Flow pattern and cleaning performance of a stationary liquid jet operating at conditions relevant for industrial tank cleaning

Cleaning of processing tanks by impinging liquid jets is common practice in the food and biotechnology sectors. However, satisfactory prediction of the cleaning performance of such jets has so far only been achieved in small scale experiments. In the present work, cleaning with a horizontal water jet was studied using a 19m³ tank and settings applicable to industrial operations: nozzle internal diameters, dN, of 2–5.5mm, cleaning distances, L, of 80–2490mm, and flow rates, Q, of 0.05–3.0m³h⁻¹. Experimental data and model predictions of the behaviour of the jet when striking an unsoiled surface showed reasonable agreement for a nozzle with dN=2mm at small cleaning distances (L 80 and 200mm). At greater dN and cleaning distances there was poorer agreement, which was attributed to jet break-up and splatter. Similar observations were made when cleaning a surface soiled with white petroleum jelly. The evolution of the cleaned area was predicted reasonably well for experiments with dN=2mm, L=80mm, and soil layer thicknesses of 0.25–1.49mm. For longer cleaning distances and larger dN only the initial stages of cleaning could be modelled, because jet break-up introduced complexities and momentum losses not accounted for in the mathematical models. The effects of jet break-up can partly be accommodated, in practice, by correcting the jet flow rate for these momentum losses.
Fysiske principper bag kunsten at lave god mad i stor skala

**General information**

State: Published

Organisations: National Food Institute, Research Group for Food Production Engineering
Modeling of pancake frying with non-uniform heating source applied to domestic cookers
The design of domestic cooking stoves is usually optimized by performing time-consuming cooking experiments, often using frying of pancakes as a standard. Simulation of cooking processes may reduce the number of experiments used in the development of the cooking stoves, saving time and resources. In this work we propose a model of contact frying of pancakes in domestic cookers, particularly in induction hobs and radiant cookers, in which the heating of the cooking vessels can be non-uniform. This non-uniformity is unavoidable in practice, but it can be reduced by optimizing the design of the cooker. The proposed model combines heat and mass transfer phenomena, and also includes the correlation between the browning development and the temperature distribution, the local water content and the cooking time. The model has been also validated through experiments using a commercial induction hob and a radiation stove. With this model the color of the cooked pancakes can be predicted, taking into account also uneven heating, and through simulations the design of the cooker can be improved.

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering, BSH Home Appliances Group, Universidad de Zaragoza
Authors: Sanz-Serrano, F. (Ekstern), Sagues, C. (Ekstern), Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Llorente, S. (Ekstern)
Pages: 114-127
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Engineering
Volume: 195
ISSN (Print): 0260-8774
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.71 SJR 1.479 SNIP 1.842
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.467 SNIP 1.873 CiteScore 3.58
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Proposing a normalized Biot number: For simpler determination of Fourier exponents and for evaluating the sensitivity of the Biot number

This paper presents a normalization of the Biot number, which enables the Fourier exponents to be fitted with a simple 3rd order polynomial ($R^2 > 0.9999$). The method is validated for Biot numbers ranging from 0.02 to 8, and presented graphically for both the Fourier exponents and the lag factors needed in the series expansion. The lag factors and Fourier exponents are validated with an average variation coefficient (CVRMSD) less than 0.006. The resulting prediction error of the thermal response is <0.6 °C for spheres and

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Research Group for Food Production Engineering
Authors: Christensen, M. G. (Intern), Adler-Nissen, J. (Intern)
Number of pages: 8
Pages: 214-221
Publication date: 2015
Main Research Area: Technical/natural sciences
Simplified equations for transient heat transfer problems at low Fourier numbers

This paper proposes an analytical solution to transient heat transfer, which also applies for the initial heating/cooling period (Fo < 0.2) of solids with simple geometries subjected to convective boundary conditions, with negligible mass transfer and phase-change. The new equation is presented and validated for infinite slabs, infinite cylinders and spheres and by an industrial application example, covering the center temperature and the volume average temperature. The approach takes ground in the residual difference between a 1 term series solution and a 100 term solution to the Fourier equation of the thermal response for solids subjected to convective heat transfer. By representing the residual thermal response as a function of the Biot number and the first eigenvalue, the new approach enables the description of the thermal response in the whole Fourier regime. The presented equation is simple and analytical in form, which allows an easy implementation into spreadsheets and thus serves as a transparent and fast tool for crude process calculations in e.g. process planning or introduction of new products to existing lines. The prediction error of the new equation is low (RMSD < 0.015) for 0 < Fo < 0.2 and 0.1 < Bi < 100 for infinite slabs, infinite cylinders, spheres and typical examples of finite bodies.
This paper presents and demonstrates a novel idea of using spherical potatoes as a dispensable, cheap device for determining the fluid-to-particle heat transfer coefficient, $h_{fp}$ in vessel cooking processes. The transmission of heat through the potato can be traced by measuring the distance from the surface to the gelatinization front, which is easy to identify visually. Knowing this distance, the gelatinization temperature, the period of immersion, and the average radius of the potato, the heat transfer coefficient can be calculated. Either a numerical model based on the Finite Element Method (FEM) or an analytical solution of the Fourier equation can be applied for the calculation. The gelatinization temperature of the potatoes used was determined to be 67°C by a direct temperature measurement and by visual inspection of the progression of the gelatinization front. A sensitivity analysis demonstrates that the method is rather precise at relevant values of $h_{fp}$ in vessel cooking (100–300 [W/m²K]), allowing a prediction of the centre temperature within ±0.6°C.
Formulation and validation of applied engineering equations for heat transfer processes in the food industry

The study is focused on convective heat transfer in the processing of solid foods, specifically with the scope to develop simple analytical calculation tools that can be incorporated into spreadsheet solutions. In areas of food engineering such as equipment manufacture the use of predictive calculations, modelling activities and simulations for improved design is employed to a high degree. In food manufacture the use process calculations are seldom applied. Even though, the calculation of thermal processes is not a challenging task in academia; this is not the case for food manufacture. However, the calculations need fundamental validation and a generality that ensures a wide application, thus also the development of simplified approximations and engineering equations have to be conducted in academia. The focus group for the utilization of the presented work is; food manufacture, authorities ensuring food safety standards and students pursuing a food engineering career but lacks full engineering training. The approach in this study is to identify possible simplifications to the complete Fourier series expansion [Fo-exp]. This is done through; a new method to non-iteratively find the Fourier exponents and lag factors needed in a 1st term approximation, expanding the use of the 1st term approximation to also cover low Fourier numbers [Fo-exp].
convective heat transfer coefficients. For the investigation it was crucial to establish a thorough understanding of the origin of both the standard $[\text{Fo-exp}]$ solution and the criteria coupled with standard simplified solutions. A new description of the internal and external resistance to heat transfer has been suggested in form of a normalization of the Biot number $[\text{Bi}]$. The normalized Biot number $[\text{Binorm}]$ enables a simple, monotonically increasing expression, used to determine the Fourier exponents and lag factors needed in the $[\text{Fo-exp}]$ solution to the heat equation. The proposed method has a low prediction error and can be used as an alternative to iterative methods or the use of charts. Additionally, $[\text{Binorm}]$ provides a rational investigation of the sensitivity of important parameters such as the thermal conductivity and the heat transfer coefficients $[\text{h}]$. For the calculation of the thermal history during convective heating and cooling of solids, a solution is proposed that can also handle the initial heating/cooling period ($[\text{Fo}<0.2]$). In the construction of the new procedure the residual between a 1st term $[\text{Fo-exp}]$ and the complete $[\text{Fo-exp}]$ was modeled without introducing new parameters, except one experimental constant. The combined procedure of the determination of Fourier exponents and lag factors have been used in excel calculations for the calculation of finite bodies. The developed method is validated with numerical solutions with comparable accuracy in two representative cases; cooling of packaged cream cheese and a three step processing of ham. In the study, three investigations into the measurement methods for convective heat transfer coefficients $[\text{hc}]$ have been conducted. The $[\text{hc}]$ for separate boundaries have been measured for a cooling operation, where also the influence of a present headspace was investigated. The contribution of the phenomena of boiling in the overall $[\text{h}]$ to suspended particles was investigated in a new experimental setup. Experiments conducted at a comparison level emphasize that process control of vessel cooking should also include boiling rate instead of only using temperature. iii A study in fluid to particle heat transfer coefficients $[\text{hfp}]$ have been conducted, where it is shown that potatoes can be used as a model food device for temperature measurements, in otherwise challenging environments. The method utilizes an observed gelatinization front in potatoes and inverse calculations of the thermal curve. Based on a literature search it has been experienced that the common rules acknowledged in textbooks and papers on the subject have not been properly investigated in terms of the criteria $[\text{Bi}<0.1]$, and the criteria that a 1st term approximation is adequate for $[\text{Fo}>0.2]$. Whereas it was possible to trace the origin of the $[\text{Fo}>0.2]$ criterion, the $[\text{Bi}<0.1]$ criterion for the lumped capacitance method were unsuccessful. However, the error accompanied by this assumption is now documented and I believe it should be stated along with the criteria in future textbooks. The analysis shows that for elementary geometries the criteria $[\text{Fo}>0.2]$, in worst case, generate calculation errors of up to 1.8%. The most troubling is that the worst case is for infinite slabs, which are used in the construction of general geometries, such as the shape of a box, increasing the induced error to almost 6%. The highest errors were observed at $[\text{Bi}]$ around 2. For food manufacture $[\text{Bi}]$ around 2 are extremely common. The thesis presents an analysis and description of the $[\text{Fo-exp}]$ to the heat equation, and also presents solutions to common challenges when calculations are conducted in food manufacture. The study provides a method where traditional processes can be calculated with a high precision by using an expanded 1st term approximation to the series expansion. This is an advantageous in terms of application in the industry where the solution can be incorporated into spreadsheet solutions. This feature is important in conducting process planning and scheduling, handling changes in products and processes and it is valuable in debottlenecking operations. It is wished that the proposed work could help facilitate that the use of rational engineering calculations are performed in food manufacture. It is also hoped that the solutions provided and the insight to the $[\text{Fo-exp}]$ will become a part of the engineering training for food science students. And most important, that the study will find application in the food industry.

**General information**

State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering, Division of Industrial Food Research
Authors: Christensen, M. G. (Intern), Adler-Nissen, J. (Intern), Leje, H. (Intern)
Number of pages: 223
Publication date: 2014

**Publication information**

Publisher: Technical University of Denmark (DTU)
ISBN (Print): 87-93109-51-2
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Phd_Martin_Gram_Christensen.pdf
Source: PublicationPreSubmission
Source-ID: 112006251
Publication: Research › Ph.D. thesis – Annual report year: 2015

**Practical Use of Nitrite and Basis for Dosage in the Manufacture of Meat Products**

The use of nitrite (NaNO2) in the manufacture of salted (cured) meat products has a long tradition in the industry, dating back to the early twentieth century. Nitrite serves several technological purposes, primarily by the formation of a stable red colour in the meat and the inhibition of the growth of Clostridium botulinum. According to an assessment report by the European Food Safety Authority (The EFSA Journal, 14, p. 1-134, 2003) all evidence points to that it is the added amount of nitrite rather than the residual amount of nitrite in the product which exerts the antimicrobial effect. Nitrite also has a desirable anti-oxidant activity and contributes to the formation of pleasant flavours.
A systematic literature review on the function and use of nitrite in meat leads to a tentative first conclusion that if the level of nitrite added to meat products is sufficient to protect against possible toxin formation from C. botulinum, then the other technological reasons for using nitrite can be accomplished within the range of 50-100 mg/kg added nitrite, as is recommended by European Food Safety Authority (EFSA), see the reference above. A similar conclusion was earlier reached after a large number of experiments were conducted in Denmark in collaboration with the Danish meat manufacturing industry in 1981-1983. Wiltshire bacon and certain canned products largely for export were not investigated in this study, however.

The adverse effects of nitrite can mainly be ascribed to the risk of forming nitrosamines from secondary amines and nitrite when curing meat products, in particular when they are heated to high temperatures, typically during frying. This issue is well described in the literature and is not pursued further, as it is not part of the assignment for the report.

In the present report the existing EU legislation on the use of nitrite is reviewed and critically compared with Danish legislation. For heat sterilised products the EU limit of 100 mg/kg on added nitrite is identical to the level specified in Danish legislation. This is the only group of products where there is complete agreement between EU and Danish legislation with respect to the use of nitrite in meat.

For bacon the EU limit of 175 mg/kg on residual nitrite is obviously higher than the DK limit of 150 mg/kg on added nitrite. The issue of limits for nitrite in bacon is important, because bacon is usually fried and is therefore a product prone to expose consumers to nitrosamines.

For cured, raw ham (“spegeskinker”) the EU limit for Rohschinken of 50 mg/kg on residual nitrite may be comparable to the DK limit of 150 mg/kg on added nitrite, considering that most of the added nitrite is decomposed during the curing process. However, a strictly quantitative conversion from added to residual amount of nitrite is not possible.

For raw fermented sausages, the EU limit of 180 mg/kg on added nitrite for a number of specified Central European sausages is obviously higher than the DK limit of 100 mg/kg on added nitrite for fermented sausages. Arguments for maintaining this high level are lacking in the available literature, and on the basis of what can be deduced with respect to the manufacturing processes for these products, it is hard to conceive of substantial arguments for the high level of 180 mg/kg.

For other heat-treated, but not sterilised meat products, the EU limit of 50 mg/kg on residual nitrite in the British speciality, jellied veal and brisket, is roughly comparable with a range of Danish products, where Danish legislation specifies from 60 to 150 mg/kg added nitrite. Denmark has specifically exempted the addition of nitrite in liver paste and meat balls, thus specifying a limit of 0 mg/kg for these particular, common products in Danish cuisine.

A major reason for the discrepancies between the EU and DK legislation is that Directive 2006/52/EC in many cases specifies residual amounts, while Denmark specifies added amounts of nitrite. Denmark’s position is in accordance with the recommendations by EFSA. However, it should be adduced that assessments of the added amount of nitrite are difficult to state for certain traditional curing processes, such as dry cured hams and traditional immersion curing of whole meat in a vat. The particularities of the production methods make such a quantification rather uncertain. Furthermore, some dry cured products from South Europe are made with nitrate, which slowly and only partly is converted to nitrite and further to NO during the curing process. The Danish limitations on the use of nitrate are identical to those of Directive 2006/52/EC.

In conclusion, most of the Danish product categories comply with EFSA’s recommended ingoing (added) nitrite level of 50-100 mg/kg. However, there is an issue regarding bacon and some unspecified products where Danish legislation allows 150 mg/kg. With regard to in particular dry cured products there is also an issue on how to specify limits on the use of nitrite in a meaningful way.

