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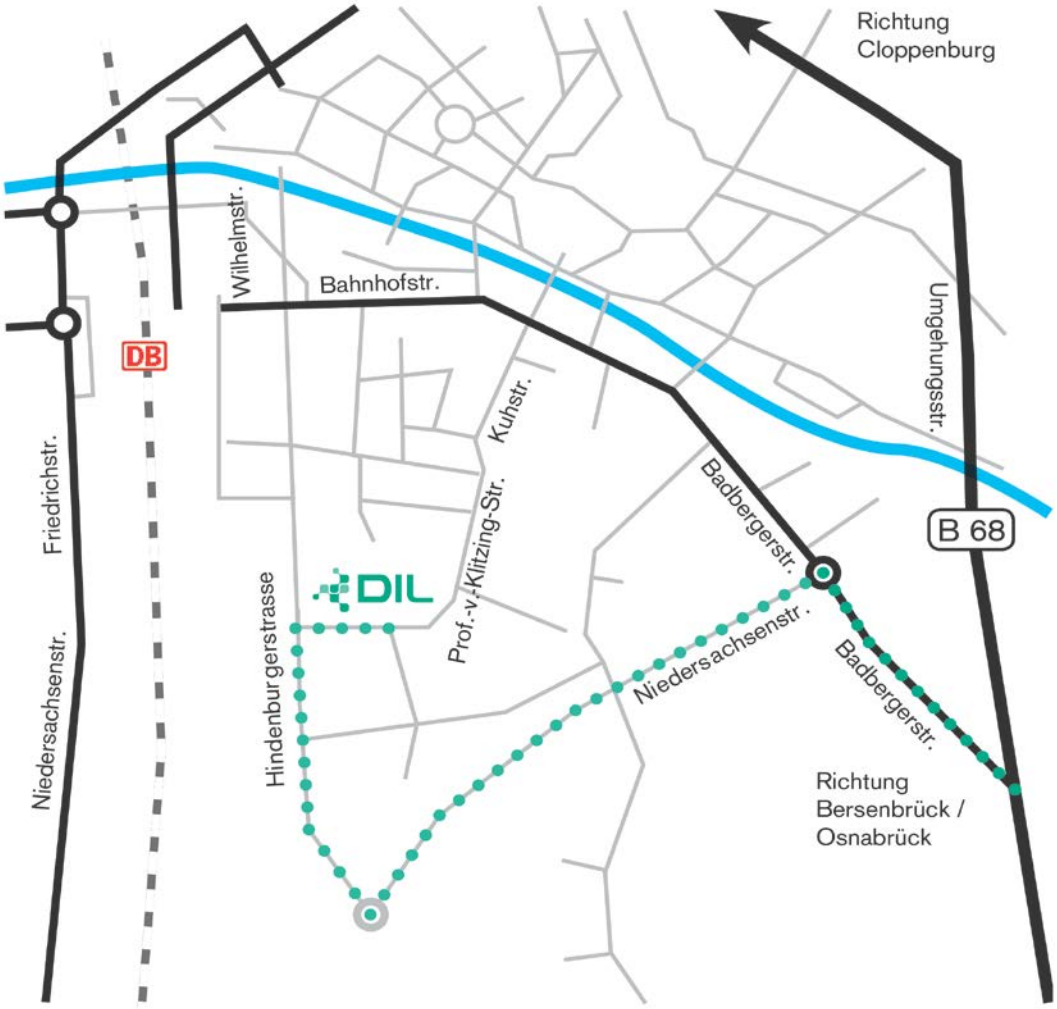
Participants

Bähler	Balz	University of Hohenheim	D	Stuttgart
Berger	Ralf Günter	Leibniz Universität Hannover	D	Hannover
Bobe	Ulrich	Nestlé PTC Singen	D	Singen
Cernela	Jérémie	AgroParisTech	F	Massy
Chichti	Emna	National Institute of Agronomic Research (INRA)	F	Montpellier
Chranioti	Charikleia	National Technical University of Athens	GR	Athen
Franke	Knut	German Institute of Food Technologies (DIL)	D	Quakenbrück
Garg	Anubha	German Institute of Food Technologies (DIL)	D	Quakenbrück
Georget	Erika	German Institute of Food Technologies (DIL)	D	Quakenbrück
Heinz	Volker	German Institute of Food Technologies (DIL)	D	Quakenbrück
Hendrickx	Marc	Katholieke Universiteit Leuven	B	Leuven
Huc	Delphine	AgroParisTech	F	Massy
Kebede	Biniam	Katholieke Universiteit Leuven	B	Leuven
Kerbstadt	Sebastian	University of Applied Sciences Osnabrück	D	Osnabrück
Knorr	Dietrich	Technical University Berlin	D	Berlin
Krepker	Maksym	Technion-Israel Institute of Technology	IL	Haifa
Lloyd	David	University of Birmingham	UK	Birmingham
Lon• arevi•	Ivana	University of Novi Sad	SRB	Novi Sad
Mao	Like	Teagasc Food Research Centre	IE	Cork
Mathys	Alexander	German Institute of Food Technologies (DIL)	D	Quakenbrück
Paesler	Patrick	University of Applied Sciences Osnabrück	D	Osnabrück

Raffray	Guilhem	CIRAD, La recherche agronomique pour le développement	F	Montpellier
Roos	Yrjo H.	University College Cork	IE	Cork
Roversi	Tommaso	University of Milan	I	Milan
Yvonne	Rudeck	University of Applied Sciences Osnabrück	D	Osnabrück
Schnare	Julian-Philip	University of Applied Sciences Osnabrück	D	Osnabrück
Schubert	Helmar	Karlsruhe Institute of Technology	D	Karlsruhe
Sevenich	Robert	Technical University Berlin	D	Berlin
Töpfl	Stefan	German Institute of Food Technologies (DIL)	D	Quakenbrück
Trystram	Gilles	AgroParisTech	F	Massy



By train

Quakenbrück can be reached easily by public transportation (DB AG to Osnabrück or Oldenburg, NWB from Osnabrück or Oldenburg each hour).

