization. In addition, 0A-100B dough displayed a more delayed crumb settling due to the higher pasting temperatures of B-type granules. Furthermore, the increase of the proportion of B-type granules also increased the apparent viscosity and viscoelastic moduli of doughs, which noticeable diminished bread expansion in 0A-100B sample. It seems that the proper proportion of starch granules varying in particle size, surface area, swelling capacity and resistance to lose their semi-crystalline structure and morphology during baking may empower the continuous phase with a combined rigidity and support (from B-type granules) and continuity and flowability (from melted A-type

granules) that results in optimum crumb settling during baking. Interestingly, 75A-25B and 25A-75B doughs resulted in GFBs with the highest specific volume and crumb cohesiveness and lower crumb hardness, the former with open grain structure (fewer cells with larger size) and the latter with close grain structure (more cells with smaller size). For the first time, it is shown that a specific A-to B-type wheat starch ratio enables: 1) the simultaneous optimization of dough viscosity and Pickering stabilization to attain GFBs with improved physical quality and; 2) the modification of crumb porosity while maintaining specific volume and crumb texture.
Results of this work would also suggest that the unique physical and sensory quality of wheat breads is not only due to the presence of gluten, but also to the proper A-to B-type starch ratio (~70% in native wheat flour) that result in the optimum physical properties of the continuous phase from a carbohydrate standpoint.

***Mario M. Martinez**, Assistant professor, School of Engineering, University of Guelph*
Dr. Martinez' research focuses on fundamental research to practical applications of edible plant tissues and resorts to physical, chemical, biological and engineering concepts to extend the use of plant-based ingredients as related to functionality and health. Dr. Martinez holds a BSc in Agricultural Engineering, a MSc in Food Innovation, a PhD in Chemistry and he was a Postdoctoral Research Associate on Carbohydrate Physical Chemistry and Digestion at the Whistler Center for Carbohydrate Research, Purdue University (USA). He is the head of the Food Innovation, Structure and Health lab and has extensive experience on carbohydrate fine structure, high shear extrusion, the manipulation of the starch digestion rate for low glycemic response and the effect of phenolic compounds on glucose homeostasis.

5.4. **Grazyna Lewandowicz**, Poznan (Poland)
Applicability of food grade modified starches as emulsion stabilizers – structural and physicochemical aspects

Food emulsions are thermodynamically unstable dispersed systems in which durability is controlled by the presence of appropriate emulsifiers and stabilizers. Hydrocolloids, particularly modified starches are typically used as the latter ones. Though modified starches are traditionally associated with thickening and gelation behaviour, they also influence the properties of dispersed systems through their interfacial properties. Due to abundance of different types of modified starches the right choice of the appropriate stabilizer can be a difficult task. Therefore the aim was to rationalize this choice by defining the main structural and physicochemical factors determining applicability of food grade modified starches as emulsion stabilizers.
The most popular examples of commercial food grade modified starches (E 1404; E 1412; E 1420; E 1422) were used for stabilizing of model emulsions. Molecular structure of modified starches was analysed using size exclusion chromatography with triple detection. Physicochemical properties of starch pastes were examined in terms of viscosity (rotational rheometry), surface activity (du Noüy ring technique) and proton relaxation phenomena (low field NMR). Emulsion stability and viscosity as well as proton relaxation phenomena were also estimated. Principal component analysis was applied to define correlation between above mentioned parameters and emulsion stability.
It was stated that for the stability of the emulsions the physicochemical properties of the continuous phase are of greatest importance. Moreover, nuclear magnetic resonance spectroscopy was fond as an excellent method for determining the functionality of starch in the formation and stabilization of emulsions. The measurements of relaxation times in starch pastes and emulsions could be recommended. The oil phase analyses are less useful in prediction of emulsion stability. Screening of modified starches confirmed high applicability of cross-linked and acetylated starches as emulsion stabilizers.

***Grazyna Lewandowicz;** I graduated as chemical engineer from the Faculty of Chemical Technology, Poznań University of Technology. After that I started work at the same faculty as an academic teacher. The subject of my*

researches from that period concerned polymer chemistry and technology. Then I got a PhD in chemistry. Soon after that I started scientific work for Polish Potato Industry R&D Centre. So began my adventure with starch science that continues until now. The essence of my research on starch is search for a correlation between its structure and functionality. I pay Special attention to starch modification employing different methods.
In addition to being the author of numerous scientific papers I am an inventor of several licensed technologies which were successfully commercialized. A lot of modified starches produced in Poland are manufactured according to know-how elaborated in my research team.
Currently I work at the Faculty of Food Science and Nutrition (Department of Biotechnology and Food Microbiology), Poznań University of Life Sciences and my scientific activity was extended by research on functional food and industrial biotechnology. At the present time, besides starch, I pay special attention to bioactive compounds contained in potatoes.