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering
Authors: Adler-Nissen, J. (Intern), Ekgreen, M. H. (Intern), Risum, J. (Intern)
Number of pages: 41
Publication date: 2014

Publication information
Place of publication: Søborg
Publisher: National Food Institute, Technical University of Denmark
ISBN (Electronic): 978-87-93109-25-4
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research › Report – Annual report year: 2015

3D modelling of coupled mass and heat transfer of a convection-oven roasting process
A 3D mathematical model of coupled heat and mass transfer describing oven roasting of meat has been developed from first principles. The proposed mechanism for the mass transfer of water is modified and based on a critical literature review of the effect of heat on meat. The model equations are based on a conservation of mass and energy, coupled through Darcy’s equations of porous media - the water flow is mainly pressure-driven. The developed model together with theoretical and experimental assessments were used to explain the heat and water transport and the effect of the change in microstructure (permeability, water binding capacity and elastic modulus) that occur during the meat roasting process.
The developed coupled partial differential equations were solved by using COMSOL Multiphysics® 3.5 and state variables are predicted as functions of both position and time. The proposed mechanism was partially validated by experiments in a convection oven where temperatures were measured online. © 2012 Elsevier Ltd.

**General information**

State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Department of Chemical and Biochemical Engineering, Center for Process Engineering and Technology
Authors: Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Gernaey, K. (Intern)
Pages: 810-820
Publication date: 2013
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Meat Science
Volume: 93
Issue number: 4
ISSN (Print): 0309-1740
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.734 SNIP 1.945 CiteScore 3.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.92 SNIP 1.85 CiteScore 3.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.488 SNIP 1.878 CiteScore 2.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.506 SNIP 1.848 CiteScore 2.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.655 SNIP 1.884 CiteScore 2.84
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.761 SNIP 1.797 CiteScore 2.75
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.547 SNIP 1.621
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.34 SNIP 1.511
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.298 SNIP 1.409
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.026 SNIP 1.628
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.144 SNIP 1.634
Scopus rating (2005): SJR 0.84 SNIP 1.533
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.079 SNIP 1.692
Design and construction of a batch oven for investigation of industrial continuous baking processes

A new batch oven has been constructed to mimic industrial convection tunnel ovens for research and development of continuous baking processes. The process parameters (air flow, air temperature, air humidity, height of baking area and the baking band velocity) are therefore highly controllable and adjustable over a wide range of settings. It is possible to monitor the product weight and temperature continuously during baking. The simultaneous measuring of mass and a window allowing for visual (e.g., by video recording) control is unique for this experimental batch oven. Two validation steps have been carried out. The uniformity of heating in the oven was assessed by measurements of local heat transfer coefficients and confirmed by baking tests. The methods showed that the oven is able to heat and bake uniformly across the baking area. Hereafter, the oven was validated against a commercial 10-m tunnel oven, with a butter cookie as the test product. The investigated quality parameters for the butter cookies were mass loss and surface browning, where the uniformity of browning was evaluated subjectively against a scale of standards and objectively by L* value measurements. Good reproducibility of the baking was documented over a range of temperatures (160°C to 190°C). Practical Applications

The purpose of this paper is to describe a new specially designed pilot scale batch oven. The batch oven is designed and constructed to imitate the baking processes in continuous tunnel ovens with forced convection. Experimental work in the new batch oven will increase knowledge of how the environment and baking conditions influence the quality of bakery products in continuous tunnel ovens. © 2013 Wiley Periodicals, Inc.
The scope of the PhD project was to increase knowledge on the process-to-product interactions in continuous tunnel ovens. The work has focused on five main objectives. These objectives cover development of new experimental equipment for pilot plant baking experiments, mathematical modeling of heat and mass transfer in a butter cookie product, and evaluation of quality assessment methods.

The pilot plant oven is a special batch oven designed to emulate continuous convection tunnel oven baking. The design, construction, and validation of the oven has been part of the project and is described in this thesis. The oven was successfully validated against a 10 m tunnel oven. Besides the ability to emulate the baking conditions in a tunnel oven, the new batch oven is designed and constructed for experimental research work. In the design options to follow the product continuously (especially weight and temperature) and control the process (air flow, temperature, and humidity) are therefore emphasized. The oven is furthermore designed to work outside the range of standard tunnel ovens, making it interesting for manufacturers of both baking products and baking equipment.

A mathematical model describing the heat and mass transfer in butter cookies during baking was formulated. The model was solved numerically by the use of a finite element method. Model optimization and validation was successfully carried out against experimental data obtained in the new pilot plant oven. The effect of the baking tray on mass transfer was examined through comparison of different modeling set-ups and experimental data. It was found that while the baking tray is likely to reduce the evaporation from the bottom surface, it is not correct to assume that no evaporation takes place at the covered surface.

Parallel to the construction of the pilot oven an advanced multi-spectral imaging method was investigated as a method for quality assessment of butter cookies. The ability of the method to assess multiple quality aspects from one image was the
main focus of the study. The system was able to predict both the surface browning and the water content in butter cookies.
Factors affecting the wettability of different surface materials with vegetable oil at high temperatures and its relation to cleanability

The main aim of the work was to investigate the wettability of different surface materials with vegetable oil (olive oil) over the temperature range of 25–200°C to understand the differences in cleanability of different surfaces exposed to high...
temperatures in food processes. The different surface materials investigated include stainless steel (reference), PTFE (polytetrafluoroethylene), silicone, quasicrystalline (Al, Fe, Cr) and ceramic coatings: zirconium oxide (ZrO2), zirconium nitride (ZrN) and titanium aluminum nitride (TiAlN). The ceramic coatings were deposited on stainless steel with two different levels of roughness. The cosine of the contact angle of olive oil on different surface materials rises linearly with increasing temperature. Among the materials analyzed, polymers (PTFE, silicone) gave the lowest cosθ values. Studies of the effect of roughness and surface flaws on wettability revealed that the cosθ values increases with increasing roughness and surface flaws. Correlation analysis indicates that the measured contact angle values gave useful information for grouping easy-clean polymer materials from the other materials; for the latter group, there is no direct relation between contact angle and cleanability. In addition to surface wettability with oil many other factors such as roughness and surface defects play an essential role in determining their cleanability.

General information
State: Published
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Pages: 86-94
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Surface Science
Volume: 263
ISSN (Print): 0169-4332
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.37 SJR 0.951 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.914 SNIP 1.3 CiteScore 3.13
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.958 SNIP 1.477 CiteScore 2.96
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.965 SNIP 1.488 CiteScore 2.78
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.918 SNIP 1.373 CiteScore 2.26
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.908 SNIP 1.402 CiteScore 2.27
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.924 SNIP 1.141
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.842 SNIP 1.023
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.899 SNIP 1.087
Investigating fluid to food particle heat transfer in a laboratory scale half-vessel through video-recording and modeling

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Authors: Feyissa, A. H. (Intern), Christensen, M. G. (Intern), Pedersen, S. J. (Intern), Hickman, M. (Intern), Risum, J. (Intern), Adler-Nissen, J. (Intern)
Number of pages: 1
Publication date: 2012
Event: Abstract from 11th Conference of Food Engineering, Leesburg, VA, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Investigating_fluid_to_food_particle_heat_transfer_in_a_laboratory_scale_half_vessel_through_video_recording_and_modeling.pdf

Uncertainty and sensitivity analysis: Mathematical model of coupled heat and mass transfer for a contact baking process
Similar to other processes, the modelling of heat and mass transfer during food processing involves uncertainty in the values of input parameters (heat and mass transfer coefficients, evaporation rate parameters, thermo-physical properties, initial and boundary conditions) which leads to uncertainty in the model predictions. The aim of the current paper is to address this uncertainty challenge in the modelling of food production processes using a combination of uncertainty and sensitivity analysis, where the uncertainty analysis and global sensitivity analysis were applied to a heat and mass transfer model of a contact baking process. The Monte Carlo procedure was applied for propagating uncertainty in the input parameters to uncertainty in the model predictions. Monte Carlo simulations and the least squares method were used in the sensitivity analysis: for each model output, a linear regression model was constructed and the standardized regression coefficients (SRCs) and R2 were computed. The effect of input parameters on model predictions was calculated, and the relative impact of the parameters on each of the outputs was ranked. Results of the uncertainty and sensitivity analysis can be used to prioritize future experimental efforts, as discussed for the contact baking process.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute, Department of Chemical and Biochemical Engineering
Computer aided simulation for developing a simple model to predict cooling of packaged foods

A new equation to predict equilibrium temperatures for cooling operations of packaged foods has been deducted from the traditional 1st order solution to Fourier's heat transfer equations. The equation is analytical in form and only requires measurable parameters, in form of area vs. volume ratio (A/V), thermo-physical properties calculated from the recipe, and the heat transfer coefficients measured in the equipment. The equation is based on an overall Biot number. The simple deducted model was tested and validated with experimental and simulated setups. Simulations have been performed using COMSOL Multiphysics, commercially available software, to test the new equation. Additionally, an experiment with all boundary conditions known, and the three dimensional coordinates of the position of six thermocouples were conducted. The COMSOL simulation showed very good conformity with experimental results matching all individual thermocouples. Simulations are used as a validation tool for cooling predictions. This was done by comparing the simulated equilibrium temperature with the calculated using the new equation. The simulations are able to evaluate cooling situations in the industry where experiments are too laborious or impossible to conduct. The deducted equation was tested for irregular geometries, unequal heat transfer and headspace restrictions. The new equation predicted equilibrium temperature curves of the simulated cooling with a low error (1.5°C for Fourier numbers below 0.3) and good precision at the target temperature (error below 0.5°C for Fourier numbers above 0.3).

Evaluating non-stick properties of different surface materials for contact frying

The paper describes, characterises and validates the construction of an experimental rig for making contact frying experiments under controlled conditions. The construction enables a controlled fouling of different coatings on steel and aluminium plate under realistic frying conditions, in order to evaluate non-stick and cleaning properties of the coatings. In accordance with industry standards pancake was selected as the food model for the non-stick properties. The performance of different frying surfaces (stainless steel, aluminium, PTFE (polytetrafluoroethylene) and three ceramic coatings with two different levels of smoothness) were tested at different frying temperatures and rated by a standardised rating procedure. The subjective rating assessment was validated by measuring the force of adhesion. The performances of the surfaces were reproducible and significantly different to be used for screening of new surface coatings for contact frying tested in frying experiments at the same temperature. In contrast, conventional testing in a convection oven could not distinguish between these surfaces. Comparative tests of the ceramic coatings showed that surface roughness had a distinct effect on their non-stick properties, so that the smoother surfaces gave a higher force of adhesion between pancake and surface.
Modelling and validation of robust partial thawing of frozen convenience foods during distribution in the cold chain

In collaboration with two commercial distributors we have tested a new concept for distribution, where convenience products for the food service industry are prepared, frozen and packed in cardboard boxes, but distributed in the chill chain at +5°C instead of in the frost chain. This will lead to a partial thawing before reaching the end user. The high
thermal buffering capacity of the product under thawing ensures that the product temperature remains stable at subzero temperatures, also in cases of temperature abuse for some hours. To investigate and validate the concept, cardboard boxes packed with small blocks of a frozen model food (23 pct. Tylose® gel) and quipped with temperature loggers were distributed by trucks operating in the cold chain. In addition, controlled storage and temperature abuse experiments were conducted. To predict the product temperature–time relationship we developed a new thawing model for the slow thawing of food pieces packed in a box. The model is based on enthalpy balances under quasi-stationary conditions; a condition that is fulfilled in the practical distribution experiments. The experiments confirmed the model predictions that the products were still partially frozen even after two days or more of distribution at +5°C, and that the temperatures inside the product and in the middle of the box were quite stable against the normal oscillations of the ambient temperature in the cold chain. The product temperature was also robust against temperature abuse, as predicted. The new distribution method not only has the potential of prolonging product shelf life but also gives the distributors an increased flexibility in the distribution chain.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
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Pages: 1247-1255
Publication date: 2011
Conference: 11th International Congress on Engineering and Food, Athens, Greece, 22/05/2011 - 22/05/2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Procedia Food Science
ISSN (Print): 2211-601X
Ratings:
Web of Science (2011): Indexed yes
Original language: English
Convenience products, Distribution, Modelling; Thawing
DOIs:
10.1016/j.profoo.2011.09.185
Source: orbit
Source-ID: 316847
Publication: Research - peer-review › Conference article – Annual report year: 2011

Modelling of coupled heat and mass transfer during a contact baking process
A mathematical model of coupled heat and mass transfer of a contact baking process is developed. In the current model formulation, a local evaporation of water is described with a reaction–diffusion approach, where a simultaneous diffusion and evaporation of water takes place. The resulting coupled model equations (unsteady state heat transfer, liquid water and water vapour) were solved using the Finite Element Method (COMSOL Multi-physics® version 3.5). During the baking process, local temperatures and overall moisture loss were measured continuously. The model – predicting temperature, liquid water content in the product and water in the vapour phase – was calibrated and partially validated using data obtained during baking of a representative food model (a pancake batter) under controlled conditions on a specially designed experimental rig. The unknown parameters in the model equations were estimated using the standard least squares method by comparing the measured with the predicted temperature profile. Good agreement was achieved between model predictions and the experimental values.