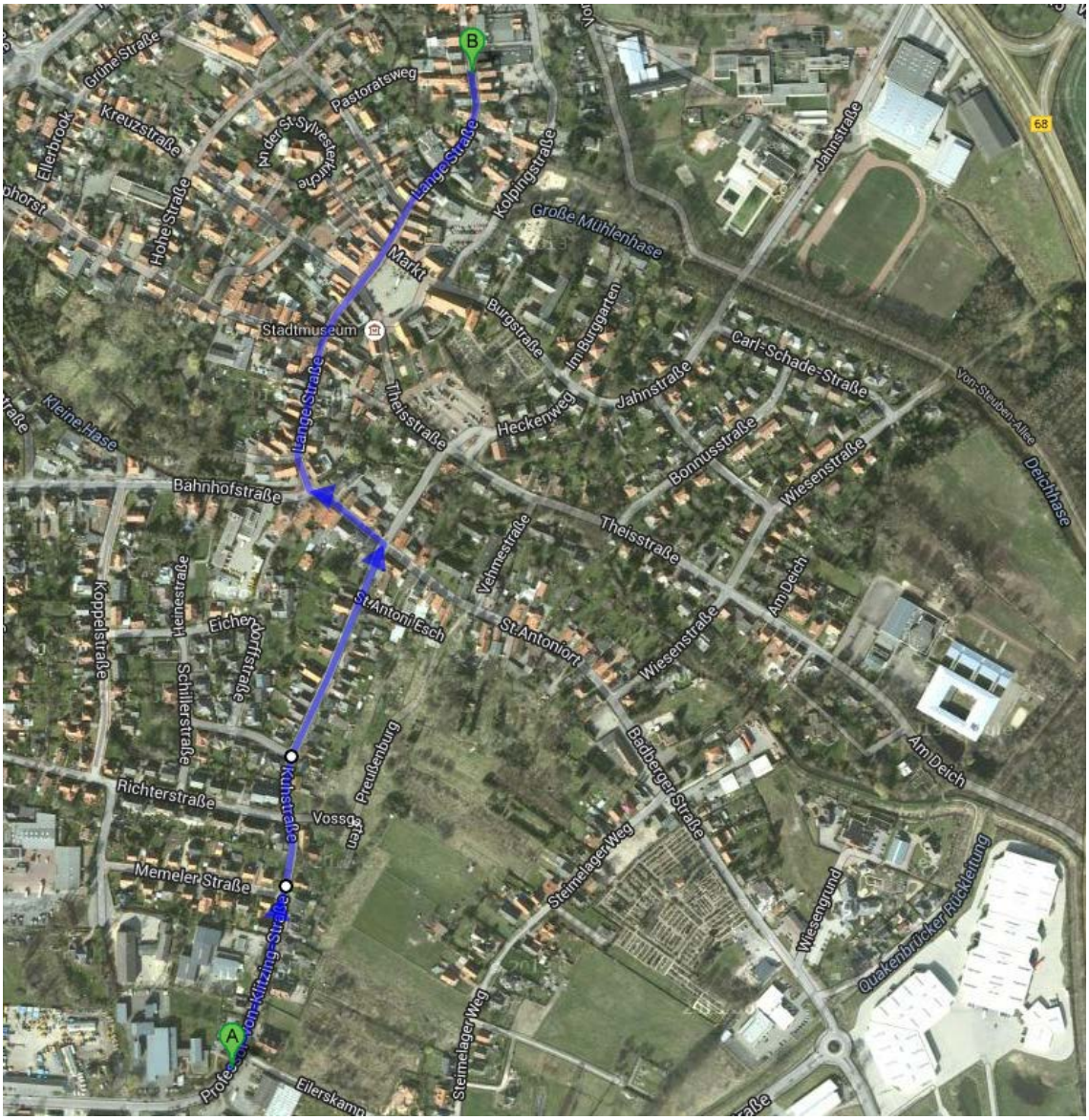
By car

Quakenbrück ist is located close to the Autobahn A1.
Coming from the direction of Bremen or Osnabrück, take the exit 65 Lohne/Dinklage.
Then turn right onto Dinklagerstraße.
At the roundabout, take the first exit onto Dinklager Ring (direction Quakenbrück) and then follow the signs for approximately 10 kilometers.
After reaching the city of Quakenbrück on the Wohldstraße, take the first exit of the roundabout onto onto Saint Annenstraße and continue straight ahead onto Friedrich-Ebert-Straße.
When reaching the next roundabout, take the second exit onto Wilhelmsstraße.
After approx. 800 meters, turn left into Bahnhofstraße and then immediately turn right into Hindenburgstraße and follow the road for approx. 500 meters.
Then turn left into Professor-von-Klitzing-Straße and follow the road for 100 meters.
You have reached your destination.

Direction to Weinhaus Köster (by walking)

Professor-von-Klitzing-Straße – Langestraße 68

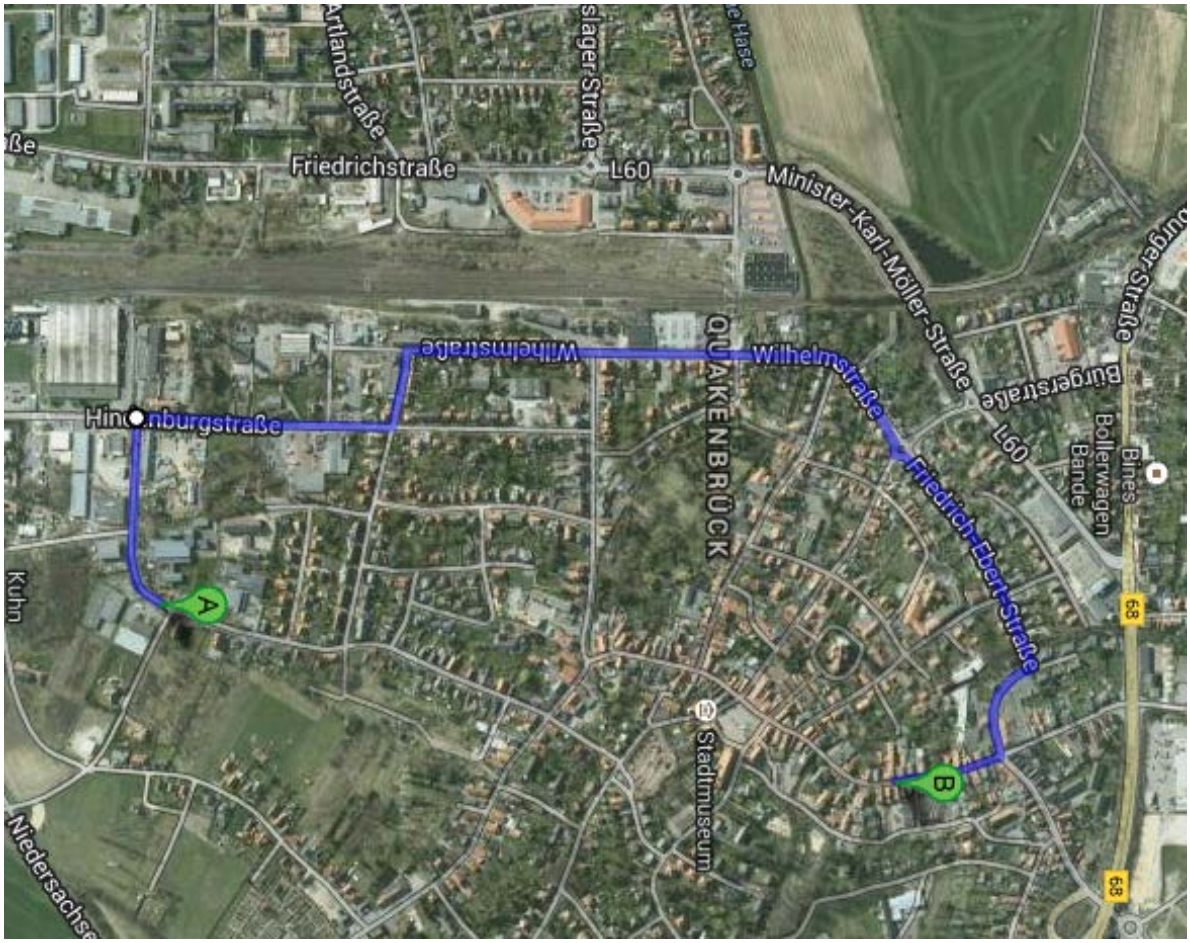
1.	On Professor-von-Klitzing-Straße to the northeast direction Eilerskamp	190 m
2.	Continue on Kuhstraße	400 m
3.	Turn left to St. Antoniort	97 m
4.	Turn right on Langestraße	500 m
	The destination is on the left side.	