Milestones:
1975 – graduated from the Faculty of Chemical Technology, Poznań University of Technology
1984 – PhD in chemistry Faculty of Chemical Technology, Poznań University of Technology
PhD thesis title: Polycondensation of diphenols with sulphur chlorides
1988 – start of work for Polish Potato Industry R&D Centre
2002 – habilitation
Habilitation thesis title: Starch modification using microwave field
2003 - start of work for Poznań University of Life Sciences
2011 – full Professor title.

5.5. **Joanna Kruk**, Cracow (Poland)
Starch nanocrystals as novel stabilizers of food emulsion

Joanna KRUK[1], Paweł PTASZEK[1], Anna PTASZEK[1], Kacper KACZMARCZYK[1]
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Food products are complex multiphase systems and many of them are emulsions. This type of dispersed systems can be composed of at least two immiscible phases – continuous and dispersed. The production of emulsions requires energy supply in order to overcome, among others surface tension and interfacial forces and obtain the expected droplets' sizes. To prevent or delay destabilization process of emulsions emulsifiers, such as lecithin, mono- and diglycerides of fatty acids, are commonly used. However, the stabilization of emulsions can be carry out using solid particles, which absorb at the interface instead surface active substances. As solid particles production may be based on raw materials such as starch, cellulose or chitosan. Pickering emulsion can be obtained using starch nanocrystals as emulsion stabilizer. Starch nanocrystals are produced using acid or enzymatic hydrolysis, precipitation, ultrasounds or combined methods.
In this work starch nanocrystals from waxy maize starch was used to stabilize emulsions produced with edible oils (sunflower, rapeseed, grapeseed, rice bran) and water. Controlled hydrolysis of starch with sulfuric acid(VI) was carried out to obtain starch nanocrystals. Dynamic light scattering method was used to characterize average size of starch solid particles after hydrolysis. Emulsions were produced by mechanical homogenizer. Rheological characterization of obtained Pickering emulsions has been carry out using classical and oscillatory tests.
Based on conducted research, it can be concluded that the emulsions obtained with edible oils, stabilized by starch nanocrystals from waxy maize starch, are viscoelastic systems having the ability to recover their structure. Crystalline starch fractions can be successfully used to stabilize dispersion systems such as emulsion.

***Joanna Kruk**, born in Krakow, Poland, 1987. Education: University of Agriculture in Krakow, Department of Food Technology, PhD graduated in 2014. Employed at University since 2014. Among her research interests are: multiphase systems and their stabilization, rheology of multiphase systems, starch treatment and modification, hydrocolloids, food texture, creating new food products. Author of publications about influence of hydrocolloids on rheological properties and stability of different types of foams and colligative properties of hydrocolloids.*

5.6. **Maria Matos**, Oviedo (Spain)
Nano-sized starch - opportunities for encapsulation

M. Matos[1,2], G. Gutiérrez[1], A. Marefati[2], N. Abdul Hadi[2], C. Blanco[4], M. Rivas[5], M. Rayner[2], B. Wiege[3]
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[2]Department of Food Technology, Engineering, and Nutrition, Lund University, P.O. Box 124, SE 221 00 Lund, Sweden
[3]Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Schützenberg 12, 32756 Detmold, Germany
[4]Department of Physical and Analytical Chemistry, University of Oviedo, Julián Clavería 8, 33006 Oviedo, Spain
[5]Dept. of Physics, University of Oviedo, Gijón Polytechnic School, 33203 Gijón, Spain
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Nanoparticles (NPs) are the right choice for strategic development of new drug delivery systems with novel applications in food, cosmetics and healthcare [1]. Starch is a non-allergenic abundant polysaccharide in nature, renewable and biodegradable making it an ideal candidate as reagent for green bioformulations. Starch models are described as concentric semi-crystalline multistate structures that are involved in the production of new nano-elements. The disruption of amorphous domains of semi-crystalline granular by acid hydrolysis will produce starch nanocrystal, while gelatinized starch will form starch in the form of starch nanoparticles (SNPs) [2].