General information
State: Published
Organisations: National Food Institute, Department of Chemical and Biochemical Engineering
Authors: Feyissa, A. H. (Intern), Gemaey, K. (Intern), Ashokkumar, S. (Intern), Adler-Nissen, J. (Intern)
Pages: 228-235
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Engineering
Volume: 106
Issue number: 3
ISSN (Print): 0260-8774
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Multispectral imaging of wok fried vegetables

This paper shows how multispectral images can be used to assess color change over time in wok fried vegetables. We present results where feature selection was performed with sparse methods from the multispectral images to detect the color changes of wok fried carrots and celeriac stored at +5°C over 14 days. A pairwise t-test was used to detect if the differences over days were significant. For both the original as well as a follow experiment significant differences were seen in particular for celeriac, but also to some extend for carrots.
New vision technology for multidimensional quality monitoring of food processes

Spectroscopy and spectral imaging in combination with multivariate data analysis and machine learning techniques have proven to be an outstanding tool for rapid analysis of different products. This may be utilized in various industries, but especially rapid assessment of food products in food research and industry is of importance in this thesis. The non-invasive spectroscopic imaging techniques are able to measure individual food components simultaneously in situ in the food matrix while pattern recognition techniques effectively are able to extract the quantitative information from the vast data amounts collected. Underlying qualitative features (latent structures) are extracted from multivariate spectral data in order to quantify desired quality parameters properly. Specically multispectral imaging which has been explored to a lesser extent than ordinary spectroscopy, having the possibility to exploit the inherent heterogeneity that exists in foodstuffs have been investigated here. An extra feature obtained by combining spectroscopy, imaging and chemometrics is exploratory analysis. This is central in food research, since novel hypotheses about the food systems under observation may be generated using this inductive analytical approach. For the food industry it is an additional advantage that the fast, non-invasive, remote sensing nature of the spectroscopic imaging methods allows on-line measurements. In this way spectroscopic imaging in combination with advanced data analysis meets the high throughput needs for quality control, process control and monitoring. In this Ph.D. project the possibilities provided by spectroscopic imaging and chemometrics have been utilized to improve the analysis and understanding of different food products. The work is presented in seven papers and two additional technical reports which make up the core of the thesis. Furthermore an introduction together with a linking of the contributions is presented in this thesis. The papers puts an emphasis on the use of multispectral imaging in the baking industry where especially the non-enzymatic browning appearance and features related to this are highlighted. These are features such as colour, water content and internal structure of bread. A paper presenting enzymatic browning in pre stir fried and thawed vegetables is also presented showing that imaging techniques such as the one investigated in this thesis is able to detect even subtle colour changes. The possibility for quantifying early as well as late spoilage in raw pork meat is investigated where use of the heterogenetic structure is utilized to obtain good results on predicting sensory evaluations as well on laboratory analysis. Colour in other settings such as in the shery industry is equally important, and a paper describing detection of cartenoid pigment in trouts using spectral images shows promising results. Finally, two technical papers present possible ways of mapping multispectral images to a visible colour space, as well as how an alternative multispectral imaging system, making use of lters, may be used to design new more broad ranged filters. Fewer filters will increase the speed of such systems. Methods for solving such problems is to the knowledge of the authors rarely covered in the literature.
Robust Modelling of Heat and Mass Transfer in Processing of Solid Foods
The study is focused on combined heat and mass transfer during processing of solid foods such as baking and frying processes. Modelling of heat and mass transfer during baking and frying is a significant scientific challenge. During baking and frying, the food undergoes several changes in microstructure and other physical properties of the food matrix. The heat and water transport inside the food is coupled in a complex way, which for some food systems it is not yet fully understood. A typical example of the latter is roasting of meat in convection oven, where the mechanism of water transport is unclear. Establishing the robust mathematical models describing the main mechanisms reliably is of great concern. A quantitative description of the heat and mass transfer during the solid food processing, in the form of mathematical equations, implementation of the solution techniques, and the value of the input parameters involves uncertainty. The objective of this thesis is to develop robust models of heat and mass transfer during processing of solid foods. The study consists of formulating the mechanistic models, solving the models by the Finite Element method (FEM), calibrating and validating the models by experimental data, evaluating the models by an uncertainty and sensitivity analysis. In the study, contact baking and roasting of meat in convection oven were chosen as representative case studies. For both representative cases, the experiments were performed and the relevant data such as product temperature, mass loss, and other process conditions were obtained. For roasting of meat in convection oven, the mechanism of water transport during roasting was studied; a theoretical assessment was made on the change in structure, water holding capacity and shrinkage. The mechanism of water transport was tested by measuring the local water content. For the roasting process, 3D and 2D mechanistic quantitative models describing the coupled heat and mass transfer were developed. The governing model equations are based on the conservation of energy and mass. Further, Darcy’s equation was used to describe the pressure driven transport of water in meat during roasting. The change in elastic modulus, evaporation, and moving boundary were incorporated into the model equations. The arbitrary Lagrangian–Eulerian (ALE) method was implemented to capture the moving boundary during the roasting process. The model equations for coupled heat and mass transfer were solved using the FEM (COMSOL). For the contact baking process, a 1D mathematical model of the coupled heat and mass transfer was developed. The model developed for the contact baking process considered the heat transfer, local evaporation, and multiphase water transport (liquid and vapour). The model equations were implemented in the COMSOL-MATLAB computing environment with the following features: parameter estimations, model validations and uncertainty and sensitivity analysis. The unknown parameters in the model were estimated by comparing the measured and simulated data – using the least square method by comparing the measured temperature against the simulated temperature. Further, the model was validated using the experimental data and a reasonably agreement between the simulated and experimental data were obtained. The uncertainty and global sensitivity analysis method were incorporated for the model of coupled heat and mass transfer. The uncertainty of model predictions due to the uncertainty in input parameters such as thermo-physical properties, heat and mass transfer coefficients, phase change initial and boundary conditions parameters were studied. A Monte Carlo based method of the uncertainty and global sensitivity analysis was used. The sensitivity analysis was performed to determine the relative effect of the different parameters on the model prediction. The relative effects of parameters on the model prediction were indentified, and their relative impact on each model output was ranked. Generally, the developed mathematical models of heat and mass transfer provide better insights about the processes. The proposed robust modelling approach was found to be a useful tool in the model building that help to cope up with different challenges in modelling of heat and mass transfer during processing of solid foods and the potential of using the approach is particularly great for frying and baking operations.

General information
State: Published
Organisations: National Food Institute, Department of Chemical and Biochemical Engineering
Authors: Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Gernaey, K. (Intern)
Number of pages: 208
Publication date: 2011

Publication information
Publisher: DTU Food
ISBN (Print): 978-87-92158-95-6
Original language: English
Main Research Area: Technical/natural sciences
**Spectral Imaging as a Tool in Food Research and Quality Monitoring of Food Production**

**General information**
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
Authors: Frosch, S. (Intern), Dissing, B. S. (Intern), Adler-Nissen, J. (Intern), Nielsen, M. E. (Intern)
Number of pages: 532
Pages: 373-384
Publication date: 2011

**Host publication information**
Title of host publication: Wide Spectra of Quality Control
Publisher: InTech
Editor: Akyar, I.
Main Research Area: Technical/natural sciences
Electronic versions:
37044d01.pdf
Links:
Source: orbit
Source-ID: 286996
Publication: Research › Book chapter – Annual report year: 2011

**The quality of meal elements for professional prepared meals**

Meal elements are convenience products which are partially prepared meal components to be used in professional kitchens. Examples are meat, vegetables or fish which are prepared for example by heat-treatment before distribution to the professional kitchens. The pre-fried vegetables and meat can for examples be used as ingredients in hot or cold dishes. We have evaluated the quality of several kinds of pre-fried vegetables. The vegetables were prepared in pilot plan using a continuous stir-frying process, frozen and analysis during the thawing period. The results show that the shelf life determined by sensory analysis of pre-fried celeriac and carrots was up to 14 days after freezing and thawing at +5°C. In another experiment the aim was to investigate the effects of storage temperature (-2°C and +5°C) on quality parameters of pre-fried red and green bell peppers during 8 days of storage. The results showed that thawing at -2°C was recommended as the ascorbic acid retention was better and the stability of the green colour was also better. The texture became softer during the storage time for red peppers but was unchanged for green peppers. The results show that the pre-fried vegetables are very robust against freezing, thawing and reheating without excessive drip losses as observed from raw or blanched vegetables. The results show that the pre-fried vegetables have a potential to be used as meal elements for professional prepared meals.

**General information**
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
Authors: Løje, H. (Intern), Adler-Nissen, J. (Intern)
Publication date: 2011
Event: Abstract from LMC Congress 2011, Odense, Denmark.
Main Research Area: Technical/natural sciences
Links:
http://www.lmccongress.dk/
Source: orbit
Source-ID: 315771
Publication: Research › peer-review › Conference abstract for conference – Annual report year: 2011

**Approaches to Robust Modelling of Frying Processes**

**General information**
State: Published
New vision technology for multidimensional quality monitoring of continuous frying of meat

The potential of using multi-spectral vision technology for quality control in a continuous frying process was investigated. Canonical discriminant analysis of the multi-spectral images of samples of fried minced meat and diced turkey could clearly visualise the effect of different heat treatments. The vision technology can also detect even slight increases in the agglutination of the fried minced meat during the process. This agglutination is undesirable, but very difficult to measure on-line. The results indicate that multi-spectral vision technology may partially or totally substitute visual inspection by an operator as a means of assessing product quality during processing. (C) 2009 Elsevier Ltd. All rights reserved.

General information
Selection Criteria and Methods for Testing Different Surface Materials for Contact Frying Processes

Inner surfaces of industrial process equipment for food are often coated to give the surfaces particular properties with respect to adhesion and cleanability. Existing coating materials (PTFE (Teflon®) or silicone based polymers) suffer from drawbacks when used in contact frying, because these coatings are not mechanically stable, they do not tolerate high enough temperatures (above 260°C) to give the right product quality, and the surfaces wear easily calling for regular service of the equipment. The present project concerns an investigation of the possibilities of replacing the widely used non-stick PTFE coating with new surface coating solutions for contact frying processes, where the food is fried by contact with a hot surface (pan frying, stir frying). The main objective of the present work is to develop suitable, scientifically based methods for selecting and testing different surface materials for contact frying processes. The surfaces selected for this purpose cover a wide spectrum of materials that range from hydrophobic to hydrophilic materials. The different surface materials investigated include stainless steel (reference), aluminium (Al Mg 5754), PTFE (polytetrafluoroethylene), silicone, quasicrystalline alloys (Al, Fe, Cr) and ceramic coatings: zirconium oxide (ZrO2), zirconium nitride (ZrN) and titanium aluminium nitride (TiAIN) with two different levels of smoothness. In order to investigate the non-stick and cleaning properties of different materials, an experimental rig has been constructed which enabled a controlled fouling of different coatings on steel and aluminium substrates under realistic frying conditions. A subjective rating procedure was employed for screening different surfaces according to their non-stick properties when used for frying of a model pancake. In order to validate the subjective assessment by means of an objective method, a technique has been developed to measure the force of adhesion between the pancake and the different surfaces; a good correlation was obtained between the subjective and the objective method up to a limiting force of adhesion. Above that the pancake disintegrated by cohesive failure. Differences in the non-stick properties of different ceramic surfaces could mostly be explained by differences in the surface topography. The interfacial contact between the pancake and the frying surface was lower for a rough surface than a smooth surface; thus, a rough surface resulted in significantly less stickiness than a smooth (electro-polished) surface. The relevance of using an oven to demonstrate the non-stick and cleaning properties of different surfaces for contact frying processes was also examined, and our results demonstrated that it is not realistic to test non-stick properties for contact frying processes by using a convective oven, as seems to be an established practice in industry. The different surfaces were analyzed for their cleaning properties by performing contact frying experiments with different foods, i.e. turkey meat, carrots and sweet potatoes at different temperatures with and without the use of oil; the different surfaces were cleaned by a combination of chemical and mechanical cleaning and the surfaces were subjectively rated for their cleanability. The results revealed that the cleanability of different surfaces was significantly reduced by the use of oil, especially at high temperatures. The different surfaces were re-used after each frying experiment, and after completion of the whole set of experiments they were cleaned and analyzed in scanning electron microscopy (SEM) in order to inspect their cleanability. Energy dispersive spectroscopy (EDS) was employed to elucidate the difference in elemental composition between stained and unstained spots in different surfaces that were clearly visible using SEM. In most of the surfaces, surface defects, grooves and scratches retained more carbon-containing residues confirming the significance of mechanical interlocking phenomenon on cleanability issues. Contact angle measurements were carried out with vegetable oil on different surfaces at different temperatures in order to study the relation between wettabillity and cleanability. The measured contact angle values gave useful information for grouping easy-clean polymer materials from the other materials; for the latter group, there is no direct relation between contact angle and cleanability, however. The study of different factors associated with wettability revealed that in addition to nature of the surface material, surface defects and surface roughness play a significant role. The wear resistance of the coatings was tested by performing abrasive wear experiments. The ceramic coatings: TiAIN and ZrN were found to show the best wear resistance properties. The experiments also revealed the poor wear resistance of stainless steel, aluminium, PTFE, silicone, zirconium oxide and quasicrystalline surfaces. The knowledge gained in this project and the methods developed to systematically test and evaluate surfaces for their non-stick and cleaning properties provide an improved basis for selecting and testing new surfaces for contact frying processes.
**Uncertainty and Sensitivity Analysis of Heat and Mass Transfer in Food Processing**

**General information**
State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Department of Chemical and Biochemical Engineering
Authors: Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Gernaey, K. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences

**Publication information**
Original language: English
Source: orbit
Source-ID: 266602
Published: Research › Poster – Annual report year: 2010

**Contact Angle Analysis of Sol-gel derived Zirconia based Hybrid Coatings on 304 Stainless Steel Substrates**

**General information**
State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Materials and Surface Engineering, Department of Mechanical Engineering
Authors: Ashokkumar, S. (Intern), Adler-Nissen, J. (Intern), Møller, P. (Intern)
Publication date: 2009

**Publication information**
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 243531
Published: Research › Sound/Visual production (digital) – Annual report year: 2009

**Fødevareindustrien kan sætte standarder for reduceret energiforbrug**

**General information**
State: Published
Organisations: Division of Food Production Engineering, National Food Institute
Authors: Jørgensen, S. B. (ed.) (Intern), Adler-Nissen, J. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences

**Publication information**
Journal: FoodDTU Midt i Ugen
Issue number: 89
Original language: Danish
Source: orbit
Source-ID: 257961
Published: Communication › Journal article – Annual report year: 2009

**Mechanism of water transport in meat during the roasting process**

**General information**
Model of heat and mass transfer with moving boundary during roasting of meat in convection-oven

General information
State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering
Authors: Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Gernaey, K. (Intern)
Publication date: 2009

Host publication information
Title of host publication: Process technology
Volume: Part 1
Main Research Area: Technical/natural sciences
Conference: 55th International Congress of Meat Science and Technology, Meat - Muscle, Manufacturing and Meals (ICoMST), 01/01/2009
Source: orbit
Source-ID: 250051
Publication: Research › Article in proceedings – Annual report year: 2009

Model of Heat and Mass Transfer with Moving Boundary During Roasting of Meat in Convection-Oven

General information
State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering
Authors: Feyissa, A. H. (Intern), Adler-Nissen, J. (Intern), Gernaey, K. (Intern)
Publication date: 2009

Host publication information
Title of host publication: European Comsol Conference 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 253751
Publication: Research › peer-review › Article in proceedings – Annual report year: 2009

Monitoring water content using multispectral imaging and NIR in a minced

General information
State: Published
Organisations: Image Analysis and Computer Graphics, Department of Informatics and Mathematical Modeling, Division of Food Production Engineering, National Food Institute
Authors: Dissing, B. S. (Intern), Erbsbøll, B. K. (Intern), Adler-Nissen, J. (Intern)
Publication date: 2009

Event: Abstract from 14th International Conference on Near Infrared Spectroscopy (NIR 2009), Bangkok, Thailand.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 250332
Publication: Research › Conference abstract for conference – Annual report year: 2009
Temporal reflectance changes in vegetables

Quality control in the food industry is often performed by measuring various chemical compounds of the food involved. We propose an imaging concept for acquiring high quality multispectral images to evaluate changes of carrots and celeriac over a period of 14 days. Properties originating in the surface chemistry of vegetables may be captured in an integrating sphere illumination which enables the creation of detailed surface chemistry maps with a good combination of spectral and spatial resolutions. Prior to multispectral image recording, the vegetables were prefried and frozen at -30°C for four months. During the 14 days of image recording, the vegetables were kept at +5°C in refrigeration. In this period, surface changes and thereby reflectance properties were very subtle. To describe this small variation we employed advanced statistical techniques to search a large featurespace of variables extracted from the chemistry maps. The resulting components showed a change in both the carrot and celeriac samples. We were able to deduct from the resulting components that oxidation caused the changes over time.