Direction to Weinhaus Köster (by car)

Professor-von-Klitzing-Straße – Langestraße 68

1.	On Professor-von-Klitzing-Straße to southwest direction Hindenburgstraße	280 m
2.	Turn right on Hindenburgstraße	350 m
3.	Take 2nd junction on the left to change on Richterstraße	110 m
4.	Turn right on Wilhelmstraße	750 m
5.	Take second exit (Friedrich-Ebert-Straße) in the roundabout	400 m
6.	Turn right to remain on Friedrich-Ebert-Straße	160 m
7.	Take 1st junction on the right to change to Langestraße	160 m
	The destination is on the right side	



Stress – temperature limits for anisotropic structuring of pasta filata cheese: a soft matter approach

Balz Bähler[1]*, Ramona Back[1], Nabil Chaib[1], Maria Ebenreth[1], Michaela Nägele[1], Olesja Schätzle[1] and Jörg Hinrichs[1]

[1] *Department of Dairy Science and Technology, Institute of Food Science and Biotechnology, University of Hohenheim, Stuttgart, Germany (*presenting author: balz.baehler@uni-hohenheim.de)*

Abstract

For the production of pasta filata cheeses, e. g. mozzarella or kashkaval, the typical fibrous structure is a result of the anisotropic assembly of casein, the main protein in milk. A systematic analysis was performed to investigate the prerequisites for the formation of a fibrous structure. It revealed three important steps: (i) the cheese curd has to be plasticized, (ii) it has to be conveyed during the process without structural distortion, (iii) it has to be kneaded/stretched to obtain the anisotropic structure.

Firstly, the cheese curd has to be plasticized. This involves exceeding the gel-sol transition temperature. A model based on a soft glass approach is deduced from experiments with direct acidified skim milk curd and small angle oscillatory shear temperature sweep experiments to explain the influence of pH and calcium on temperature behavior of dense protein systems. The temperature at which the cheese curd starts to flow (G` > G``) is assumed to be the temperature where the casein micelles are small enough to behave as hard spheres.

Secondly, the plasticized curd is conveyed in the process and a range of constant flow profiles were characterized by means of a capillary rheometer. Depending on fat in dry matter a characteristic shear stresses above which the process becomes instable and an impact on structure formation could be observed with reduced anisotropy. This could be related to gel-sol transition also observed in small angle oscillatory shear experiments.

Thirdly, the stretching step leads to an anisotropic structure. This has to be retained over time, because relaxation can undo the structure formation. The viscoelastic relaxation behavior of the casein systems could be modeled with a Maxwell model and necessary processing times could be deduced from the relaxation time.

The results were applied to a new pasta filata cheese process based on extrusion technology.

Keywords: Food engineering, Dairy technology, Pasta filata cheese, Food processing.

Curriculum Vitae:

Balz Bähler, born 18. June 1985, did study food science at ETH Zurich (Switzerland) and obtained a Bachelor degree in Food Science (2004-2007) and a Master of Science degree in Food Science (Major: Food Processing, 2008-2010) from ETH Zurich, Switzerland. Since July 2010, Balz Bähler is a PhD student at University of Hohenheim, Germany, Institute of Food Science and Biotechnology in the Laboratory of Dairy Science and Technology (Supervisor: Prof. Dr.-Ing. Jörg Hinrichs), developing an innovative production process for pasta filata cheese based on extrusion technology.

Experimental study and modeling of heat and water transfer during domestic pan-frying

Jérémie Cernela[1]*, Bertrand Heyd[1], Bertrand Broyart[1]

[1] *UMR 1145 Génie Industriel Alimentaire, AgroParisTech, Massy, France*
*(*jeremie.cernela@gmx.fr)*

Abstract

Domestic cooking is the last step in the life cycle of many food products, and probably the least controllable in terms of operating conditions, and thus of food quality. This work focuses on heat and water transfer during the pan-frying operation and, more precisely, on the critical issue of contact heat transfer, in order to properly model the temperature rises in the products cooked in this way.

The first step was the assessment of the variability of heat treatments applied to products in their domestic pan-frying, because few researches on this topic have been found in the literature [1,2]. About thirty domestic pan-frying protocols were reproduced with different materials, highlighting a large variability of pan temperature kinetics and gradient of pan surface temperature.

The next step was to develop an original cooking apparatus being able to reproduce in the lab and in a controlled way all the pan-frying heating conditions previously measured at domestic scale. The fine instrumentation of this apparatus also offers the particular advantage to provide an accurate and non-disturbing measurement of the pan surface temperature just under the product and of the contact heat flux. These data were so far only approximately measured in the food process domain [3,4].

To produce various experimental data, this cooking apparatus was used to cook three food simulants having different contact characteristics: a gel emulsion, a cereal batter and a breaded poultry product. The analysis of all the thermal and water losses data collected showed distinct patterns. The further modeling of heat and water transfer in these products during their pan-frying enabled us to validate heat and water transfer models. For this purpose, we introduced a new approach to describe the coupling between water vapour emission and heat transfer in the confined space between the pan and food product.

Keywords: Pan-frying, Instrumented cooking device, Heat and mass transfer, Modeling

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Curriculum Vitae:

Jérémie received his European Master's degree in 2009 from the ENSAIA, a French Graduate School for Agronomy and Food Science, with a specialization in dairy products. Then, he got his PhD in 2013 at AgroParisTech, a French Graduate School in Agronomy, Environment, Life Science and Food Technology, working on heat and mass transfer and lipid oxidation during domestic cooking operations. Since last year, he works as a research engineer at the research centre of an international agri-food company specialised in dairy products.

NANOMECHANICAL MEASUREMENTS AND MODELLING OF WHEAT ENDOSPERM TO PREDICT FRACTIONATION BEHAVIOR

Emna Chichti [1*], Matthieu George [2], Jean-Yves Delenne [1], Farhang Radjaï [3], Valérie Lullien-Pellerin [1]

[1] *INRA, UMR 1208 Ingénierie des Agropolymères et Technologies Emergentes, 34060 Montpellier, France*

[2] *L2C, UMR 5221, CNRS-UM2, Place Eugène Bataillon, 34095 Montpellier cedex, France*

[3] *LMGC, UMR 5508, UM2, Montpellier, 34095 Cedex 5, France*

Modelling of the wheat endosperm has been developed in order to identify key factors which play a role in the mechanical behaviour of grain fractionation (1). The model was based on actual knowledge of the endosperm structure and taking into account the described mechanical properties of its major components (starch and protein) that were reported to be quite identical (2). The model showed that according to these parameters, the fracture propagate differently depending on both endosperm porosity and starch/protein matrix adhesion. However, the lack of information about mechanical properties at the local scale constitutes a major limitation for the modelling. An original method using Atomic Force Microscopy (AFM) tip to progressively abrade the surface of tablets made of pure starch and gluten was developed in order to measure at the nano-scale the mechanical properties of the wheat endosperm main components. Unexpectedly, important differences have been observed between the mechanical properties of starch granules and protein network (i.e. gluten). These results appeared in contradiction with previous published studies using indentation and were used to refine the model in order to compare the numerical results with the experimental ones obtained at the macroscopic scale.