Several methods have been known to produce SNPs such as high-pressure nanoemulsification, cross-linking, microemulsion/antisolvent nanoprecipitation [1-6]. The final properties of the SNPs are strongly influenced by the synthesis route and conditions so it will determine its final applications. For example, there has been indications of the bacterial inhibition properties of starch nanoparticles (SNPs) loaded with antibiotics or biocide metals, such as Ag, but it has been reported that bactericidal properties of the NPs are size dependent being more effective on 1-10 nm range [7]. A soft chemistry technique that allows size control with a growing interest is the microemulsion method [5] since it does not require sophisticated equipment, hazardous reagents and extreme conditions.

Recently, there has been also an increased use of magnetic iron oxide NPs (IONPs) for various biomedical applications being used as promising agents in detection and analysis, or in different therapies such as targeted drug delivery since they have a high magnetic moment and posse superparamagnetic properties. These type of magnetic NPs can be manipulated under the influence of an external magnetic field being able to act in a specific site of action which enables controlling and recovery later on for reuse or recycle. It has also been demonstrated the feasibility of producing loaded magnetic iron oxide impregnated SNPs for controlled drug release by a synthesis based on the microemulsion method known as emulsion crosslinking [8].

In this presentation, up-to-date information regarding the synthesis of SNPs used for encapsulation and its novel bioapplications both in food and healthcare will be presented.

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[8] Likhitkar, Sweta Bajpai, A.K. Magnetically controlled release of cisplatin from superparamagnetic starch nanoparticles. Carbohydrate Polymers 87 (2012) 300– 308.

María Matos *started in 2007 in the Group of Emulsions and Interfacial Phenomena from the University of Oviedo, supervised by Prof. Mª del Carmen Pazos and Assistant Prof. Gemma Gutiérrez presenting my doctoral thesis entittled "Production of emulsions with controlled droplet size containing bioactive compounds using membranes" in the year 2013.*

The work done in my thesis was focused on the formulation and preparation, both by mechanical agitation and membrane emulsification, simple and double emulsions with controlled droplet size in order to obtain monodisperse emulsions that could be able to entrap bioactive compounds of special interest in food, pharma industries.

During the whole period 2007-2018 I have also been participating in several projects with industries (Wherle Umwelt Gmbh, Arcelor Mittal, Fuchs lubricants, Reny Picot, Alcoa, etc.) mainly characterizing and studying the cycle life of emulsions and also by studying the treatment of waste oil in water emulsions from metalworking industries using several techniques such as coagulation, flocculation, centrifugation, ultrafiltration and vacuum evaporation.
During the phD I have a short stay at Lund University (Sweden) where I started working with starch involved in a Research Project titled Starch Pickering Emulsions for Targeted Delivery (Speximo). After that I carried other 6 short research stays (total 8 months) as postdoctoral researcher supervised by Prof. Marilyn Rayner and been involved in several Projects funded by Crafoord Foundation and Vinnova - The Swedish Innovation Agency.
In year 2009, I started to participate in a research line focusing on the Formulation and preparation of emulsions and niosomes containing biocompounds with functional applications in the food industry. In 2013, a collaboration was started with Prof. Carmen Blanco from Department of Analytical chemistry of University of Oviedo with the main purpose of produce Synthetic exosomes for clinical diagnostics development and formed the group Emulsions, nanovesicles and Bioanalysis. In 2018, the group Nanobiomem was funded together more researchers from Physics Depart-ment (UO) with the main objective of synthesis of nanoparticles/nanovesicles for the early and non-invasive diagnosis of colorectal cancer and also to break bad biofilms.
I am assistant professor since 2015 at University of Oviedo but I also continue my research and my interest with starch at Lund University with short stays and visits every year. I am also external deputy supervisor of PhD student there together with Marilyn Rayner (main) and PhD Ali Marefati (deputy) and we collaborate in her PhD project together with PhD Berthold Wiege form Max Rubner Institute in the development of Pickering emulsions stabilized by short chain fatty acids (SCFA) modified starches.
During all these research years my research has been produced 31 research articles, 1 book chapters and the participation on 35 international conferences I have supervised 18 MSc Thesis, 4 diploma works, one doctoral thesis (defended on 2014) at UO and currently I supervise two more that are undergoing. I have also supervised two PhD external visiting students from Isfahan University of Technol-ogy (IUT) (Iran) and Université de Bejaia (Algerie). I have participated in 13 important national and international research collabora-tions and projects within academia and have also cooperated in more than 10 re-search and industrial Projects in collaboration with companies being from 2015 main researcher in most of them.