General information
State: Published
Organisations: Image Analysis and Computer Graphics, Department of Informatics and Mathematical Modeling, Division of Food Production Engineering, National Food Institute
Authors: Dissing, B. S. (Intern), Clemmensen, L. K. H. (Intern), Ersbøll, B. K. (Intern), Løje, H. (Intern), Adler-Nissen, J. (Intern)
Pages: 1917-1922
Publication date: 2009

Host publication information
Title of host publication: 2009 IEEE 12th International Conference on Computer Vision Workshops (ICCV Workshops)
Publisher: IEEE
ISBN (Print): 978-1-4244-4442-7
Main Research Area: Technical/natural sciences
Electronic versions:
Dissing.pdf
DOIs: 10.1109/ICCVW.2009.5457516

Bibliographical note
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Source: orbit
Source-ID: 250334
Publication: Research › Article in proceedings – Annual report year: 2009

Process development of enzyme catalysed industrial production of partial acylglycerols

General information
State: Published
Organisations: Department of Systems Biology, CHEC Research Centre, Department of Chemical and Biochemical Engineering, Division of Food Production Engineering, National Food Institute
Authors: Damstrup, M. (Intern), Kiil, S. (Intern), Xu, X. (Intern), Jensen, A. D. (Intern), Adler-Nissen, J. (Intern)
Publication date: Oct 2008

Publication information
Place of publication: Søborg, Denmark
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Phdfinal jan 2009.pdf
Source: orbit
Source-ID: 236723
Publication: Research › Ph.D. thesis – Annual report year: 2008
Robust modelling of heat-induced reactions in an industrial food production process exemplified by acrylamide generation in breakfast cereals

Data from an industrial case study of breakfast cereal production indicated that the generated amounts of acrylamide are greatly dependent upon the combined effects of temperature and heating time in a roasting step process. Two approaches to obtain process models for acrylamide generation were tested. The first applied a pathway-based model. The second developed a simpler more robust model based on the integrated effects of time and temperature, where the generation of acrylamide was crudely fitted to an exponentially rising function. The development of the two models highlighted a number of difficulties in applying multi-parameter models and emphasized the advantages of "classical" approaches to process modelling, especially for use in an industrial context. The study faced with a significant degree of variability in the data, due to fluctuations in the process, which also emphasized the importance of robustness in the developed models. The correlations obtained for predicting acrylamide generation in the case study present a useful tool for food processing industry to minimize acrylamide generation. In the present case it was possible by lowering process temperature and prolonging residence time to achieve an approximately 80% reduction in acrylamide content while maintaining the desired product quality. (C) 2007 The Institution of Chemical Engineers. Published by Elsevier B.V. All rights reserved.
Continuous wok-frying of vegetables: Process parameters influencing scale up and product quality

A new process for continuous stir-frying in industrial scale has been developed for producing convenience high-quality vegetables. The understanding of the dynamics of heat and mass transfer during stir-frying is crucial for up-scaling and controlling the process. The effect of different factors, such as heat flux, contact surface area, frying temperature and type of raw material is discussed. Part of the water content of the raw vegetables evaporates during the process; this keeps down the product temperature through an evaporation-cooling mechanism, resulting in an improved texture. This removal of loosely bound water from the vegetables allows the products to be frozen and re-heated without drip loss, and it is also an advantage when using them as ingredients in composite foods, such as pâtés. Examples developed by a professional chef indicate that he saved up to half of the cooking time compared with the use of raw, cleaned vegetables.
Health through Convenience: The Technological Challenge

General information
State: Published
Organisations: National Food Institute, Division of Food Production Engineering
Authors: Adler-Nissen, J. (Intern)
Pages: 913-914
Publication date: 2007

Host publication information
Title of host publication: ECCE-6 Book of Abstracts
Volume: 2
Main Research Area: Technical/natural sciences
Conference: European Congress of Chemical Engineering - 6, Copenhagen, Denmark, 16/09/2007 - 16/09/2007
Source: orbit
Source-ID: 250197
Publication: Research - peer-review › Article in proceedings – Annual report year: 2007

Sodium diffusion in cured pork determined by 22Na radiology

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology
Authors: Vestergaard, C. (Ekstern), Andersen, B. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 258-265
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Meat Science
Volume: 76
Issue number: 2
ISSN (Print): 0309-1740
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.734 SNIP 1.945 CiteScore 3.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.92 SNIP 1.85 CiteScore 3.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.488 SNIP 1.878 CiteScore 2.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.506 SNIP 1.848 CiteScore 2.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
A METHOD OF FRYING MINCED MEAT

A method of frying minced meat comprising the steps of providing a heated frying surface, providing a flow of discrete and separate particles of minced meat in a condition wherein the mean temperature of the flow of particles is less than 5 degrees centigrade, preferably less than 2 degrees centigrade and most preferably less than 0.5 degrees centigrade, and heating the discrete particles to the onset of frying conditions defined as a discernible change of the colour of the particle from the original red meat colour to a grey and brownish colour by bringing the discrete particles into contact with the heated frying surface.

General information
State: Published
Organisations: Division of Food Production Engineering, National Food Institute
Authors: Adler-Nissen, J. (Intern)
Publication date: 2006

Publication information
Patent number: WO2006092139
Date: 08/09/2006
Original language: English

Bibliographical note
International application published under the World Intellectual Property Organization (WIPO)
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252324
Applicable models of industrial processes base on process understanding: Acrylamide prediction

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology
Authors: Jensen, B. B. B. (Intern), Friis, A. (Intern), Adler-Nissen, J. (Intern)
Pages: 18-20
Publication date: 2006

Host publication information
Title of host publication: Foodsim
Place of publication: Ghent
Publisher: EUROSIS-ETI
Main Research Area: Technical/natural sciences
Conference: Foodsim, Naples, Italy, 01/01/2006
Source: orbit
Source-ID: 191135
Publication: Research - peer-review › Article in proceedings – Annual report year: 2006

Hvordan påvirker hydrokolloider aromaafrigivelse fra fødevarer?

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Bylaite, E. (Intern), Meyer, A. B. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 34-36
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Kemi
Volume: 87
Issue number: 1
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Original language: Danish
Source: orbit
Source-ID: 183922
Publication: Communication › Journal article – Annual report year: 2005

Improved quality of vegetable products by continuous stir-frying

General information
State: Published
Organisations: Department of Systems Biology, Food Production Engineering
Authors: Adler-Nissen, J. (Intern)
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: J. Food Engin.
Original language: English
Source: orbit
Source-ID: 194436
Storage stability of margarines produced from enzymatically interesterified fats compared to those prepared by conventional methods - Chemical properties

In this study, four margarine hardstocks were produced, two from enzymatically interesterified fats at 80 and 100% conversion, one from chemically randomized fat and one from physically mixed fat. These four hardstocks, blended with 50% sunflower oil, were mainly used for the production of table margarines in a pilot plant. Storage stability studies were carried out at storage temperatures of 5 and 25°C for 12wk. Margarines from the enzymatically interesterified fats were compared to the margarines produced by the conventional methods (chemical interesterification and physical blending) and to selected commercial margarines. The changes in the chemical properties of the products, including peroxide values (PV), tocopherols, free fatty acids, volatile oxidation products, and sensory evaluation, were examined during storage. It was observed that the margarine produced from the chemically interesterified fat had higher PV in weeks 4, 8 and 10 than the margarines produced from the enzymatically interesterified fats and the physically blended fat. These differences were not caused by different contents of tocopherols in the hardstocks. The differences between the processes for chemical and enzymatic interesterification, including further treatment stages, might be responsible for the development of a high PV in the margarine produced from the chemically interesterified fat. However, the contents of volatiles did not show the same tendency as observed for PV for the margarines stored at 25°C during 12wk. Storage at 25°C accelerated oxidation compared to storage at 5°C. The content of α- and γ-tocopherols decreased faster than the content of β- and δ-tocopherols during storage. This phenomenon was only affected by storage time, not by storage temperature. Sensory analysis did not show consistent differences between the produced margarines and commercial margarines, and no hydrolysis occurred for these four margarines during storage. The margarines produced from the enzymatically interesterified fats had low PV and a similar taste and smell compared to the margarine produced from the chemically interesterified fat.

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology, Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Novozymes A/S
Authors: Zhang, H. (Intern), Jacobsen, C. (Intern), Pedersen, L. S. (Ekstern), Christensen, M. W. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 227-238
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Lipid Science and Technology
Volume: 108
Issue number: 3
ISSN (Print): 1438-7697
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2016): CiteScore 2.06 SJR 0.71 SNIP 1.024
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.642 SNIP 0.881 CiteScore 1.85
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.737 SNIP 1.051 CiteScore 1.98
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.852 SNIP 1.124 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.873 SNIP 1.207 CiteScore 2.06
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
23Na-MRI quantification of sodium and water mobility in pork during brine curing

General information
State: Published
Organisations: Department of Systems Biology, Food Production Engineering
Authors: Vestergaard, C. S. (Intern), Risum, J. (Intern), Adler-Nissen, J. (Intern)
Pages: 663-672
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Meat Science
Volume: 69
Issue number: 0309-1740
ISSN (Print): 0309-1740
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.734 SNIP 1.945 CiteScore 3.33
Web of Science (2016): Indexed yes
Effect of xanthan on flavor release from thickened viscous food model systems

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Bylaitie, E. (Intern), Adler-Nissen, J. (Intern), Meyer, A. B. S. (Intern)
Pages: 3577-3583
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Effects of chemical and enzymatic modification on dough rheology and biscuit characteristics

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology
Authors: Pedersen, L. (Ekstern), Kaack, K. (Ekstern), Bergsøe, M. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 152-158
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Science
Volume: 70
ISSN (Print): 0022-1147
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.77 SNIP 1.013 CiteScore 1.92
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.83 SNIP 0.985 CiteScore 1.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.937 SNIP 1.11 CiteScore 2.07
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.011 SNIP 1.079 CiteScore 2.24
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.978 SNIP 1.086 CiteScore 1.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.934 SNIP 1.058 CiteScore 1.9
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.047 SNIP 1.101
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.969 SNIP 1.001
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.886 SNIP 0.924
Scopus rating (2007): SJR 0.695 SNIP 0.966
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.724 SNIP 0.895
Web of Science (2006): Indexed yes
Industrial Stir Frying

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology
Authors: Adler-Nissen, J. (Intern)
Pages: 32-34
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Asia Pacific Food Industry
Volume: 17
Issue number: 5
ISSN (Print): 0218-2734
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 184605
Publication: Research › Journal article – Annual report year: 2005

Influence of hydrocolloids and viscosity on aroma release

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Bylaite, E. (Intern), Meyer, A. B. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 391-394
Publication date: 2005
Main Research Area: Technical/natural sciences

Host publication information
Title of host publication: State-of-the-art in Flavour Chemistry and Biology
Publisher: AZ Druckerei und Datentechnik GmbH, Kempten, Germany
Editors: Hofman, T., Rothe, M., Schieberle, P.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 183915
Publication: Research - peer-review › Article in proceedings – Annual report year: 2005
Salt distribution in dry-cured ham measured by computed tomography and image analysis

Forty-seven hams were scanned four times by computed tomography (CT) while being manufactured into dry-cured hams. An image-processing algorithm measured CT values in the lean part of the hams and provided line profiles reflecting the magnitude and spatial location of salt gradients. At the end of manufacturing, seven entire hams were dissected and the salt content of the lean part determined. Likewise, in the remaining 40 hams, the lean meat of the slices corresponding to the CT images was dissected, analyzed chemically for NaCl and compared to the CT value. The salt content of entire dry-cured hams correlated well ($r^2=0.94$) to the CT value of a 10 mm section located at the center of femur bone, perpendicular to the length axis of the hams. In the same position, significant correlations between the CT values before ($r^2=0.71$) and after ($r^2=0.80$) the ageing period and actual chemical analysis of the same section were demonstrated. Line profiles illustrating the combined salt tribution and dehydration within a ham related to the physical characteristics of the ham as well as to the manufacturing process. These findings reveal that the effects of altered manufacturing practices can be followed non-invasively, while hams are still in production. Computed tomography combined with appropriate image analysis offers advantages as a non-invasive tool in both research and product development.
General Information
State: Published
Organisations: Department of Systems Biology, Image Analysis and Computer Graphics, Department of Informatics and Mathematical Modeling, Food Production Engineering
Authors: Vestergaard, C. S. (Intern), Erbou, S. G. (Intern), Thauland, T. (Ekstern), Berg, P. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 9-15
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication Information
Journal: Meat Science
Volume: 69
Issue number: 1
ISSN (Print): 0309-1740
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.734 SNIP 1.945 CiteScore 3.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.92 SNIP 1.85 CiteScore 3.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.488 SNIP 1.878 CiteScore 2.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.506 SNIP 1.848 CiteScore 2.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.655 SNIP 1.884 CiteScore 2.84
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.761 SNIP 1.797 CiteScore 2.75
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.547 SNIP 1.621
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.34 SNIP 1.511
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.298 SNIP 1.409
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.026 SNIP 1.628
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.144 SNIP 1.634
Scopus rating (2005): SJR 0.84 SNIP 1.533
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.079 SNIP 1.692
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.782 SNIP 1.554
Storage stability study for margarines produced by enzymatically interesterified fats compared to the margarines by the conventional methods I. Physical properties

In this study, margarine hardstocks were produced from two enzymatically interesterified fats at conversion degrees of 80 and 100%, a chemically randomized fat and a physically mixed fat, respectively. These four hardstocks blended with 50% of sunflower oil were mainly used for the production of table margarines in a pilot plant. Storage stability studies were carried out at storage temperatures of 5 and 25 °C during 12 wk. Margarines from the enzymatically interesterified fats were compared to the margarines produced by conventional methods and to selected commercial products. The changes in the physical properties of margarines, including hardness, dropping point, crystal form, and sensory evaluation, were examined during storage. It was observed that margarine storage stability increased with increasing conversion degree. The color of margarines made from the enzymatically interesterified fats was more similar to that of the physically mixed fat than that of the margarine from the chemically randomized fat, which had less color. Crystal transformation was accelerated at high storage temperature. Crystal size was not only related to the types of crystals, but also to the driving force of temperature difference. A larger crystal size was observed at 5 °C than at 25 °C for the margarine made from the blend. Margarines produced from interesterified fats had better physical properties than the blend. Overall, the margarine produced from the enzymatically fully converted fat had physical properties similar to the margarine produced from the chemically interesterified fat.