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In 2009, I graduated from the National Institute of Applied Sciences and Technology (INSAT, Tunis, Tunisia) after 5 years studying industrial biology, which is a multidisciplinary training focused on biological processes related to medical, pharmaceutical and food industries. This engineer background helped me to obtain my master degree in food science and process at the Higher National School of Agronomy and Food Industries (ENSAIA, Nancy, France) in 2010. Recently, I defended my PhD in chemistry, biochemistry and food technologies at Montpellier SupAgro. My work was interested in understanding the link between wheat endosperm texture and the fractionation behaviour, using a mutli-scale approach. Since September, I work as an assistant professor in food engineering at Montpellier SupAgro.

Microencapsulation of flavoring, colorant and sweetener food compounds

Charikleia Chranioti* and Constantina Tzia

School of Chemical Engineering, National Technical University of Athens, Athens, Greece

*(*cchranioti@chemeng.ntua.gr)*

Abstract

The present study employs the encapsulation of three representative food compounds, belonging in flavoring, colorant and sweetener categories. The first one is fennel oleoresin, coming from a well-known Mediterranean aromatic plant that is generally incorporated in many processed foods. However, it is susceptible to light, heat and oxygen, and therefore needs to be encapsulated. Four different agents (chitosan-CH, modified starch-MS, gum arabic-GA, and maltodextrin-MD) both individually and in blends were tested using freeze-drying method. The objective was to evaluate the properties of the emulsions and the freeze-dried products as well as to assess their oxidative stability. Based on the results, MS-CH, GA-MS and MS-MD-CH showed good efficiency along with the best oxidative stability. The encapsulation of two natural colorants; saffron and beetroot, was also studied. Beetroot consists mainly of two major water-soluble fractions, betacyanins and betaxhantins [1], while saffron includes crocins, a carotenoid family with biologically active effect on human health [2]. However, due to poor heat and light stability, encapsulation is needed. The agents used were selected based on the previous study while freeze drying was applied. The objective was to study their incorporation in a chewing gum model system. In the third part, an attempt has been conducted to encapsulate a Stevia (*Stevia rebaudiana*)-based sweetener since nowdays there is a growing interest in using natural, non-calorie sweeteners, and alternative to sucrose [3]. The purpose was to control its release while improving its properties. Spray, freeze and oven drying were tested while maltodextrin and inulin were used as agents. The obtained products were evaluated in terms of efficiency, hygroscopicity, solubility, moisture and release profile, while the syrups were tested with respect to viscosity, turbidity and sensory properties. Overall, the study focused on developing stable and easily to be incorporated products, leading thus to food systems with improved properties, better quality characteristics and health benefits.

Keywords: Encapsulation, Fennel oleoresin, Beetroot, Saffron, Stevia-based Sweetener.

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Curriculum Vitae:

Chranioti Charikleia, is a PhD Candidate at National Technical University of Athens (NTUA), School of Chemical Engineering, thesis title '*Microencapsulation of flavoring, colorant and sweetener food compounds*'. She has graduated from Chemical Engineering department of Aristotle University of Thessaloniki. MSc in '*Food Science and Technology*' of Food Science and Technology department of Aristotle University of Thessaloniki and in '*Catalysis and Environmental Protection*' of Hellinic Open University. She has experience on Food technology and in analytic-instrumental analysis. She has been a co-author in 2 chapters and she has published 3 papers in journals of international scientific books on Food Science and Technology.

***Geobacillus stearothermophilus* spore germination and inactivation mechanisms during innovative multi hurdle combinations for food sterilization**

Erika Georget[1, 2]*, Alexander Mathys[2], Volker Heinz[2], Ralf Günter Berger[1]

[1] *Institute of Food Chemistry, Leibniz University Hanover, Hanover, Germany*

[2] *German Institute of Food Technologies DIL, Quakenbrück, Germany (*e.georget@dil-ev.de)*

Abstract

Bacterial spores are a major concern for food safety due to their high resistance to conventional preservation hurdles. Inactivation by thermal and/or chemical treatments frequently leads to quality losses [1]. In this work, alternative approaches were considered to inactivate spores based on mechanistic investigations under emerging hurdles and multi-hurdle combinations.

One approach is to combine spore germination and inactivation of the heat sensitized spores by pasteurization. To investigate spore germination mechanisms, *Geobacillus stearothermophilus* ATCC7953 spore (*Gs*) high pressure (HP) germination and inactivation mechanisms were investigated at 200 MPa by *in situ* FT-IR and fluorometry. Further investigations were conducted on chemical germination mechanisms as alternative pathway. Laurdan stained *Gs* spores were used for *in situ* germination experiments and provided information on the inner membrane state. Finally, HP was combined to temperature, targeting germination or a one-step inactivation. Continuous ultra-high pressure homogenization (UHPH) was tested on spores of *Gs* and *Bacillus subtilis* PS832 (*Bs*) at T_{inlet}=20-85°C and p=150-350 MPa.

In situ observations suggested reversible or minor changes affecting the spore structure under hydrostatic HP, comprising the induction of a different ordered gel-like lipid phase of the inner membrane, possibly responsible for the 3 log_{10} germination observed at 200 MPa/55°C. A broad range of amino acid combinations failed at triggering nutrient germination while Calcium-dipicolinic acid (non-nutrient) germination up to 3.5 log_{10} was achieved. A two-phase mechanism was derived which suggested a role of cortex fragments in this germination path. However, in both approaches full heat sensitization by single-step germination was not successful.

UHPH at low T_{inlet} showed no inactivation or germination, possibly due to the short residence time under HP (<1 s) and in agreement with previous *in situ* observations [2]. Through thermal inactivation kinetics, the expected temperature contribution to UHPH inactivation was assessed. Significant inactivation of *Bs* and *Gs* was achieved for T_{valve}>120°C and T_{valve}>135°C respectively. The inactivation profiles matched the extrapolated thermal inactivation profiles. This suggested a key role of temperature over other stress factors and the need for thermo-resistant strains in UHPH sterilization validation. UHPH as an emerging sterilization technology is relevant for industry and could enable spore inactivation with a reduced thermal load.

Keywords: Food sterilization, bacterial spores, in situ, high pressure, nutrient, germination, ultra-high pressure homogenization UHPH.

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Curriculum Vitae:

Erika Georget received her Master's degree in Food Process Technologies from the École Nationale Supérieure d'Agronomie et des Industries Alimentaires (ENSAIA, Nancy, France) in 2011. Since then, she joined the Graduate School of Natural Sciences at the Leibniz University Hanover, Germany and conducts her Ph.D. research at the German Institute of Food Technologies DIL. There, she investigates new spore inactivation technologies in a project supported by the Nestlé Research Centre NRC Lausanne. Prior to joining DIL, she interned at Sidel Shanghai (China), the Fraunhofer Institute for Process Engineering and Packaging IVV (Freising, Germany) and the NRC Lausanne (Switzerland), where she investigated thermal inactivation of enzymes and microorganisms for food preservation.