5.7. **Willi Pabst**, Prague (Czech Republic)
The use of starch and starch-related products in ceramic processing technology

Willi PABST*1, Eva GREGOROVÁ1, Tereza UHLIŘOVA1, María Andrea CAMERUCCI2, María Laura SANDOVAL2, Mariano Hernán TALOU2
Department of Glass and Ceramics, University of Chemistry and Technology, Prague (UCT Prague), Technická 5, 166 28 Prague 6, Czech Republic
División Cerámicos, Instituto de Investigationes en Ciencia y Tecnología de Materiales (INTEMA), Av. Juan B. Justo 4302, B7608FDQ Mar del Plata, Argentina
During the last two decades starch and starch-related products have become very important processing additives in ceramic technology, mainly for the preparation of ceramics with controlled porosity and microstructure. This contribution reviews the use of native and modified starches and starch-related products (such as wheat flour, gelatinized and water-soluble starch) in ceramic processing technology, ranging from binders for extrusion to fugitive pore formers and foam stabilizers.

***Prof. Dr. Willi Pabst** is Full Professor of Chemistry and Technology of Inorganic Materials at the University of Chemistry and Technology, Prague (UCT Prague), Czech Republic (since 2016). He is an author or coauthor of more than 85 full-text papers in impacted journals (> 120 contributions on WOS, H-index 27, > 1100 non-auto citations) and 13 book chapters. He is Head of the Ceramics group at the Department of Glass and Ceramics of the UCT Prague, and one of his fields of interest concerns the use of starch and other polysaccharides in ceramic shaping and processing technology.*

1.1. **Fred Brouns,** Maastricht (Netherlands)

Starch, Sugar and public health: does the carbohydrate source matter?

*Maastricht University, Faculty Of Health Medicine and Life Sciences,

There is much to do in social media about the effects of carbohydrates, in particular sugars, on health and disease. In recent years a number of publications have suggested that fructose and high fructose corn syrup are prime contributors to the global obesity and diabetes epidemic. This suggestion has been strongly based on sugar consumption data calculated from food disappearance data that were criticized to be flawed by not taking into account food waste and sugar exports. Some authors particularly highlighted a role of fructose containing sugars as both being a "toxic" and leading to increased energy intake, sweet addiction, obesity, fatty liver and chronic disease. Such statements about fructose have their origin in studies done with very high doses, mostly in rats and mice and usually as pure fructose, at levels much higher than we normally consume with our diet. However, humans consume fructose almost always along with glucose. The effects of fructose + glucose are very different from those observed after pure fructose intake.

Opposite opinions also exist. For example, recent meta-analyzes showed that a regular consumption of small amounts of fructose in the diet is associated with a significant risk reduction for diabetes and heart disease. This is partly the reason for the recent EFSA health claim concerning the use of fructose in exchange for glucose containing sugars. Very recently various Joint WHO/FAO Expert Consultations have resulted in a number of descriptive reports on the role of diet and life style on wellness and disease, such as the report on diet, nutrition and the prevention of chronic diseases (2003), the global status report on non-communicable diseases (2014), global action plan for the prevention and control of non-communicable diseases 2013-2020 and the recent 2015 guideline on “Sugars intake for adults and children “ The latter is part of WHO’s effort to reach targets set by the Global Action Plan for NCDs 2013-2020 to halt the rise in diabetes and obesity and reduce the burden of premature deaths due to NCDs by 25% by 2025. In this guideline it is stated that ‘Limiting the intake of free sugars to less than 10% of total daily energy intake as part of a healthy diet is required. The WHO expert panel further concluded that a reduction to less than 5% of total energy is suggested for additional health benefits. The WHO guideline may lead to the impression that sugars are the prime reason of obesity and diabetes. In this respect it is important to note that total energy intake, which includes not only total sugar but also lipid, alcohol, along with many other factors, have a concerted impact on the development of obesity in contrast to the any specific kind of carbohydrate. It is also important to realize that diabetes is not a disease caused by sugar, but concerns a disturbed metabolism of sugar once insulin resistance has developed. Further that insulin insensitivity and the development of type 2 diabetes in the non-elderly is mainly associated with being overweight, regardless of the cause in terms of main type of macronutrient in the diet.