General information
State: Published
Organisations: Department of Biotechnology, Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources
Authors: Zhang, H. (Intern), Jacobsen, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 530-539
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Lipid Science and Technology
Volume: 107
Issue number: 7-8
ISSN (Print): 1438-7697
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.06 SJR 0.71 SNIP 1.024
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.642 SNIP 0.881 CiteScore 1.85
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.737 SNIP 1.051 CiteScore 1.98
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.852 SNIP 1.124 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Acrylamid i fødevarer

**General information**

**State:** Published
**Organisations:** Division of Food Chemistry, National Food Institute, Food Biotechnology and Engineering Group, Department of Systems Biology
**Authors:** Granby, K. (Intern), Frandsen, H. (Ekstern), Kaack, K. (Ekstern), Jensen, B. B. B. (Intern), Adler-Nissen, J. (Intern)
**Pages:** 18-21
**Publication date:** 2004
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Alimenta
**Volume:** 5
**ISSN (Print):** 1395-1718
**Original language:** Danish
**Source:** orbit
Apparatus for emulsion production in small scale and under controlled shear conditions

In this article, a rotor-stator apparatus for the production of 5 g batches of emulsion is introduced. Special attention was paid to the design of the apparatus and its construction, ensuring close tolerances in all machined parts. The size of the dispersing gap was 500 µm. The need to prepare small quantities of homogeneous emulsion formulations containing costly ingredients formed the impetus for this work. We present a set of emulsion production experiments using a model mayonnaise recipe with a weight percentage of dispersed oil of 80%, and illustrate the effect of rotor speed on the average size and size distributions of the resulting oil droplets. These size distributions were within the same range as a commercial mayonnaise. The maximum shear rates and corresponding shear stresses existing in the apparatus at different rotational speeds were estimated. A stabilization time related to rotor speed and geometry was also calculated. We discuss the scale-up of emulsion production, giving consideration to the length of time the shear stress is applied as well as to the magnitude of the shear stress.
Comment on fermentation technology: Creative fermentation technology for the future

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Adler-Nissen, J. (Intern)
Pages: 33-34
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Science
Volume: 69
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.77 SNIP 0.985 CiteScore 1.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.937 SNIP 1.11 CiteScore 2.07
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.011 SNIP 1.079 CiteScore 2.24
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.978 SNIP 1.086 CiteScore 1.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.934 SNIP 1.058 CiteScore 1.9
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.047 SNIP 1.101
Web of Science (2010): Indexed yes
Effects of Degree of Enzymatic Interesterification on the Physical Properties of Margarine Fats: Solid Fat Content, Crystallization Behavior, Crystal Morphology, and Crystal Network

In this study enzymatic-interesterified margarine fats with different conversion degrees were produced in a packed-bed reactor. The effects of conversion degree on the formation of free fatty acids and diacylglycerols, solid fat content, crystallization behavior, microstructure, and crystal network were investigated, and the enzymatically interesterified products were compared with a chemically interesterified product. Formation of free fatty acids and diacylglycerols increased slightly with increasing conversion degree. The solid fat content was higher at 10 and 20 °C and lower at 30, 35, and 40 °C with increasing conversion degree. Increased conversion degree from the blend to products, measured by X-ray with addition of 50% of rapeseed oil for dilution, caused the content of α to decrease from 100% to 33%, and 30% and eventually to pure â crystal. However, double chain packing was observed for both the blend and products. Isothermal crystallization kinetics was characterized by the Fisher-Turnbull model. The highest free energy was observed for the blend. A small deformation with oscillation tests shows a significant difference between the blend and interesterified products. The differences of microstructure between the blend, different conversion degree, and chemical randomized product were observed.

General information
State: Published
Organisations: Food Production Engineering, Department of Systems Biology, Ytkemiska Institutet
Authors: Zhang, H. (Intern), Smith, P. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 4423-4431
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 52
Issue number: 14
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
Enzymatic firming of processed red pepper by means of exogenous pectinesterase
The objective of this investigation was to demonstrate that the firmness of a commercial vegetable product, diced and frozen red pepper (Capsicum annum var. Sendt), could be improved by the use of exogenous pectinesterase in an
industrially relevant process. The diced pepper pieces 10 x 10 x 7 mm were infused under vacuum with a commercially available pectinesterase. The range of optimal process conditions was: 15-20°C, 45 min infusion time, a 10-25 mM CaCl2 infusion brine, a w/w ratio of pepper fruit to infusion brine of 1.5:1, and an enzyme dosage of 30-60 pectinesterase units (PEU) per kg pepper fruit. The firmness as measured by back extrusion was improved by a factor of two to three. The effect of firming was robust and conserved after freezing and heating in a simulated household cooking process. The firming process seems easily adaptable to industrial conditions and may be applicable to other vegetable and fruit products.

**General information**

State: Published
Organisations: Department of Systems Biology
Authors: Jensen, M. (Ekstern), Petersen, B. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 217-227
Publication date: 2004
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Food Biotechnology
Volume: 18
ISSN (Print): 0890-5436
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.271 SNIP 0.433 CiteScore 0.73
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.338 SNIP 0.49 CiteScore 0.79
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.298 SNIP 0.477 CiteScore 0.82
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.283 SNIP 0.456 CiteScore 0.65
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.267 SNIP 0.267 CiteScore 0.51
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.289 SNIP 0.57 CiteScore 0.62
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.314 SNIP 0.357
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.24 SNIP 0.248
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.252 SNIP 0.219
Scopus rating (2007): SJR 0.263 SNIP 0.282
Scopus rating (2006): SJR 0.437 SNIP 0.727
Scopus rating (2005): SJR 0.406 SNIP 0.996
Scopus rating (2004): SJR 0.392 SNIP 0.516
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.201 SNIP 0.398
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.274 SNIP 0.389
Scopus rating (2001): SJR 0.467 SNIP 0.708
Scopus rating (2000): SJR 0.317 SNIP 0.507
Scopus rating (1999): SJR 0.405 SNIP 0.854
Forbedrede smørbare fedtprodukter via enzymatisk modifikation af smørfedt

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology, Enzyme and Protein Chemistry
Authors: Xu, X. (Intern), Jacobsen, C. (Intern), Mu, H. (Intern), Adler-Nissen, J. (Intern)
Pages: 408-411
Publication date: 2004
Main Research Area: Technical/natural sciences

Hvad betyder storskala produktion af fødevarer for fødevarekvaliteten?

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Adler-Nissen, J. (Intern)
Publication date: 2004
Event: Abstract from BIOSAM BioForum konference 2.juni 2004
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 155292
Publication: Research › Conference abstract for conference – Annual report year: 2004

Influence of lambda-carrageenan on the release of systematic series of volatile flavor compounds from viscous food model systems

The effect of lambda-carrageenan addition level (0.1, 0.25, 0.4, and 0.5% w/w) and viscosity on the release of systematic series of aroma compounds (aldehydes, esters, ketones, and alcohols) was studied in thickened viscous solutions containing lambda-carrageenan and 10 wt % of sucrose. Air-liquid partition coefficients K (37°C) of a total of 43 aroma compounds were determined in pure water and in the lambda-carrageenan solutions by static headspace gas chromatography. Mass transfer of the aroma compounds in water and in the thickened lambda-carrageenan solutions which had a wide viscosity range was assessed by dynamic headspace gas chromatography. K(37°C) increased as the carbon chain increased within each homologous series. Esters exhibited the highest volatility, followed by aldehydes, ketones, and alcohols. Under equilibrium, no overall effect of lambda-carrageenan was found, except with the most hydrophobic compounds. Analysis of flavor release under nonequilibrium conditions revealed a suppressing effect of lambda-carrageenan on the release rates of aroma compounds, and the extent of decrease in release rates was dependent on the physicochemical characteristics of the aroma compounds, with the largest effect for the most volatile compounds. However, none of the effects was of a magnitude similar to the obtained changes in the macroscopic viscosity, and the suppressing effects are therefore attributable to the thickener and not the physical properties of the increasingly viscous systems.

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Bylaite, E. (Intern), Ilgunaite, Z. (Ekstern), Meyer, A. B. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 3542-3549
Publication date: 2004
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 155292
Publication: Research › Conference abstract for conference – Annual report year: 2004
Modification of margarine fats by enzymatic interesterification: Evaluation of a solid-fat-content-based exponential model with two groups of oil blends

Lipozyme TL IM-catalyzed interesterification for the modification of margarine fats was carried out in a batch reactor at 70°C with a lipase dosage of 4%. Solid fat content (SFC) was used to monitor the reaction progress. Lipase-catalyzed interesterification, which led to changes in the SFC, was assumed to be a first-order reversible reaction. Accordingly, the change in SFC vs. reaction time was described by an exponential model. The model contained three parameters, each with a particular physical or chemical meaning: (i) the initial SFC (SFC0), (ii) the change in SFC (ΔSFC) from the initial to the equilibrium state, and (iii) the reaction rate constant value (k). SFC0 and ΔSFC were related to only the types of blends and the blend ratios. The rate constant k was related to lipase activity on a given oil blend. Evaluation of the model was carried out with two groups of oil blends, i.e., palm stearin/coconut oil in weight ratios of 90:10, 80:20, and 70:30, and soybean oil/fully hydrogenated soybean oil in weight ratios of 80:20, 65:35, and 50:50. Correlation coefficients higher than 0.99 between the experimental and predicted values were observed for SFC at temperatures above 30°C. The model is useful for predicting changes in the SFC during lipase-catalyzed interesterification with a selected group of oil blends. It also can be used to control the process when particular SFC values are targeted.
Na-MRI quantification of sodium movements in pork during brine curing as related to meat pH

A model study of measuring diffusion during curing with 23Na images, Na-profiles, Apparent Diffusion Coefficients, T1-weighted images is presented.

General information
State: Published
Organisations: Department of Systems Biology
Authors: Vestergaard, C. S. (Intern), Risum, J. (Intern), Adler-Nissen, J. (Intern)
Quantification of salt concentrations in cured pork by computed tomography

Eight pork loin samples were mounted in Plexiglas cylinders and cured for five days. Samples were scanned by computed tomography (CT) once every 24 h. At the end of the experiment, the cylinders were cut in 1 cm sections and analyzed for chloride. From image analysis of the CT images, concentration profiles were extracted and fitted to a diffusion model which included a term to account for a non-negligible mass transfer coefficient. It was found that CT provides accurate estimates of salt gradients in meat and it was suggested that this analytical method could be valuable in scientific research and product development.
Release of peppermint flavour compounds from chewing gum: effect of oral functions

During chewing, the oral cavity functions like a bellow, forcing volatile flavour compounds into the exhaling air to the nasal compartment. Accordingly, we hypothesised that flavour release from chewing gum is predominantly governed by chewing frequency (CF), although other oral functions, like masseter muscle activity (MMA), chewing force (CFO), and saliva flow rate (SFR), may also play a role. In 10 healthy young males, the retronasal expired air of menthol and menthone from peppermint-flavoured (2%) chewing gum was determined as functions of CF, SFR, MMA, and CFO. The experimental setup comprised three separate series of a 4-min chewing period. These series differed only with respect to CF, i.e., habitual frequency, and 60 and 88 strokes/min. Results showed that more than 50% of the released menthol and menthone could be retrieved in the expired air and saliva. After 2-min of chewing, the concentration of flavour compounds in the expired air depended primarily on MMA and CF, becoming higher with increased MMA and CF. The concentration of flavour compounds in saliva depended primarily on SFR and the duration of the chewing task, becoming lower with high SFR and prolonged chewing duration. An increased volume of saliva in the mouth seemed to keep more flavour compounds in the aqueous phase, thereby diminishing the release via the retronasal route. In conclusion, flavour release to the retronasal compartment was dependent on MMA and CF and influenced by the volume of saliva present in the mouth.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Department of Systems Biology
Authors: Haahr, A. (Intern), Bardow, A. (Ekstern), Thomsen, C. (Ekstern), Jensen, S. (Ekstern), Nauntofte, B. (Ekstern), Bakke, M. (Ekstern), Adler-Nissen, J. (Intern), Bredie, W. (Ekstern)
Pages: 531-540
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Physiology & Behavior
Volume: 82
Issue number: 2-3
ISSN (Print): 0031-9384
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
Rheological properties of biscuit dough from different cultivars, and relationship to baking characteristics

Rheological properties of semi-sweet biscuit doughs from eight wheat cultivars were studied, and related to the dimensional changes of biscuits after cutting and baking. The tested cultivars were selected in order to represent a wide diversity in biscuit baking performance, and were grown with low use of N-fertiliser in three successive years. A standard recipe for semi-sweet biscuit dough was used, and the amount of water added was adjusted to the water absorption capacity. The rheological properties of the dough were characterised by creep recovery and oscillation. The fundamental methods showed that maximum strain at creep, recovery, storage modulus G', and phase angle delta were significantly influenced by the tested cultivars. The ranking of the cultivars according to phase angle delta was identical in each of the years investigated which indicates that phase angle delta reflects differences in structural properties with genetic control. Multivariate regression of flour physiochemical, dough rheological, and biscuit baking characteristics showed that a decrease in biscuit length was correlated under several rheological parameters, including phase angle delta, Farinograph and creep recovery parameters. Sedimentation value was the only physiochemical flour characteristic with considerable influence on the model. Validation of the partial least squares-model including all samples from the 3 years gave only a weak correlation (r = 0.58), whereas when each single year was evaluated separately, the correlation increased considerably (r = 0.71 and 0.87).
Changes in macroscopic viscosity do not affect the release of aroma aldehydes from a pectinaceous food model system of low sucrose content

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Bylaite, E. (Intern), Meyer, A. B. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 8020-8026
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 51
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.278 SNIP 1.421 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.423 SNIP 1.479 CiteScore 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.43 SNIP 1.471 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.384 SNIP 1.446 CiteScore 3.1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.408 SNIP 1.392
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.317 SNIP 1.303
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.361 SNIP 1.324
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.249 SNIP 1.439
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.358 SNIP 1.418
Hygienic Design of Closed Processing Equipment by use of Computational Fluid Dynamics

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Jensen, B. B. B. (Intern), Friis, A. (Intern), Adler-Nissen, J. (Intern)
Publication date: 2003

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 155225
Publication: Research › Ph.D. thesis – Annual report year: 2003

Nye fødevarestivelser

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Wischmann, B. (Intern), Adler-Nissen, J. (Intern)
Pages: 30
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Plus Proces
Issue number: 5
Original language: Danish
Source: orbit
Source-ID: 46313
Publication: Communication › Journal article – Annual report year: 2003

Sensoriske oplevelser kan oversættes til fysiske målinger

General information
State: Published
Organisations: Department of Systems Biology
Authors: Friis, A. (Intern), Kjøbæk, N. (Intern), Adler-Nissen, J. (Intern), Ahmt, T. (Ekstern)
Pages: 20-23
Publication date: 2003
Main Research Area: Technical/natural sciences
A packed-bed enzyme mini-reactor for the production of structured lipids using nonimmobilized lipases

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology, Enzyme and Protein Chemistry
Pages: 205-206
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the American Oil Chemists Society
Volume: 79
Issue number: 2
ISSN (Print): 0003-021X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.64 SJR 0.696 SNIP 0.905
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.682 SNIP 0.997 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.767 SNIP 1.043 CiteScore 1.68
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.809 SNIP 1.074 CiteScore 1.71
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.871 SNIP 1.236 CiteScore 1.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.833 SNIP 1.292 CiteScore 1.98
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.763 SNIP 1.056
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.863 SNIP 1.183
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.667 SNIP 1.037
Food product models developed to evaluate starch as a food ingredient

Three highly reproducible food models have been developed to evaluate rheological and functional properties of starches. The food models are dutch vla, dressing, and white sauce, and they vary in pH, serving temperature, oil content, and content of other functional ingredients than starch (milk proteins, whole egg, carrageenan). The viscous properties were calculated in a controlled stress rheometer, and the power law index, n, and the consistency index, K, was calculated. The viscoelastic properties at small deformations were measured by oscillating viscometry. Also a spreadability analysis was performed. The rheological data for the three food models were analysed by use of a principal component analysis (PCA), which enabled an evaluation of the functionality of the models and visualisation of the correlation to the concentration of starch. The rheological parameters all varied significantly with starch concentration in dutch vla. In dressing and white sauce most of the rheological parameters depended on the starch concentration. In addition, it was found that results from the empirical rheological method (USDA consistometer) correlate well with fundamental rheological parameters. Syneresis was measured for a period of time up to 15 days. The degree of syneresis of dressing was highly dependent on starch concentration, while the syneresis of the white sauce was dependent on time but not on starch concentration. The dutch vla showed no syneresis at all.