Multi-scale study of industrial semi-hard cheeses: better understanding the eye growth phenomenon

Delphine Huc[12345*], Camille Michon[123], François Mariette[45]

[1]*AgroParisTech, UMR1145 Ingénierie Procédés Aliments, F-91300 MASSY*

[2]*INRA, UMR1145 Ingénierie Procédés Aliments, F-91300 MASSY*

[3]CNAM, UMR1145 Ingénierie Procédés Aliments, F-75003 PARIS

[4]Irstea, UR TERE, 17 Av. de Cucillé, CS 64427, F-35044 RENNES

[5]Université Européenne de Bretagne, France

Abstract

Some semi-hard cheeses are downgraded because their eyes are not mastered, as regards to their number, size, shape or repartition. The eye growth phenomenon relies on empirical knowledge and needs to be better understood and formalized. To do so, an original multi-scale investigation strategy was designed, based on the combination of Magnetic Resonance Imaging (MRI) to monitor eye growth during ripening [2], rheology to provide information on the cheese matrix resistance [3], biochemistry to quantify metabolites [5] and microscopy to analyze the microstructure [1, 4]. However, semi-hard cheeses are very heterogeneous products due to their process, which makes the combination of methods even more essential, in order to characterize spatial differences inside a product (eyes, curd grains, protein network, bacteria, etc), so that eye growth mechanisms could be studied using both time and spatial dependency monitoring.

A strong opening gradient was identified between under the rind and the core zone of cheese, with smaller and fewer eyes under-rind, growing slower core ones [4, 6]. Several leads were investigated to explain these differences. The microstructure of the cheese matrix in these two zones did not present any significant difference, so the only parameters left that could cause the opening gradient were the salt content and the rheological properties. The combination of MRI and gas pressure measurement demonstrated that the salt content influenced the eye growth gradient through the CO_2 production, by slowing down the growth and metabolism of bacteria. The higher firmness under the rind assessed using Lubricated Squeezing Flow tests could strengthen the opening gradient. Insights on crack development were also found by observing a pure fat layer at the periphery of eyes and showing that the cheese matrix possessed strain-hardening properties, maximized at the eye's apex. All experiments were led at an industrial scale to avoid scale-up issues.

Keywords: Eye growth kinetic; ripening; multi-scale; gradient

References

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Curriculum Vitae:

My education is a combination of an Engineering Degree (National Institute of Applied Sciences, Toulouse, France) in Biochemistry and a PhD in Food Science (Rennes 1 University, Rennes, France). I have been working on research projects led in public laboratories with at least one industrial partner for four years, first during internships, then during my PhD and now in my current position, realizing a Post Doctorate at AgroParisTech (Massy, France), coordinating a research project and participating to teaching programs.

FROM FINGERPRINTING TO KINETICS IN EVALUATING FOOD QUALITY CHANGES:

Process impact comparison after processing and during storage

Biniam T. Kebede*

Co-promotor: Dr. Tara Grauwet

Promotor: Prof. Ann Van Loey

Laboratory of Food Technology, Leuven Food Science and Nutrition Research Centre (LFoRCe), Department of Microbial and Molecular Systems (M2S), Katholieke Universiteit Leuven, Kasteelpark Arenberg 22, 3001 Leuven, Belgium
*(*BiniamTamiru.Kebede@biw.kuleuven.be)*

Abstract

Mechanistic and quantitative processing impact comparison and shelf-life evaluation are still key challenges in food technology. Recently, progress in analytical methods (e.g. GC-MS) and data analysis techniques (e.g. chemometrics) made it feasible to obtain more information from a particular food matrix. In this work, a comprehensive integration HS-SPME–GC–MS fingerprinting, multivariate data analysis and complex single/multi-response kinetics was performed to develop an analytical and engineering tool box. Starting from a fingerprint, markers can be selected from which enhanced mechanistic and quantitative insight can be obtained using a kinetic study. The potential of this tool box was critically evaluated, on the one hand, for comparing the impact of thermal and high pressure high temperature (HPHT) processing immediately after processing and during storage. On the other hand, the potential of accelerated shelf-life testing (ASLT) was investigated, since conducting the whole shelf-life study can be quite resource consuming. From the process impact comparison, two chemical reactions (Maillard reaction and oxidation reaction), which were differently affected by HPHT processing in comparison thermal processing, could be identified. Based on the fingerprinting results, a kinetic study further zoomed into quantitative compound differences. The multivariate accelerated shelf-life method resulted into two scientific valuables. A model to fit the overall quality changes during storage and the calculation of an acceleration factor which links the changes observed at higher storage temperatures to the quality changes which can be expected at lower temperatures. In addition, it enabled selection of chemical reactions and their reaction products which were responsible for the changes in the volatile fraction during storage. Hence, the work clearly demonstrated that fingerprinting followed by kinetics is an effective tool box to increase a mechanistic and quantitative insight into important chemical changes during food processing and storage and furthermore to exploit the potential of ASLT.

Keywords: Headspac-GC-MS fingerprinting, chemometrics, thermal processing high pressure processing, accelerated shelf-life testing

Curriculum Vitae:

Mr. Biniam T. Kebede has completed his MSc studies with excellent study results and started his PhD studies at the KU Leuven Laboratory of Food Technology in October 2011. During the course of his PhD, he guided 4 students during their master thesis and has been giving tutorials (Course: B-KUL-I0O41 Low Temperature Processing of Foods to 2nd Master students in Food science and technology (IUPFOOD-program)), during 2011-2012; 2012-

2013; 2013-2014 academic years. Based on the work performed until now, three papers have been published, two in Food Chemistry and one in Food Research International, and three more are in preparation. The obtained research results have been (orally) presented on EFFoST annual meeting, 12-15 November 2013, Bologna, Italy and on the 19th National Symposium on Applied Biological Sciences, 7th February 2014, Gembloux, Belgium.

ANTIMICROBIAL POLYMER NANOCOMPOSITES WITH TUNABLE PROPERTIES FOR FOOD PACKAGING

Maksym A. Krepker[1], Rotem Shemesh[1,2], Anita Vaxman[2], and Ester Segal[1,3]

[1] [1]*Technion – Israel Institute of Technology, Department of Biotechnology and Food Engineering, Haifa 32000, Israel*

[2]*Carmel Olefins Ltd., Bazan Group, Haifa, Israel*

[3]*Technion – Israel Institute of Technology, the Russell Berrie Nanotechnology Institute, Haifa 32000, Israel*

Abstract

Recent outbreaks of food-borne pathogens over the past years in Europe and the United States have demonstrated the devastating epidemiological and economical outcomes of these events. Thus, over the past decade there is an immense effort to develop antimicrobial packaging systems. The increasing consumer health concern and growing demand for healthy foods have stimulated the use of natural biopreservatives, such as essential oils (EOs), defined as GRAS (generally recognized as safe) antimicrobial agents. The highly volatile nature of EOs, which is advantageous for their efficient diffusion and mode of action, presents a major obstacle for their incorporation with synthetic polymers via conventional high-temperature melt compounding and processing.