There are several important aspects in this respect that need to be put into perspective and will be reviewed briefly in this presentation:

1) Is fructose a poison and is glucose safe?
2) What makes ‘free sugars’ different from ‘intrinsic sugars’?
3) Should the prime concern be about the carbohydrate type or simply about food type and quantity consumed?
4) Why is added sugar in soft drink worse than added sugar in food?
5) Many starches induce a greater increase in blood glucose and insulin than free sugars. Why is the sole focus on free sugars?
6) Should we avoid as much carbohydrates as possible?
7) Do we eat too much of everything?

Prof Dr. Fred Brouns *obtained a PhD at Maastricht University in the Netherlands for his research “Food and Fluid Related Aspects in Highly Trained athletes” For this he was awarded the Dutch Sports Medicine Award. Fred has >35 years experience in the field of nutrition sciences and health. He headed international R&D functions in at Wander Dietetics, Sandoz Nutrition, Novartis Nutrition, Eridania-Beghin-Say, Cerestar and*

Cargill Inc. He chaired various food and nutrition expert panels at the International Life Sciences Institute (ILSI) Europe, Brussels and at IDACE, Paris. Fred became invited member of the British Nutrition Society and is a registered Biomedical Researcher as well as board member (2008-2012) of the Dutch Academy of Nutritional Sciences. He obtained fellowships of the American College of Sports Medicine and the European College of Sports Sciences and published extensively. Fred published > 300 science papers and presented > 200 key-note lectures worldwide. He was awarded with several innovation prizes. From 2008- 2015 he held a full chair "Health Food Innovation" at the Faculty of Health, Medicine and Life and Sciences, within School of Nutrition and Translational Research in Metabolism (NUTRIM), Maastricht University. His main research interests concern vitality and physical function in health and disease, related to aspects of carbohydrates, sugars, sweeteners, dietary fibers and starchy staple foods, in particular grains, fruits and juices. In addition he coordinates an international research consortium addressing adverse reactions to wheat and gluten and is a globally invited speaker on these topics.

1.2. **Nelli Elizarov,** Berlin (Germany)
Bioethanol – Market Data and Policy Framework post 2020

A quarter of Europe's greenhouse gas emissions are caused by the transport sector. Due to increasing mobility it has not seen a decline in emissions as other sectors. It remains the main cause of air pollution in cities. Meeting the Paris Agreement targets all kind of available technologies reducing greenhouse gas emissions should be used. On the way towards a low-carbon economy the use of liquid biofuels is an already available and high potential way to contribute to Europe's emission reduction targets. What is the role of Bioethanol in decarbonising the EU and German transport sector? What is the current market situation for Bioethanol?
Future investments and market developments depend on the policy framework post 2020, whereof the revised Renewable Energy Directive (RED II) constitutes the single most important set of regulations. What is the policy state of play in Europe and in Germany in the transport sector? What are future possibilities and challenges for biofuels and advanced biofuels in Europe under the RED II?

***Nelli Elizarov** Since 2017 Adviser for Research and Statistics, German Bioethanol Industry Association, 2016-2017 Research Fellow, Université Côte d'Azur, Medicinal Chemistry (Total Synthesis), 2015-2016 Post-Doc, Université Côte d'Azur, Green Chemistry (Heterogeneous Bi- and Au-catalyzed reactions and Flow-Chemistry), 2010-2014 PhD, University of Potsdam, Organic Chemistry (Sequential oxidative and non-oxidative Pd-catalyzed reactions), 2005-2010 Chemistry, University of Potsdam*

Publications
*Selected: P. D. Giorgi, N. Elizarov, S. Antoniotti, Chem. Cat. Chem. **2017** 9, 1830–1836.*
Highlighted by Wiley in Hot topics: gold.
„Selective oxidation of activated alcohols by supported gold nanoparticles under an atmospheric pressure of O2: batch and continuous flow studies."
*N. Elizarov, S. Antoniotti Chemistry Select **2016**, 1, 3219–3222.*
"Highly efficient Hosomi-Sakurai reaction of aromatic aldehydes catalyzed by Montmorillonite doped with simple bismuth(III) salts. Batch and continuous flow studies."
*B. Schmidt, N. Elizarov, U. Schilde, A. Kelling J. Org. Chem. **2015**, 80, 4223–4234.*
featured article und Cover Mai 2015
„Dual Role of Acetanilides: Traceless Removal of a Directing Group through Deacetylation/ Diazotation and Palladium-Catalyzed C-C Coupling Reaction."
*Schmidt, N. Elizarov Chem. Commun. **2012**, 48, 4350–4352.*
„Selective arene functionalization through sequential oxidative and non-oxidative Heck reactions."