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Wischmann, B. (Intern), Bergsæe, M. N. (Intern), Adler-Nissen, J. (Intern)
Pages: 167-173
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication Information
Journal: Nahrung
Volume: 46
Issue number: 3
ISSN (Print): 0027-769X
Ratings:
BFI (2008): BFI-level 1
Web of Science (2002): Indexed yes
Original language: English
Source: orbit
Source-ID: 46081
Publication: Research - peer-review › Journal article – Annual report year: 2002
Melting properties and Lintnerisation of potato starch with different degrees of phosphorylation

Lintner dextrins were prepared from size fractionated potato starch granules from two potato varieties (90BKG22 and Lady Rosetta) that contain high or low natural content of esterified phosphate, respectively. The time course of hydrolysis showed the typical two-phase kinetics, with a maximal degree of hydrolysis of between 74% and 81% after 30 days of hydrolysis, except for the fraction of smallest granules of the low phosphorylated variety (low P), which was hydrolysed to 98%. The relative amount of retained glucose-6-P in the Lintner dextrins was 18.6% for the low P variety and 46.6% for the high P variety. However, when calculating the relative distribution of phosphate in the granules, it was shown that approximately 80% (low P) and 35.5% (high P) was located in the amorphous region. Melting characteristics were followed by differential scanning calorimetry (DSC). The DSC endothermic peak became low and broad during the time course of hydrolysis, with rise in enthalpy change, indicating a strong dependency on the amorphous region of the granules. After annealing the same fractions showed the typical raise in gelatinisation temperature and narrowing of gelatinisation peak. The values of the melting temperatures (T-o, T-m and T-c) are positively correlated to the degree of phosphorylation of the starch dextrin fractions both before and after annealing.
Production of structured lipids in a packed-bed reactor with Thermomyces lanuginosa lipase

Lipase-catalyzed interesterification between fish oil and medium-chain TAG has been investigated in a packed-bed reactor with a commercially immobilized enzyme. The enzyme, a Thermomyces lanuginosa lipase immobilized on silica by granulation (Lipozyme TL IM; Novozymes A/S, Bagsvaerd, Denmark), has recently been developed for fat modification. This study focuses on the new characteristics of the lipase in a packed-bed reactor when applied to interesterification of TAG. The degree of reaction was strongly related to the flow rate (residence time) and temperature, whereas formation of hydrolysis by-products (DAG and FFA) were only slightly affected by reaction conditions. The degree of reaction reached equilibrium at 30-40 min residence time, and the most suitable temperature was 60°C or higher with respect to the maximal degree of reaction. The lipase was stable in a 2-wk continuous operation without adjustment of water content or activity of the column and the substrate mixture.

General information
State: Published
Organisations: Department of Systems Biology
Authors: Xu, X. (Intern), Porsgaard, T. (Intern), Zhang, H. (Intern), Adler-Nissen, J. (Intern), Høy, C. (Intern)
Pages: 561-565
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the american oil chemists society
Volume: 79
Issue number: 6
ISSN (Print): 0003-021X
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1.64 SJR 0.696 SNIP 0.905
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.682 SNIP 0.997 CiteScore 1.66
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.767 SNIP 1.043 CiteScore 1.68
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.809 SNIP 1.074 CiteScore 1.71
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.871 SNIP 1.236 CiteScore 1.81
Production of structured phospholipids by lipase-catalyzed acidolysis: optimization using response surface methodology

General information
State: Published
Organisations: Department of Systems Biology
Authors: Peng, L. (Ekstern), Xu, X. (Intern), Mu, H. (Intern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 523-532
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Enzyme and Microbial Technology
Volume: 31
Issue number: 4
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Skånsomhed i fødevareproduktion

General information
The continuous wok - a new unit operation in industrial food processes

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Friis, A. (Intern), Adler-Nissen, J. (Intern)
Pages: 62-71
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Title of host publication: Bedre mad gennem viden
Publisher: Levnedsmiddelcentret
Source: orbit
Source-ID: 155133
Publication: Communication › Book chapter – Annual report year: 2002
Efficiency of enzymatic and other alternative clarification and fining treatments on turbidity and haze in cherry juice

Several alternative strategies were examined for improving conventional juice fining procedures for cherry juice clarification and fining in laboratory-scale experiments: Centrifugation of freshly pressed juice from 1000g to 35000g induced decreased turbidity according to a steep, negative power function. Individual and interactive effects on turbidity and haze formation in precentrifuged and uncentrifuged cherry juice of treatments with pectinase, acid protease, bromelain, gallic acid, and gelatin-silica sol were investigated in a factorial experimental design with 32 different parameter combinations. Gelatin-silica sol consistently had the best effect on juice clarity. Centrifugation of cherry juice (10000g for 15 min) prior to clarification treatment significantly improved juice clarity and diminished the rate of haze formation during cold storage of juice. Both treatment of precentrifuged cherry juice with Novozym 89L protease and co-addition of pectinase and gallic acid improved cherry juice clarity and diminished haze levels. None of the alternative treatments produced the unwieldy colloids notorious to gelatin-silica sol treatment. The data suggest that several alternative clarification strategies deserve further consideration in large-scale cherry juice processing. Precentrifugation of juice before clarification and fining is immediately recommended.

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Meyer, A. B. S. (Intern), Köser, C. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 3644-3650
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 49
Issue number: 8
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.278 SNIP 1.421 CiteScore 3.25
Web of Science (2014): Indexed yes
Lipid oxidation in fish oil enriched mayonnaise: Calcium disodium ethylenediaminetetraacetate, but not gallic acid, strongly inhibited oxidative deterioration

The antioxidative effects of gallic acid, EDTA, and extra emulsifier Panodan DATEM TR in mayonnaise enriched with 16% fish oil were investigated. EDTA reduced the formation of free radicals, lipid hydroperoxides, volatiles, and fishy and rancid off-flavors. The antioxidative effect of EDTA was attributed to its ability to chelate free metal ions and iron from egg yolk located at the oil-water interface. Gallic acid reduced the levels of both free radicals and lipid hydroperoxides but promoted slightly the oxidative flavor deterioration in mayonnaise and influenced the profile of volatiles. Gallic acid may therefore promote the decomposition of lipid hydroperoxides to volatile oxidation products. Addition of extra emulsifier reduced the lipid hydroperoxide levels but did not influence the level of free radicals or the oxidative flavor deterioration in mayonnaise; however, it appeared to alter the profile of volatiles. The effect of the emulsifier on the physical structure and rheological properties depended on the presence of antioxidants.
Microbial survival and odor in laundry

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology, Food Production Engineering
Authors: Jepsen, S. M. (Intern), Johansen, C. (Intern), Stahnke, L. H. (Intern), Adler-Nissen, J. (Intern)
Pages: 385-394
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Surfactants and Detergents
Volume: 4
Issue number: 4
Original language: English
Source: orbit
Source-ID: 225896
Publication: Research - peer-review › Journal article – Annual report year: 2001

Oxidation in fish oil-enriched mayonnaise 4: Effect of tocopherol concentration on oxidative deterioration

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology, Department of Systems Biology, Department of Biochemistry and Nutrition
Pages: 308-318
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: European Food Research and Technology
Volume: 212
Issue number: 3
ISSN (Print): 1438-2377
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
### Prediction of Cleanability in Food Processing Equipment using CFD

**General information**

*State:* Published  
*Organisations:* Department of Systems Biology, Alfa Laval  
*Authors:* Jensen, B. B. B. (Intern), Adler-Nissen, J. (Intern), Andersen, J. F. (Ekstern), Friis, A. (Intern)  
*Pages:* 1859-1863

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*Original language:* English  
*Source:* orbit  
*Source-ID:* 225903  
*Publication:* Research - peer-review ➔ Journal article – Annual report year: 2001
Production of margarine fats by enzymatic interesterification with silica-granulated Thermomyces lanuginosa lipase in a large-scale study

Interesterification of a blend of palm stearin and coconut oil (75:25, w/w), catalyzed by an immobilized Thermomyces lanuginosa lipase by silica granulation, Lipozyme TL IM, was studied for production of margarine fats in a 1- or 300-kg pilot-scale batch-stirred tank reactor. Parameters and reusability were investigated. The comparison was carried out between enzymatic and chemical interesterified products. Ex perimentally, Lipozyme TL IM had similar activity to Lipozyme IM for the interesterification of the blend. Within the range of 55-80 degreesC, temperature had little influence on the degree of interesterification for 6-h reaction, but it had slight impact on the content of free fatty acids (FFA). Drying of Lipozyme TF IM from water content 6 to 3% did not affect its activity, whereas it greatly reduced FFA and diacylglycerol contents in the products. Lipozyme TL IM was stable in the 1-kg scale reactor at least for 11 batches and the 300-kg pilot-scale reactor at least for nine batches. Due to regiospecificity of the lipase (sn-1,3 specific), enzymatically interesterified products had different Fatty acid distribution at sn-2 position from the chemically randomized products, implying the potential nutritional benefits of the new technology.
Purification of specific structured lipids by distillation: Effects on acyl migration

The cause and effects of acyl migration during the purification of specific structured lipids by distillation were studied in a conventional batch deodorizer with stripping steam. The mixture of specific structured lipids produced by lipase-catalyzed acidolysis between rapeseed oil and capric acid contained a large amount of free fatty acids and a small amount of partial acylglycerols besides triacylglycerols. Therefore, the effect of steam, free fatty acids, diacylglycerols, and monoacylglycerols on acyl migration was studied in a palm oil midfraction model. The results showed that all these factors influenced the rate of acyl migration, and their combinations made the effect more severe. However, diacylglycerols were found to be the main reason for acyl migration. In the distillation of the specific structured lipid product mixture, distillation temperature and time were the main factors to determine the degree of acyl migration and the extent of separation of free fatty acids. The results indicate that more efficient separation technology should be used to improve the quality of the purified structured lipids.

In order to reduce the distillation temperature, vacuum should be made as low as possible with more effective pumps. To reduce the distillation time, thin-film principle in a packed column should be used, or other more efficient distillation techniques such as molecular distillation or short-path distillation should be exploited.
**Synthesis of structured triacylglycerols containing caproic acid by lipase-catalyzed acidolysis: Optimization by response surface methodology**

Production in a batch reactor with a solvent-free system of structured triacylglycerols containing short-chain fatty acids by Lipozyme RM IM-catalyzed acidolysis between rapeseed oil and caproic acid was optimized using response surface methodology (RSM). Reaction time (t(r)), substrate ratio (S-r), enzyme load (E-1, based on substrate), water content (W-c, based on enzyme), and reaction temperature (T-e), the five most important parameters for the reaction, were chosen for the optimization. The range of each parameter was selected as follows: t(r) = 5-17 h; E-1 = 6-14 wt %; T-e = 45-65 degreesC; S-r = 2-6 mol/mol; and W-c = 2-12 wt %. The biocatalyst was Lipozyme RM IM, in which Rhizomucor miehei lipase is immobilized on a resin. The incorporation of caproic acid into rapeseed oil was the main monitoring response. In addition, the contents of mono-incorporated structured triacylglycerols and di-incorporated structured triacylglycerols were also evaluated. The optimal reaction conditions for the incorporation of caproic acid and the content of di-incorporated structured triacylglycerols were as follows: t(r) = 17 h; S-r = 8.5; E-1 = 14 wt %; W-c = 10 wt %; T-e = 65 degreesC. At these conditions, products with 55 mol % incorporation of caproic acid and 55 mol % di-incorporated structured triacylglycerols were obtained.