Two types of inorganic carriers i.e., layered nanoclays and Halloysite nanotubes (HNTs), are modified with a model EO, carvacrol (CV, originating from Oregano and Thyme). Thermal gravimetric analysis shows that the thermal stability of CV within these hybrids is significantly enhanced, allowing for melt compounding of CV at elevated temperatures, suitable for polymer processing. The inorganic carriers-CV hybrids are melt-compounded with common polyolefins (at temperatures of 140-250°C), including low-density polyethylene (LDPE) and polypropylene (PP), followed by subsequent cast or blown extrusion for film production. The resulting films exhibit highly potent and long-lasting (up to two years) antimicrobial activity against a variety of food-borne bacteria species and fungi, while the corresponding polymer/CV films (no carrier) demonstrate activity for up to several weeks. Preliminary “in vivo” experiments with vegetables have shown profound enhancement in their shelf life. This is the first work to report on polymer/EOs systems with a wide and prolonged antimicrobial activity. The generic methodology presented in this work can be used for engineering tailor-made packaging materials with tunable antimicrobial activity (both potency and long-lasting) for various food systems.

Keywords: Antimicrobial Packaging, Essential Oils, Active Packaging, Inorganic/Organic Hybrids.

Curriculum Vitae:

Maks received his B.Sc. and M.Sc. degrees in Biotechnology and Food Engineering from the Technion – Israel Institute of Technology in 2009 and 2011, respectively. His M.Sc thesis was directed towards the development of optical biosensors for detection of organophosphorus compounds, which are used as herbicides or insecticides, under the direction of Prof. Ester Segal. His current research focuses on developing novel antimicrobial

polymers for active food packaging applications and integrating optical biosensors into packaging systems.

Food-grade emulsion production using a low energy Rotating Membrane technology

David Lloyd[1*], Ian Norton[1] and Fotis Spyropoulos[1]

[1] *School of Chemical Engineering, University of Birmingham, Birmingham, United Kingdom (*dml066@bham.ac.uk)*

Abstract

Emulsions are ubiquitous within the food industry (e.g. mayonnaise, butter, milk, vinaigrettes). These are typically manufactured by mechanically breaking down two immiscible liquid phases in the presence of a surfactant until one phase is dispersed within the other. Whilst this approach is extensively used within process equipment such as homogenisers, rotor-stator mixers, colloid mills etc., these have been demonstrated to be very energy inefficient [1]. As such, research is focused on developing novel emulsification technologies that are more sustainable.

One such process is Rotating Membrane Emulsification (RME). The process creates droplets individually as the dispersed phase is passed through the pores of a membrane into the continuous phase. By rotating the membrane, droplets at its surface grow to a specific size before detaching due to acting drag and centrifugal forces. Droplets can be designed with each one forming in an almost uniform way. Consequently, extremely narrow droplet size distributions are achievable, improving droplet stability against Ostwald ripening and batch-to-batch reproducibility [2].

With careful consideration of operating conditions and surfactant choice, RME (using a 6.1 µm shirasu-porous-glass membrane) can be competitive with both a rotor-stator high-shear mixer (HSM) and an ultrasonic probe (SON) for producing 10% vol. sunflower oil-in-water emulsions. This is in particular if the IFT can be reduced to low values quickly by positioning the surfactant in the dispersed phase rather than its conventional placing within the continuous phase (Fig. 1a). Comparable droplet sizes are achievable despite lower overall energy input even at similar emulsion production rates (Fig. 1b).

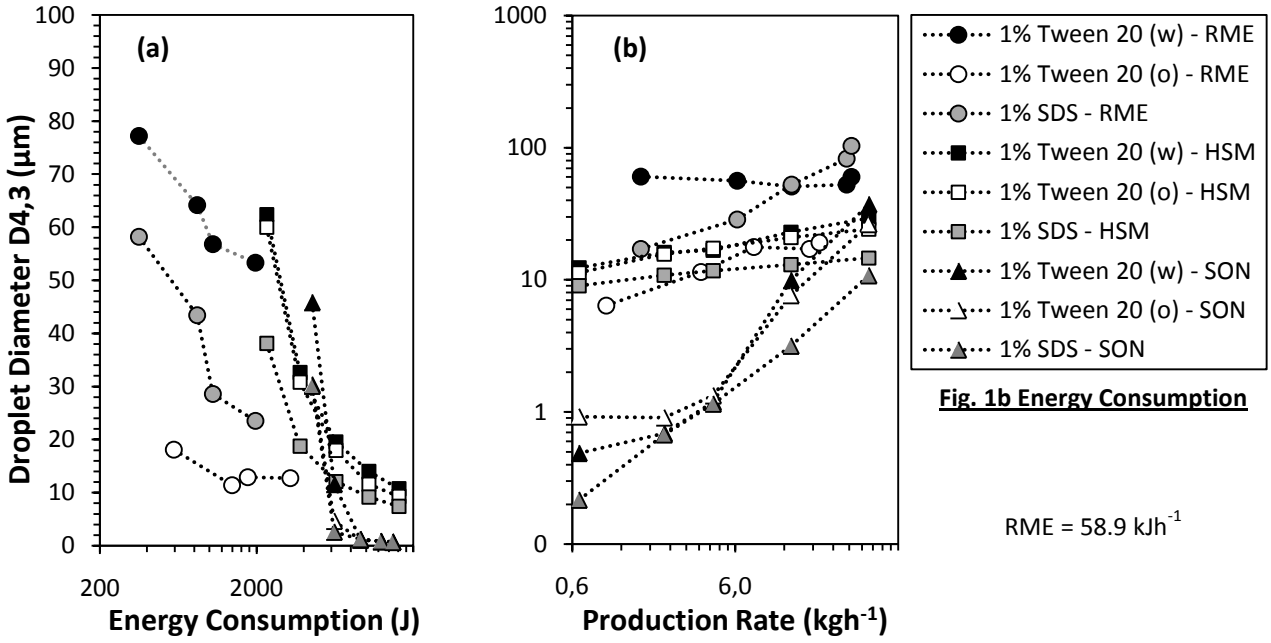

Fig 1: Process comparison manufacturing at production rates 3.7-6.2 kgh^{-1} (a) and intermediate energy input (b). NOTE: (w) and (o) indicate that Tween 20 is positioned within the continuous or dispersed phases respectively. RME = Rotating Membrane Emulsification, HSM = High-

Shear Mixer, SON = Ultrasonic Probe.

The purpose of this work is to develop understanding of the important process mechanisms that determine the resultant emulsion microstructure. This should enable insight into how to design and operate such equipment [3] and may therefore facilitate up-scaling RME to formulate batch sizes more comparable with industrial scale food manufacturing.

Keywords: Food engineering, Emulsification, Rotating Membrane, Low energy

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Curriculum Vitae:

David graduated with a Bachelor of Engineering degree in Chemical Engineering from Loughborough University (UK) in 2010. During this time, he spent 14 months in industry at the agrochemical company Syngenta as a Process Engineer. Upon completing his degree, he immediately continued within academia undertaking an Engineering Doctorate in Formulation Engineering at the University of Birmingham (UK). The title of his doctoral thesis is ‘Mechanistic understanding of the Rotating Membrane Emulsification process towards the development of scale-up theory’. David completes his doctorate in September 2014.