1.3. **Hans Matilla,** Helsinki (Finnland)
Single-step, single-organism bioethanol production and bioconversion of lignocellulose waste materials by phlebioid fungal species

Detailed information will be presented at the convention.

1.4. **Timo Broeker**, Lemgo (Germany)
bioCO2nvert – using CO2 for renewable energy storage

Environmental concerns drive industrial development towards efficiency. Not seldom this leads to advanced fields of activity, for example through adding value to a side stream. Beside spent grains, breweries produce a major side stream: CO2. Present utilization like liquefaction is rarely feasible, consumes further energy and offers a solution only for a small percentage of the overall emission produced in breweries. On the other hand, power-to-gas and methanisation of the electrolytic produced hydrogen with CO2 are becoming an intensively discussed technology to contribute to the transformation of the energy system. In order to benefit from that technology, there is a demand for cheap and pure CO2 sources, which makes breweries interesting for implementation. An innovative lab scale reactor for the biocatalytic methanisation has been build up and attached to fermentation. The implementation into a local brewery has been investigated. Experimental and published results have been used to study several possibilities to realise a biocatalytic P2G concept in a brewery.

Germany as a country with a high amount of renewable electricity had to shut off 5,5 TWh of wind power in 2017, since no storage capacities are available yet. Power-to-gas/liquid is being considered as the technology with the highest energy storage potential. In order to become economic, cheap and pure CO2 sources are significantly important.
Is alcoholic fermentation are going to play the most important role of Power-to-X and the transition of the energy system?
After lab scale studies now we move to building a pilot reactor at container size, to prove feasibility and model business cases in hardware-in-the-loop kind of experimental set up.

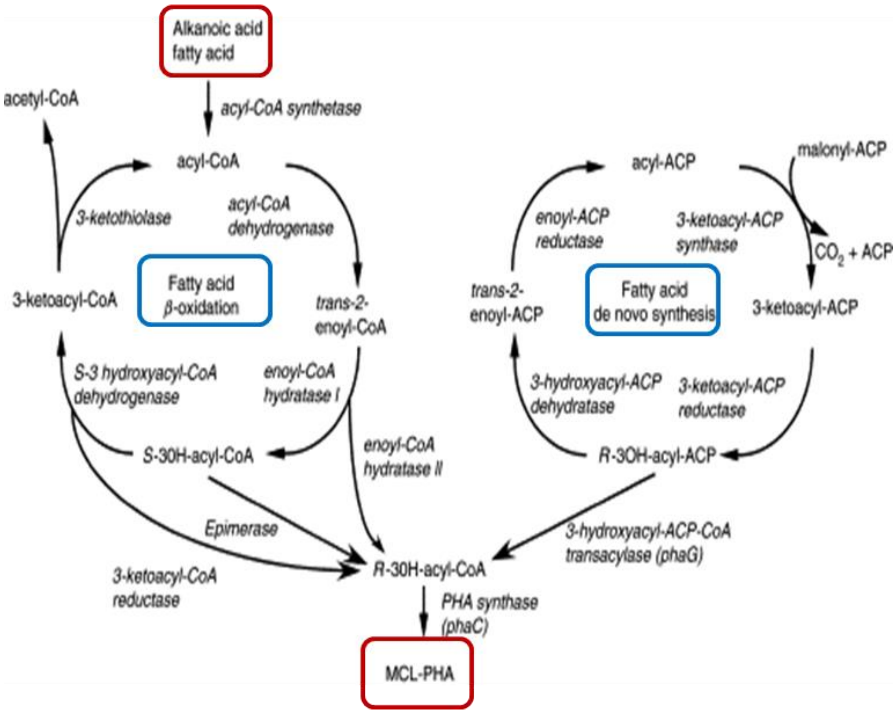
***Timo Broeker** is a biotech engineer and holds a master degree from the University of Applied Sciences OWL in Lemgo, where he has been working as at the Department of beverage technology on research projects for almost 10 years. He deals with issues of side-stream valorisation and cascade processes. He also is a member of the managing board of the Institute of Food Technology NRW.*