**General information**

State: Published
Organisations: Department of Systems Biology
Pages: 5771-5777
Publication date: 2001
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of agricultural and food chemistry
Volume: 49
Issue number: 12
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.278 SNIP 1.421 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.423 SNIP 1.479 CiteScore 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.43 SNIP 1.471 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.384 SNIP 1.446 CiteScore 3.1
Validation of a texture simulation

General information
State: Published
Organisations: Food Biotechnology and Engineering Group, Department of Systems Biology
Authors: Kjøbæk, N. (Intern), Friis, A. (Intern), Rugholt, S. (Intern), Møller, P. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 101-105
Publication date: 2001

Host publication information
Title of host publication: Papers presented at the Nordic Rheology Conference 2001, Trondheim, June 14-16, 2001: general papers and papers from the special session on mixed systems, also featuring papers from the Nordic Rheology Conference, June 2000, Helsinki
Publisher: Nordic Rheology Society
Editor: Friis, A.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 155111
Publication: Research › Article in proceedings – Annual report year: 2001

Effect of ascorbic acid on iron release from the emulsifier interface and on the oxidative flavor deterioration in fish oil enriched mayonnaise

General information
State: Published
Enzymatic gelation of sugar beet pectin in food products

General information
State: Published
Organisations: Department of Biotechnology
Authors: Bergsøe, M. N. (Intern), Jensen, M. (Intern), Adler-Nissen, J. (Intern)
Pages: 237-243
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Hydrocolloids
Volume: 14
Issue number: 3
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.1 SJR 2.043 SNIP 2.041
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.846 SNIP 1.966 CiteScore 4.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.251 SNIP 2.564 CiteScore 5.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.1 SNIP 2.292 CiteScore 4.81
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.866 SNIP 2.086 CiteScore 3.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.615 SNIP 1.921 CiteScore 3.57
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.743 SNIP 1.513
Hygenic design of In-line components using CDF

General information
State: Published
Organisations: Department of Biotechnology
Authors: Jensen, B. B. B. (Intern), Adler-Nissen, J. (Intern), Friis, A. (Intern)
Pages: 26-28
Publication date: 2000

Host publication information
Title of host publication: Food and Drink, Processing for innovative products
Place of publication: Birmingham, United Kingdom
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 177398
Publication: Research - peer-review › Journal article – Annual report year: 2000

Lipase-catalyzed production of structured lipids via acidolysis of fish oil with caprylic acid

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Pages: 263-274
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Lipids
Volume: 7
Issue number: 4
Ratings:
Scopus rating (2012): SJR 0.43 SNIP 0.918
Scopus rating (2011): SJR 0.609 SNIP 1.029
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.45 SNIP 0.812
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.715 SNIP 0.722
BFI (2008): BFI-level 1
Lipozyme IM-catalyzed interesterification for the production of margarine fats in a 1 kg scale stirred tank reactor

Lipozyme IM-catalyzed interesterification of the oil blend between palm stearin and coconut oil (75/25 w/w) was studied for the production of margarine fats in a 1 kg scale batch stirred tank reactor. Parameters such as lipase load, water content, temperature, and reaction time were investigated. The reusability of Lipozyme IM was also studied under optimized conditions. The interesterification products were monitored by analysis of triacylglycerol profiles, the contents of diacylglycerols, free fatty acids (FFA), and solid fat contents. The contents of some triacylglycerol species, which were categorized by equivalent carbon number (ECN), namely ECN34, 36, 48, and 50, decreased by 6.0, 5.9, 5.8, and 13.7%, respectively, after enzymatic interesterification, similar to the reduction of those species after chemical interesterification, 6.6, 6.0, 7.1, and 12.9%, respectively. On the other hand, those of ECN38, 40, 42, 44, and 46 increased by 1.1, 1.6, 6.8, 16.7, and 6.5%, respectively, in comparison with the increase of those species after chemical interesterification, 0.2, 1.5, 6.5, 17.0, and 9.2%, respectively. Lipase load and reaction time had great influence on the degree of interesterification. A Lipozyme IM load of 6% was required for a reaction of 6 h and at 60 °C, to reach a stable degree of interesterification. Temperature variation in the range of 50–75 °C did not affect the reaction degree as well as the contents of diacylglycerols, but the content of FFA slightly increased with higher temperature. Addition of water to the enzyme increased the contents of diacylglycerols and FFA in the products linearly. However, it had no effect on the degree of interesterification for the first batch when the enzyme was reused. Lipozyme IM was stable in the 10-batch test after adjusting the water content in the system. The relationship between the content of water in the system and that of FFAs in the products was evaluated and discussed.
Lipozyme IM-catalyzed interesterification for the production of margarine fats in a 1 kg scale stirred tank reactor
Lipozyme IM-catalyzed interesterification of the oil blend between palm stearin and coconut oil (75/25 w/w) was studied for the production of margarine fats in a 1 kg scale batch stirred tank reactor. Parameters such as lipase load, water content, temperature, and reaction time were investigated. The reusability of Lipozyme IM was also studied under optimized conditions. The interesterification products were monitored by analysis of triacylglycerol profiles, the contents of diacylglycerols, free fatty acids (FFA), and solid fat contents. The contents of some triacylglycerol species, which were categorized by equivalent carbon number (ECN), namely ECN34, 36, 48, and 50, decreased by 6.0, 5.9, 5.8, and 13.7%, respectively, after enzymatic interesterification, similar to the reduction of those species after chemical interesterification,
6.6, 6.0, 7.1, and 12.9%, respectively. On the other hand, those of ECN38, 40, 42, 44, and 46 increased by 1.1, 1.6, 6.8, 16.7, and 6.5%, respectively, in comparison with the increase of those species after chemical interesterification, 0.2, 1.5, 6.5, 17.0, and 9.2%, respectively. Lipase load and reaction time had great influence on the degree of interesterification. A Lipzyme IM load of 6% was required for a reaction of 6 h and at 60 degrees C, to reach a stable degree of interesterification. Temperature variation in the range of 50-75 degrees C did not affect the reaction degree as well as the contents of diacylglycerols, but the content of FFA slightly increased with higher temperature. Addition of water to the enzyme increased the contents of diacylglycerols and FFA in the products linearly. However, it had no effect on the degree of interesterification for the first batch when the enzyme was reused. Lipzyme IM was stable in the 10-batch test after adjusting the water content in the system. The relationship between the content of water in the system and that of FFAs in the products was evaluated and discussed.
Oxidation in fish-oil-enriched mayonnaise 2: Assessment of the efficacy of different tocopherol antioxidant systems by discriminant partial least squares regression analysis

Oxidative protection of mayonnaises with 16% fish oil was studied during cold storage (5 degrees C) after supplementation with different tocopherol systems: the ternary antioxidant system ascorbic acid, lecithin and tocopherol (A/L/T), and two commercial mixtures, an oil-soluble (Toco 70) preparation and a water-soluble (Grindox 1032) preparation. The physical structure of the fish-oil-enriched mayonnaise was manipulated by adding extra emulsifier (Panodan TR) with the purpose of investigating whether or not this affected the antioxidative activity of the tocopherol mixtures. A number of different analytical techniques HPLC, high-performance liquid chromatography, gas chromatography mass spectrometry (GC-MS), sensory analysis, confocal laser scanning microscopy and rheological measurements were employed to elucidate the chemical, sensory, structural and rheological aspects of the oxidation process. Discriminant partial least squares regression was used to analyse the data obtained. The three tocopherol preparations not only affected the oxidative stability of the mayonnaises differently they also influenced the rheological and structural properties of the mayonnaises in different ways. The rheological and structural properties of the mayonnaise were also affected by the addition of extra emulsifier, but this did not influence the formation of fishy and rancid off-flavours. Addition of the A system caused the immediate formation of distinct fishy and rancid off-flavours in the fresh mayonnaises. The volatile compounds trans-2-heptenal, 3-octen-3-one, 1-octen-3-ol, trans,cis-2,4-heptadienal, trans,trans-2,4-heptadienal, trans-2-octenal, nonanal and trans,cis-3,6-nonadienal were thought to contribute to the fishy and rancid flavours. Addition of Toco 70 did not affect the sensory perception of mayonnaise nor the development of volatile of flavour compounds as evaluated by GC-MS, but the peroxide values were slightly increased in mayonnaise containing Toco 70 as compared to the other mayonnaises. Mayonnaise with Grindox 1032 seemed to have fewer fishy and rancid off-flavours than mayonnaises without antioxidant. This flavour-protective effect of Grindox 1032 was correlated to an increase in the size of the droplet diameter of mayonnaises supplemented with Grindox 1032.

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology, Department of Systems Biology, Department of Biochemistry and Nutrition
Authors: Jacobsen, C. (Intern), Hartvigsen, K. (Intern), Lund, P. (Intern), Adler-Nissen, J. (Intern), Hølmer, G. K. (Intern), Meyer, A. S. (Intern)
Pages: 242-257
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: European Food Research and Technology
Volume: 210
Issue number: 4
ISSN (Print): 1438-2377
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Oxidation in fish oil-enriched mayonnaise 3: Assessment of the influence of the emulsion structure on oxidation by discriminant partial least squares regression analysis

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology, Department of Systems Biology, Department of Biochemistry and Nutrition, Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering
Primary odorants of laundry soiled with sweat/sebum: Influence of lipase on the odor profile

General information
State: Published
Organisations: Department of Biotechnology
Authors: Jepsen, S. M. (Intern), Munch, P. (Ekstern), Stahnke, L. H. (Intern), Adler-Nissen, J. (Intern), Schieberle, P. (Ekstern)
Pages: 505-515
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Surfactants and Detergents
Volume: 3
Issue number: 4
Original language: English
Source: orbit
Source-ID: 177394
Publication: Research - peer-review › Journal article – Annual report year: 2000

Primary odorants of naturally soiled laundry: Influence of lipase on the odour profile

General information
State: Published
Organisations: Department of Biotechnology, Deutsche Forschungsanstalt für Lebensmittelchemie
Authors: Jepsen, S. M. (Intern), Münch, P. (Ekstern), Stahnke, M. L. H. (Intern), Adler-Nissen, J. (Intern), Schieberle, P. (Ekstern)
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: J. Surfactants and Detergents
Original language: English
Source: orbit
Source-ID: 173978
Publication: Research - peer-review › Journal article – Annual report year: 2000

Production of structured lipids by lipase-catalysed interesterification in an ultrafiltration membrane reactor

General information
State: Published
Organisations: Department of Biochemistry and Nutrition, Department of Chemical and Biochemical Engineering, Department of Biotechnology
Pages: 1667-1671
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Biotechnology Letters
Volume: 22
Issue number: 21
ISSN (Print): 0141-5492
Ratings:
Production of structured lipids by lipase-catalyzed interesterification in a flat membrane reactor
A METHOD AND APPARATUS FOR STIR-FRYING

A method and apparatus for stir-frying discrete pieces or particles of one or more foodstuffs by heating a surface (14) and bringing discrete pieces into contact with the heated surface through an inlet means (22), transporting said discrete pieces across the heated surface (14) by means of a mechanically driven stirring means and scraping means in the form of a helix (4), the discrete pieces being stirred such that the orientation of same with respect to the heated surface (14) is altered such that the various surface portions of the discrete pieces are brought into heat conducting contact with the heated surface (14), at the same time scraping the heated surface (14) by means of the rim of the helix or by means of special scraping and stirring elements (27) arranged along the rim of the helix such that the entire area of the heated surface contacted by the discrete pieces is scraped mechanically so as to remove any layer of material originating from the foodstuffs and adhering to the heated surface (14) and finally, removing the discrete pieces from contact with the heated surface through an outlet means (25, 26).

General information
State: Published
Organisations: Department of Biotechnology, JPJ Engineering ApS
Authors: Adler-Nissen, J. (Intern), Jensen, J. P. (Ekstern), Dyhr, E. (Ekstern)
Publication date: 1999

Publication information
Patent number: WO1999029218
Date: 17/06/1999
Original language: English

Bibliographical note
International application published under the World Intellectual Property Organization (WIPO)
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 173184
Publication: Research › Patent – Annual report year: 1999

**Deodorization principles - stripping efficiency in cross-flow and counter-current operations**

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering
Authors: Balchen, S. (Intern), Gani, R. (Intern), Adler-Nissen, J. (Intern)
Pages: 245-255
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Inform
Volume: 10
Issue number: 3
Original language: English
Source: orbit
Source-ID: 175037
Publication: Research › Journal article – Annual report year: 1999
Enzymatic degradation of plant cell wall polysaccharides: The kinetic effect of competitive adsorption

General information
State: Published
Organisations: Department of Biotechnology, Technical University of Denmark
Authors: Norsker, M. (Intern), Adler-Nissen, J. (Intern), Bloch, L. (Ekstern)
Pages: 307-310
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Nahrung
Volume: 43
Issue number: 5
Original language: English
Source: orbit
Source-ID: 173203
Publication: Research - peer-review › Journal article – Annual report year: 1999

Oxidation in fish-oil-enriched mayonnaise 1: Assessment of propyl gallate as an antioxidant by discriminant partial least squares regression analysis

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology, Department of Systems Biology, Department of Biochemistry and Nutrition
Authors: Jacobsen, C. (Intern), Hartvigsen, K. (Intern), Lund, P. (Intern), Meyer, A. S. (Intern), Adler-Nissen, J. (Intern), Holstborg, J. (Ekstern), Hølmer, G. K. (Intern)
Pages: 13-20
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: European Food Research and Technology
Volume: 210
ISSN (Print): 1438-2377
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.742 SNIP 0.882 CiteScore 1.81
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.732 SNIP 0.822 CiteScore 1.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.828 SNIP 0.908 CiteScore 1.71
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.791 SNIP 0.901 CiteScore 1.71
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.872 SNIP 1.038 CiteScore 1.68
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.009 SNIP 1.097 CiteScore 1.87
ISI indexed (2011): ISI indexed yes
Oxidation mechanisms in real food emulsions: Oil-water partition coefficients of selected volatile off-flavor compounds in mayonnaise

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology
Authors: Jacobsen, C. (Intern), Meyer, A. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 317-327
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: European Food Research and Technology: international journal of food research and technology
Volume: 208
ISSN (Print): 1438-2377
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.742 SNIP 0.882 CiteScore 1.81
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Parameters affecting diacylglycerol formation during the production of specific-structured lipids by lipase-catalyzed interesterification

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Mu, H. (Intern), Skands, A. (Ekstern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 175-181
Publication date: 1999
Main Research Area: Technical/natural sciences
Partitioning of selected antioxidants in mayonnaise

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology
Authors: Jacobsen, C. (Intern), Schwarz, K. (Ekstern), Stockmann, H. (Ekstern), Meyer, A. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 3601-3610
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 47
Issue number: 9
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.278 SNIP 1.421 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.423 SNIP 1.479 CiteScore 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.43 SNIP 1.471 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.384 SNIP 1.446 CiteScore 3.1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.408 SNIP 1.392
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.317 SNIP 1.303
Web of Science (2009): Indexed yes
Production of specifically structured lipids by enzymatic interesterification in a pilot enzyme bed reactor: process optimization by response surface methodology

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Mu, H. (Intern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 207-213
Publication date: 1999
Main Research Area: Technical/natural sciences

Production of structured lipids by lipase-catalyzed interesterification in a packed bed reactor: Effect of reaction parameters on the level of diacylglycerols in the products

General information
State: Published
Organisations: Department of Biochemistry and Nutrition, Department of Biotechnology
Authors: Mu, H. (Intern), Xu, X. (Intern), Adler-Nissen, J. (Intern), Høy, C. (Intern)
Pages: 158-164
Publication date: 1999
Main Research Area: Technical/natural sciences
Effects of lipid-borne compounds on the activity and stability of lipases in micro-aqueous systems for lipase-catalyzed reaction

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 441-446
Publication date: 1998

Host publication information
Title of host publication: Stability and Stabilization of Biocatalysts
Place of publication: Amsterdam
Publisher: Elsevier
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 171233
Publication: Research › Article in proceedings – Annual report year: 1998

Fermentability of an enzymatically modified solubilised potato polysaccharide (SPP)

General information
State: Published
Organisations: Department of Biotechnology, Novo Nordisk A/S, Copenhagen University Hospital, University of Copenhagen
Authors: Olesen, M. (Ekstern), Gudmund-Høyer, E. (Ekstern), Norsker, M. (Intern), Kofod, L. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 110-114
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Clinical Nutrition
Volume: 52
ISSN (Print): 0954-3007
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.8 SJR 1.347 SNIP 1.179
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.586 SNIP 1.192 CiteScore 2.86
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.516 SNIP 1.183 CiteScore 2.78
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.422 SNIP 1.329 CiteScore 3.15
Interactions between functional ingredients, antioxidants and off-flavour compounds in mayonnaise with fish oil