Influence of lecithin from different sources on crystallization properties of fat phase and quality of spread cream

Ivana Lon• arevi•

Department of Engineering Carb Foods, Faculty of Technology, University of Novi Sad, Bul. cara Lazara 1, 21000 Novi Sad, Serbia

(ivana.radujko@tf.uns.ac.rs)

Abstract

Vegetable lecithins are commercially derived from oil-bearing seeds such as soybeans, sunflower kernels and rapeseed. The color of lecithin, its consistency, phospholipid composition and fatty acid profile generally gives us a clear indication of the origin of the product. Soybean seeds are the main source of lecithin in confectionery industry in Serbia and elsewhere. The extensive production of sunflower and rapeseed oil opens the possibility of using lecithin from these sources, as an alternative. Also, the development of functional foods dictates the use of edible fats with no undesirable *trans* fatty acids, obtained by fractionation and transesterification instead of common hydrogenation process. This work

investigates the possibility of soy lecithin replacement in cocoa spread cream production with sunflower and rapeseed lecithin, in terms of optimizing the amount of lecithin (concentration 0.3%, 0.5% and 0.7%) and milling time in laboratory ball mill (30, 40 and 50 minutes). Gas chromatography was used in order to examine the fatty acid composition in edible non trans-fat as well as in lecithin from different sources. Phospholipid composition in soy, sunflower and rapeseed lecithin was determined using quantitative phosphorus nuclear magnetic resonance technique. Crystallization properties of fat phase of cocoa spread cream were examined by pulsed nuclear magnetic resonance spectroscopy, while crystallization kinetics was defined using the Gompertz's mathematical model. Rheological properties of cocoa spread cream were analyzed by rotational viscometry, certain textural characteristics were determined using texture analyzer and also thermal properties using differential scanning calorimetry. The color on the surface of cocoa spread cream was defined using tristimulus colorimetric method, and sensory analysis was determined by the scale over a period of six months of storage in the dark and room temperature. Shelf-life of cocoa spread cream was determined applying gas chromatographic analyses of the formed aldehydes as secondary products of lipid oxidation. Fatty acid determination showed that vegetable fat used in spread cream production contains 0,11% of undesirable trans fatty acids. Sunflower lecithin has no unstable polyunsaturated alpha linolenic (É-3) fatty acid, resulting in better oxidative stability comparing with soy and rapeseed lecithin. Different amounts of lecithin from different sources have no significant impact on crystallization characteristics and crystallization kinetics of non trans fat. Sunflower lecithin has three times less viscosity value comparing to soy and rapeseed lecithin, which is more useful during spread cream production process. Cocoa spread cream sample containing 0,5% of soy lecithin and 40 minutes milling time in ball mill is the most homogenous comparing to other samples with soy lecithin. Sample with 0,5 % of sunflower lecithin and 40 minutes milling time has good rheological properties, while further adding of lecithin to 0,7% substantially reduces all rheological properties. Cocoa spread cream samples with rapeseed lecithin have similar characteristics as the ones with soy lecithin, having 0,5% of rapeseed lecithin and 40 minutes of milling time in ball mill as the optimal. All samples containing different lecithins have very similar thermal characteristics

and good melting range during tasting. Surface color parameters of all cocoa spread cream samples have no significant statistical difference ($p<0.05$) in the first week after production, while cocoa spread cream samples with sunflower lecithin have the lowest surface luminosity (L*), which means the darkest color of all samples, during six months of storage. Sensory analysis confirmed that there were no significant differences in the quality of cocoa spread cream with the addition of soybean, sunflower and rapeseed lecithin. On the other hand, the sample with the addition of 0.7% sunflower and rapeseed lecithin with maximum milling time improves the flavor. After storing the samples for six months in a dark place at room temperature, there were certain changes in the sensory properties, which are most expressed in a flavor, which is less aromatic. Aldehyde content, of which only hexanal was detected, is present in a small proportion in all samples of cocoa spread cream with the addition of lecithin from different sources and does not increase over a period of six months of storage. The result is that sunflower and rapeseed lecithin can be used in spread cream production as the substitute for soy lecithin, which is widely commercially used.

Curriculum Vitae:

2009-present	Research assistant, Department of Engineering Carb Foods, Faculty of Technology, University of Novi Sad
2013	PhD in Food Ingeneering, Faculty of Technology, University of Novi Sad PhD title: *Influence of lecithin from different sources on crystallization properties of fat phase*

and quality of spread cream with the addition of functional vegetable oils, defended on 31st December 2013

2009-2013 PhD student (average grade 10/10), Department of Engineering Carb Foods, Faculty of Technology, University of Novi Sad

2008 MSc in Technology, Faculty of Technology, University of Novi Sad

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Monoglyceride Self-Assembled Structure in O/W Emulsions and Its Application to Control Flavor Release

Like Mao[1, 2], Yrjö H. Roos[2], Song Miao[1]

[1] *Teagasc Food Research Centre, Moorepark, Fermoy, Cork, Ireland*

[2]*School of Food and Nutritional Sciences, UniversityCollegeCork, Cork, Ireland*

Abstract

Monoglycerides (MGs) can form self-assembled structures (liquid crystals) in oil, which can be used as delivery systems for bioactives. In this study, MG was incorporated in Tween 20-stabilized O/W emulsions, and the properties of MG structured emulsions and release of four different flavor compounds was investigated. Differential scanning calorimetry (DSC) analysis indicated that MG developed☐form crystalline structure at 25°C within 4 days, while ☐and sub ☐forms occurred at 4 °C. Polymorphic transitions occurred during storage under various

thermal conditions. Synchrotron X-ray diffraction (XRD) study revealed that MG liquid crystals (☐ form) were stacking in a well ordered lamellar style with a bilayer thickness of 49.5 Å. ☐ and sub-☐ forms of the crystals were packing in hexagonal and orthorhombic styles, respectively.Rheological measurementsshowed that emulsions with MG☐ form crystalline structure had gel-like properties (storage modulus > loss modulus), and variation in oil content or MG content can result in emulsion with different viscosities, storage modulus and fluid types (shear thinning or Newtonian). GC static headspace analysis revealed that flavors had significantly lower air-emulsion partition coefficients from MG structured emulsions than from unstructured emulsions (p <0.05). GC dynamic headspace analysis showed that all the flavors had significantly lower initial (30s) headspace concentrations above structured emulsions than flavors above unstructured emulsions. However, the release rate tended to increase with MG content. With the reduction of oil content from 20% to 10%, initial headspace concentrations increased for limonene and hexanal, while decreased for propanol and diacetyl. Moreover, the delayed-release caused by MG self-assembled structure was weakened in oil-reduced systems. When different oils were applied, partition coefficients and release rates of the flavors were significantly lower in medium-chain triglyceride emulsions than in soybean oil emulsions ($p < 0.05$).These results indicated that MG structured emulsions can be potentiallyused as delivery systems to modulate flavor release.

Keywords: monoglyceride; self-assemble; liquid crystals; emulsion; flavor release; headspace

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Curriculum Vitae:

Mr. Mao is currently a 4th year PhD student from University College Cork in Ireland. He got the master degree in Food Science and Engineering in 2008, and worked in the beverage industry for 2.5 years. His research background is mainly on food structure and functionality. His PhD program is designing of structured emulsions to control the release of bioactive compounds in food system. He studied three different emulsion systems, i.e., monoglyceride

structured emulsion, WPI-pectin multilayer emulsion, emulsion filled protein gel, for the delivery of volatile flavor compounds.

Multi-objective optimization for the design of food processes.

Application to an innovative hot-smoking process, in an African industrial context.