1.5. **Jeroen Hugenholz,** Wageningen (Netherland)
Conversion of municipal solid waste into higher value components (project EURBIOFIN)

UrBioFin; production of mcl-PHA for municipal solid waste
Jeroen Hugenholtz, Ricardo Nagtegaal, Ruud Veloo and Frits de Wolf
Wageningen Food & Biobased Research, The Netherlands

UrBioFin is the acronym of a collaborative project sponsored by The European Commission on valorization of municipal solid waste (MSW). In this project, several European research institutes and industrial partners join forces to up-grade an existing, Spanish, bio-ethanol plant towards the production of higher-value chemicals such as bioethylene, medium-chain fatty acids and various bioplastics (poly hydroxy alkanoates/PHA). The task of Wageningen Food & Biobased Research (WFBR) within this consortium is to develop, optimalize and scale-up a two-step process to produce medium-chainlength PHA’s from short chain fatty acids produced during anaerobic digestion of the organic part of the MSW. In the first step, the short chain fatty acids are converted by oleogenic yeasts such as Cryptococcus curvatus into medium- and long-chain fatty acids, which are subsequently fed to the PHA-producing bacterium, Pseudomonas putida. This leads to production of PHA’s containing much longer fatty acids residues with more flexible, superior, material properties in comparison to convential PHB (polyhydroxybutyric acid) and PHV (polyhydroxyvaleric acid). With this approach, PHA production is not only expected to be cost-effective, but will also lead to more extensive use of PHA for instance as biodegradeable packaging material or for agricultural use as biodegradeable foil or mulch.

Current plant for Bioethanol from Municipal Solid Waste (Valencia)



MCL-PHA production in *Pseudomonas putida*

***Jeroen Hugenholtz** has completed his PhD from the University of Groningen, The Netherlands and postdoctoral studies from University of Georgia, USA. He is currently leader of a fermentation expertise group at Wageningen Research and (part-time) holder of a professor chair at the University of Amsterdam in Industrial Molecular Microbiology. He has published more than 200 papers in international scientific journals and is author of more than 20 patents in the area of (food) fermentation and metabolic engineering.*

Wednesday, April 10th 2019

08^{30} 4.5 **D.C. Saxena,** Punjab (India)
Modification of starch: How would it affect the flowability during bulk handling and processing

08^{55} 4.6 **Saeed Amer Asiri,** Berlin (Germany)
Enzymatically modified starch with improved gelation behavior

5. Application

09^{20} 5.1. **Gueba Agoda-Tandjawa**, Caen (France)
Starch-carrageenan interactions in aqueous media: role of each polysaccharide chemical and macromolecular characteristics

09^{45} 5.2. **Gemma Gutiérrez**, Oviedo (Spain)
Encapsulation of resveratrol in emulsions stabilized by rice or quinoa starch particles

10^{10} Communication Break

10^{35} 5.4. **Grazyna Lewandowicz**, Poznan (Poland)
Applicability of food grade modified starches as emulsion stabilizers – structural and physicochemical aspects

11^{00} 5.5. **Joanna Kruk**, Cracow (Poland)
Starch nanocrystals as novel stabilizers of food emulsion

11^{25} 5.6. **Maria Matos**, Oviedo (Spain)
Nano-sized starch - opportunities for encapsulation

12^{00} Lunch Break

13^{00} 5.7. **Willi Pabst**, Prague (Czech Republic)
The use of starch and starch-related products in ceramic processing technology

15th European Bioethanol and Bioconversion Technology Meeting

13^{25} 1.1. **Fred Brouns,** Maastricht (Netherlands)
Starch, Sugar and public health: does the carbohydrate source matter?

13^{50} 1.2. **Nelli Elizarov,** Berlin (Germany)
Bioethanol – Market Data and Policy Framework post 2020

14^{15} 1.3. **Hans Matilla,** Helsinki (Finnland)
Single-step, single-organism bioethanol production and bioconversion of lignocellulose waste materials by phlebioid fungal species

14^{40} Communication Break

15^{10} 1.5. **Timo Broeker**, Lemgo (Germany)
bioCO2nvert – using CO2 for renewable energy storage

15^{35} 1.6. **Jeroen Hugenholz,** Wageningen (Netherland)
Conversion of municipal solid waste into higher value components (project EURBIOFIN)

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