Guilhem Raffray[1], Patrick Sebastian[2] and Antoine Collignan[3]

[1]CIRAD, UMR QualiSud, Food Process Engineering TA B-95/16, 73, rue JF Breton 34398 Montpellier Cedex 5, France. guilhem.raffray@cirad.fr

[2]Université de Bordeaux, I2M, UMR CNRS 5295, Esplanade des Arts et Métiers, 33405 Talence Cedex, France

[3]Montpellier SupAgro, UMR QualiSud, Food Process Engineering Research Unit, 1101 avenue Agropolis, CS 24501, 34093 Montpellier Cedex 5, France

Abstract

The purpose of this work is the food process design optimization for the production of African traditional hot-smoked products[1]. Based on a methodology of interpretation and aggregation of multiple industrial constraints[2], a multi-objective decision tool is developed for improving the technological performances of productivity, energy efficiency and product quality. This mathematical tool lies on the Function-Behavior-Structure (FBS) ontology of design[3]. The most desirable solution is found using a genetic algorithm which evaluates various design alternatives. First results concern the optimization of the design of an innovative technology of radiant-plate hot smoking, able to reproduce the typicality of traditional products[4]. First results highlight the coherency of the multi-objective optimization tool and its ability to converge. Moreover, this decision tool remains adapted for the design of food processes in the context of developing countries. Indeed, the scientific expertise on local specificities is valued.

Keywords: Multiple criteria decision analysis, Food process performance, Design optimization, Hot smoking

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Curriculum Vitae:

I graduated in 2011 from one of the top 5 French school of industrial engineering, Arts et Métiers ParisTech. In addition, I specialized in modeling and simulating complex thermal and physical phenomena during Master degree courses in Mechanics and Energy (University of Bordeaux). I then started a PhD during which I adapted some mathematical tools for solving complex design issues of agri-food industry. During my thesis project, I enjoyed to develop multiobjective decision tools which proved to provide efficient mathematical tools. Therefore, during the first years of my career, I would like to improve my knowledge in the domain of operational research.

AN ENGINNERING APPROACH TO DESIGN FOOD STRUCTURES FOR THE DELIVERY OF TARGETED FUNCTIONALITY: APPLICATION TO BIOACTIVE ENCAPSULATION

Tommaso Roversi* and Laura Piazza

*Department of Food, Environmental and Nutritional Sciences, University of Milan, Milan, Italy (*tommaso.roversi@unimi.it)*

Abstract

Designing and developing new functional food ingredients suitable to deliver a specific functionality during digestion represent one of the most interesting and promising perspectives in the field of food science. In this talk, an engineering approach to food structure design for the delivering of tailor-made functionality in the manufacturing of bioactive carriers will be presented, that explores the relationship: material properties-processing-destructurization behavior in the gut.

We'll first present a brief overview of the dynamics of alginate gels, a natural polymer extensively used in the food industry as thickening agent. The complex aging behavior of these gels results in a tunable characteristic length scale, which is important for the production of novel food structures. We'll then see that an aqueous core, enclosed by a well-defined external alginate shell, can be obtained by coextruding two phases in a concentric laminar flow column and suddenly gelling the external polymer phase before interdiffusion with the internal phase takes place. Furthermore, the possibility of using alginate microbeads to deliver bioactives compounds in the human gut will be discussed. In particular, we will see how the capsules manufactured throughout the coextrusion technique release small bioactive once placed in an *in vitro* simulated small intestine model; the possibility to use alginate microsphere to protect probiotic viability from gastric condition will be also presented. Finally, emphasis will be placed on the potentiality of nanoparticle generation as drug delivery system; self assembly of a low molecular weight polymer under mild technological conditions will be described and relevant example of its application will be given.

Keywords: alginate, microcapsules, drug delivery, small intestine model, solvent shifting, nanoparticle.

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Curriculum Vitae:

Tommaso Roversi is currently a research fellow at the University of Milan, where he obtained his master degree in Food Science in 2009. In 2013 he received his PhD in Food Biotechnology, while working on encapsulation technology for the delivery of food functionality. His field of interest include food product design, food rheology and applied colloid science. Throughout the unifying theme is understanding structure-function-processing relationship.

High pressure thermal sterilization (HPTS): The way to increase microbial food safety and to mitigate food process contaminants in selected food systems

Robert Sevenich[1*], Florian Bark[1] , Elke Kleinstueck[1] , Colin Crews[2], Celine Pye[2] , Jaromir Hradecky[3], Kai Reineke[4], Maria Lavilla[5],Inigo Martinez-de-Maranon[5], Dietrich Knorr[1]

[1] *Department of Food Biotechnology and Food Process Engineering, Technische Universität Berlin, Germany*

[2] *The Food and Environment Research Agency, York, United Kingdom*

[3] *Department of Food Chemistry and Analysis, Institute of Chemical Technology, Prague, Czech Republic*

[4] *Leibniz Institute for Agriculture Engineering (ATB) Potsdam, Germany*

[5]AZTI Tecnalia, Bilbao, Spain

Abstract

HPTS offers an alternative to retorting, and means by which safe foods are achieved with lowered heat input. Till today nearly no data about possible formation or reduction of sometimes cancerogenic food processing contaminants (FPCs) by HPTS has been published. Lower temperatures and shorter dwell-times used in HPTS compared to retorting could give lower formations of FPCs, like furan. Since consumers of some HPTS relevant foods are infants, minimizing risk of exposure is important. To test and to gain insight in the formation of FPCs, a vegetable puree (suitable for babyfood) and different canned fish-products were HPTS treated. To establish suitable sterilization conditions F_0-value of 7 min were tested. Foods and ACES-buffer (pH 7, 0.05 M) were inoculated with 2 different spore strains, *Bacillus amyloliquefaciens* and *Geobacillus stearothermophilus*. Samples were treated at 600 MPa, 90°-121°C in a labscale high pressure system (Unipress) for up to 30 minutes. Formation of furan was present in all samples, whereby depending on temperature a reduction in comparison to retorting of 71-96% was possible. The more pressure resistant strain of the tested was *B. amyloliquefaciens*. Depending on the temperature a 4 $\log_{10}$ to 5 $\log_{10}$ inactivation was achieved within 0.5-20 min. The results show that reduction of FPCs, process time and temperature is possible with HPTS.

Based on the inactivation n^{th}-order-modeling was performed to extrapolate 12 $\log_{10}$ inactivation, which is feasible for industrial relevant T,t at 600 MPa. Scale-up trials were conducted with the 55LHT Hiperbaric-system to validate findings. Preliminary results confirmed the results from lab scale. Lower formation of FPCs occurred as well and storage trials at 37°C for 21 days (Standard NFV04-408) showed that between 113-115°C with holding times being 7.40-9.9 minutes all systems were stable. Benefits of HPTS are a double safety in terms of spore inactivation and a reduced toxicological potential.

Keywords: High pressure thermal sterilization, food processing contaminants, spores, up-scaling.

*Corresponding author: r.sevenich@tu-berlin.de

Data of this work have been generated within the multidisciplinary EU research project (PROMETHEUS)

Curriculum Vitae: Born on the 9th of May 1983 in Berlin

September 2011 – current	PhD-Student at the Department of Food Biotechnology and Food Process engineering (TU Berlin) with the main research field high pressure processing

October 2005 – August 2011	TU Berlin, studies of Food technology with the main interest in innovative Technologies and process development
July 1997 – July 2003	Abitur at the Kant-Gymnasium in Berlin-Spandau