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering, National Food Institute
Authors: Jacobsen, C. (Intern), Meyer, A. S. (Intern), Adler-Nissen, J. (Intern)
Publication date: 1998
Event: Abstract from Lipidforums seminar: Marine Lipids - Production for Food. Tromsø, 1.-2. oktober 1998, Tromsø, 
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170521
Publication: Research - peer-review › Journal article – Annual report year: 1998
Oxidation mechanisms in real food emulsions: Method for separation of mayonnaise by ultracentrifugation

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Biotechnology
Authors: Jacobsen, C. (Intern), Meyer, A. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 87-101
Publication date: 1998
Main Research Area: Technical/natural sciences

Pilot batch production of specific-structured lipids by lipase-catalyzed interesterification: preliminary study on incorporation and acyl migration

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Balchen, S. (Intern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 301-308
Publication date: 1998
Main Research Area: Technical/natural sciences
Production of specific-structured lipids by enzymatic interesterification: elucidation of acyl migration by response surface design

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Skands, A. (Ekstern), Høy, C. (Intern), Mu, H. (Intern), Balchen, S. (Intern), Adler-Nissen, J. (Intern)
Pages: 1179-1186
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of American Oil Chemists' Society
Volume: 75
Issue number: 9
Original language: English
Source: orbit
Source-ID: 171200
Publication: Research - peer-review › Journal article – Annual report year: 1998

Production of specific-structured lipids by enzymatic interesterification in a pilot continuous enzyme bed reactor

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Balchen, S. (Intern), Høy, C. (Intern), Adler-Nissen, J. (Intern)
Pages: 1573-1579
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Volume: 75
Original language: English
Source: orbit
Source-ID: 171202
Publication: Research - peer-review › Journal article – Annual report year: 1998

Production of specific structured lipids by enzymatic interesterification: optimization of the reaction by response surface design

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Skands, A. R. H. (Intern), Adler-Nissen, J. (Intern), Høy, C. (Intern)
Pages: 463-471
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Fett/Lipid
Volume: 100
Original language: English
Source: orbit
Source-ID: 169845
Publication: Research - peer-review › Journal article – Annual report year: 1998
Anitoxidative effect of glucose oxidase and catalase in mayonaises of different oxidative susceptibility. I: Experimental investigations

General information
State: Published
Organisations: Department of Biotechnology, Technical University of Denmark
Authors: Isaksen, A. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 841-846
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: Lebensmittel-Wissenschaft und Technologie
Volume: 30
Original language: English
Source: orbit
Source-ID: 167283
Publication: Research - peer-review › Journal article – Annual report year: 1997

Anitoxidative effect of glucose oxidase and catalase in mayonaises of different oxidative susceptibility. II: Mathematical modelling

General information
State: Published
Organisations: Department of Biotechnology, Technical University of Denmark
Authors: Isaksen, A. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 847-852
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: Lebensmittel-Wissenschaft und Technologie
Volume: 30
Original language: English
Source: orbit
Source-ID: 167285
Publication: Research - peer-review › Journal article – Annual report year: 1997

Functional Properties of potato fibres after enzymatic modification

General information
State: Published
Organisations: Department of Biotechnology
Authors: Norsker, M. (Intern), Adler-Nissen, J. (Intern)
Pages: 255-259
Publication date: 1997

Host publication information
Title of host publication: Proceedings
Main Research Area: Technical/natural sciences
Conference: 1st International Symposium on Food Rheology and Structure, Zürich, Switzerland, 16/03/1997 - 16/03/1997
Source: orbit
Source-ID: 169134
Publication: Research › Article in proceedings – Annual report year: 1997

Modellering af procesforhold under kontinuerlig varmebehandling

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, The Danish Polymer Centre, Department of Biotechnology
Authors: Karlson, T. (Intern), Szabo, P. (Intern), Hassager, O. (Intern), Friis, A. (Intern), Adler-Nissen, J. (Intern)
Pilot batch production of cocoa butter-like fats from Chinese vegetable tallow by enzymatic interesterification

General information
State: Published
Organisations: Department of Biotechnology, Zhengzhou Grain College
Authors: Xu, X. (Intern), Hu, X. (Ekstern), Balchen, S. (Intern), Zhang, G. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 104-112
Publication date: 1997

Host publication information
Title of host publication: Proceedings of The International symposium on New Approaches to Functional Cereals and Oils
Place of publication: Beijing
Publisher: CCOA
Main Research Area: Technical/natural sciences
Conference: The International symposium on New Approaches to Functional Cereals and Oils, Beijing, 01/01/1997
Source: orbit
Source-ID: 171350
Publication: Research - peer-review › Article in proceedings – Annual report year: 1997

Specific-structured lipids: nutritional perspectives and production potentials

General information
State: Published
Organisations: Department of Biotechnology, Department of Biochemistry and Nutrition
Authors: Xu, X. (Intern), Høy, C. (Intern), Balchen, S. (Intern), Adler-Nissen, J. (Intern)
Pages: 806-813
Publication date: 1997

Host publication information
Title of host publication: Proceedings of International Symposium on the Approaches to Functional Cereals and Oils
Place of publication: Beijing
Publisher: CCOA
Main Research Area: Technical/natural sciences
Conference: International Symposium on the Approaches to Functional Cereals and Oils and Exhibitions, Beijing, 01/01/1997
Source: orbit
Source-ID: 171231
Publication: Research › Article in proceedings – Annual report year: 1997

Heat inactivation kinetics of the two Trypsin inhibitors during high-temperature-short-time processing of soymilk

General information
Potato starch: degree of phosphorylation related to dynamic rheological characteristics

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, Division of Food Production Engineering
Authors: Poulsen, L. (Intern), Muhrbeck, P. (Ekstern), Adler-Nissen, J. (Intern)
Publication date: 1996

Host publication information
Title of host publication: Starch: structure and functionality
Publisher: Royal Society of Chemistry
Editors: Frazier, P. J., Donald, A. M., Richmond, P.
ISBN (Print): 0-85404-742-5
Main Research Area: Technical/natural sciences
Conference: Starch structure and functionality, Cambridge, 01/01/1996
Source: orbit
Source-ID: 239682
Publication: Research › Conference abstract in proceedings – Annual report year: 1996

Rheological measurements at high temperatures

General information
State: Published
Organisations: Department of Biotechnology
Authors: Friis, A. (Intern), Jensen, C. (Ekstern), Muhrbeck, P. (Intern), Adler-Nissen, J. (Intern)
Pages: 96-98
Publication date: 1996

Host publication information
Title of host publication: Annual transactions of the Nordic Rheology Society
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 167361
Publication: Research - peer-review › Book chapter – Annual report year: 1996

Antimicrobial enzymes: Application and future potential in the food industry

General information
State: Published
Organisations: National Institute of Aquatic Resources, National Food Institute
Authors: Fuglsang, C. (Ekstern), Johansen, C. (Intern), Christgau, S. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 390-396
Aeration-Controlled Formation of Acid in Heterolactic Fermentations

Controlled aeration of Leuconostoc mesenteroides was studied as a possible mechanism for control of the formation of acetic acid, a metabolite of major influence on the taste of lactic fermented foods. Fermentations were carried out in small scale in a medium in which growth was limited by the buffer capacity only. Ethanol and acetic acid formed during the fermentation were analyzed by rapid head space gas chromatography, and the ratio of the molar concentrations of these two volatiles quantitatively predicted the balance between the formation of acetic acid and lactic acid. The oxygen concentration during the fermentations decreased rapidly to zero, meaning that oxygen transfer was limited by the volumetric oxygen transfer rate, k1aC*. A linear correlation between k1aC* and the quantity of acetic acid produced was established, and it is suggested that such oxygenated heterolactic fermentation processes should be analyzed as fed-batch fermentations with oxygen as the limiting substrate. Addition of fructose in limited amounts leads to the formation of one half mole of acetic acid for each mole fructose, thus offering an alternative mechanism for controlling acetic acid formation.

Critical Assessment of the Applicability of Superoxide Dismutase As An Antioxidant in Lipid Foods

General information

State: Published
Organisations: Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering, Department of Biotechnology, Food Production Engineering, Department of Systems Biology
Authors: Meyer, A. B. S. (Intern), Rørbaek, K. (Intern), Adler-Nissen, J. (Intern)
Pages: 171-175
Publication date: 1994
Main Research Area: Technical/natural sciences

Publication information

Journal: Food Chemistry
Volume: 51
ISSN (Print): 0308-8146
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.85 SJR 1.706 SNIP 2.091
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.597 SNIP 1.962 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.595 SNIP 2.027 CiteScore 3.92
Mashing of Rice with Barley Malt Under Nonconventional Process Conditions for Use in Food Processes

Non-conventional mashing conditions are relevant in the development of a lactic acid-fermented soymilk beverage where mashed rice is the source of carbohydrates for the fermentation and sweetness of the beverage. Advantages in the process layout could be achieved by mashing at higher pH and lower malt concentrations than normally used in the brewing industry. The work reported here assessed the consequences of mashing under non-conventional conditions. Malt concentration in the cereal part was varied from 25% to 70% (w/w), pH was varied within 5.3 to 7.1, and prolongation of the holding times at 50 degrees C and 62 degrees C was investigated. Regression equations have been established for predicting yields of soluble protein, low molecular weight sugars and total fermentability as functions of pH and malt concentration. The results showed that the maltose yield was constant while glucose, maltotriose and total fermentable sugar yields decreased slightly with increasing pH and decreasing malt concentration. Prolonged mash holding times at 50 degrees C and 62 degrees C gave minor increases in protein yields only. It is concluded that it is quite acceptable to use nonconventional mashing conditions when a mashing step is integrated in other food processes.
Modelling of a Co-rotating Disc Scraped-Surface Heat Exchanger for Food Processing

General information
State: Published
Organisations: National Food Institute, Department of Chemical and Biochemical Engineering
Authors: Friis, A. (Intern), Adler-Nissen, J. (Intern), Hassager, O. (Intern)
Publication date: 1994

Original language: English
Source: orbit
Source-ID: 235351
Publication: Research - peer-review › Journal article – Annual report year: 1994
Modelling of a Co-Rotating, Disc Scraped-Surface Heat Exchanger for Food Processing

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, National Food Institute, Division of Industrial Food Research
Authors: Friis, A. (Intern), Adler-Nissen, J. (Intern), Hassager, J. (Ekstern)
Pages: 295-297
Publication date: 1994

Optimization studies of a lactic acid fermented beverage process

General information
State: Published
Organisations: Division of Food Production Engineering, National Food Institute
Authors: Moe, T. (Ekstern), Adler-Nissen, J. (Intern)
Pages: 555-557
Publication date: 1994

Scale-up Studies for the Production of High Protein Content Lactic Beverages

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Authors: Adler-Nissen, J. (Intern), Moe, T. (Ekstern)
Pages: 119-131
Publication date: 1994
Proteases

General information
State: Published
Organisations: National Food Institute
Authors: Adler-Nissen, J. (Intern)
Pages: 159-203
Publication date: 1993

Host publication information
Title of host publication: Enzymes in Food Processing
Place of publication: New York
Publisher: Academic Press
Edition: 3rd
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 235746
Publication: Research - peer-review › Book chapter – Annual report year: 1993

Enzymatic Modification of Potato Fibre

General information
State: Published
Organisations: Department of Systems Biology, National Food Institute
Authors: Kofod, L. V. (Ekstern), Bergsøe, M. N. (Intern), Adler-Nissen, J. (Intern)
Publication date: 1992

Host publication information
Title of host publication: Proceedings at International Symposium on Plant Polymeric Carbohydrates
Main Research Area: Technical/natural sciences
Conference: International Symposium on Plant Polymeric Carbohydrates, Berlin, Germany, 01/01/1992
Source: orbit
Source-ID: 236503
Publication: Research - peer-review › Article in proceedings – Annual report year: 1992

Fermentation of Prefermented and Extruded Rice Flour by Lactic Acid Bacteria from Sikhae
The acid- and flavor-forming properties of Lactobacillus plantarum and Leuconostoc mesenteroides isolated from Sikhae, a Korean traditional lactic acid fermented fish product, were examined and compared to those of Lactobacillus casei and Lactococcus lactis subsp. diacetylactis DRC3. The effects of prefermentation of rice flour in solid-state with Bacillus laevolacticus and Saccharomyces cerevisiae, extrusion cooking and addition of soymilk as the substrate of lactic acid fermentation were tested. Extrusion cooking and prefermentation of rice increased the soluble solid and sugar contents before malt digestion. The amount of sugar consumption during lactic fermentation varied with the type of bacteria. Leuconostoc mesenteroides(sikhae) and Lactobacillus plantarum(sikhae) increased up to 6 times of original cell number by 24 hrs of fermentation in rice + soymilk substrate, but Lactococcus lactis decreased in the same substrates. The final pH of the cereal lactic beverage was in the range of 3.4 - 4.1, L. mesenteroides(sikhae) had relatively higher pH compared to other lactic acid bacteria. L. mesenteroides(sikhae) produced apple juice-like flavor, while L. plantarum, L. casei and L. lactis yielded objectionable off-flavor. The HPLC analysis showed that the lactic ferment of L. mesenteroides(sikhae) contained relatively small amount of lactic acid and malic acid which was not detected in other microorganisms tested.

General information
State: Published
Organisations: National Food Institute
Authors: Lee, C. H. (Ekstern), Min, K. C. (Ekstern), Souane, M. (Ekstern), Mathiasen, T. E. (Ekstern), Adler-Nissen, J. (Intern), Chung, M. J. (Ekstern)
Pages: 239-255
Publication date: 1992
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Biotechnology
Volume: 6
Issue number: 3
ISSN (Print): 0890-5436
Inactivation of Copper, Zinc Superoxide Dismutase from Saccharomyces Cerevisiae in Lipid Food Model Systems

General information
State: Published
Organisations: Department of Systems Biology, Center for BioProcess Engineering, Department of Chemical and Biochemical Engineering, Food Production Engineering
Authors: Refsgaard, H. (Intern), Meyer, A. B. S. (Intern), Adler-Nissen, J. (Intern)
Pages: 564-568
Publication date: 1992
Main Research Area: Technical/natural sciences

Publication information
Journal: Lebensmittel-Wissenschaft und Technologie
Volume: 25
ISSN (Print): 0023-6438
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.31
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.11
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.12
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.18
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 210613
Publication: Research - peer-review › Journal article – Annual report year: 1992

Projects:

Udvikling og konstruktion af udstyr til måling af energioverførsel i bageovne samt forsøgsudstyr til elektrisk modstandsopvarmning af faste fødevarer

National Food Institute
Research Group for Food Production Engineering
Period: 01/04/2014 → 31/12/2014
Number of participants: 1
Project participant:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Private funding (private)
Name of research programme: Ellab-fonden
Amount: 75,000.00 Danish Kroner
**Praksis for fremstilling af kødprodukter**

National Food Institute

Research Group for Food Production Engineering
Period: 01/04/2013 → 30/11/2014
Number of participants: 1
Project participant:
Adler-Nissen, Jens (Intern)

**Follow the fish – Sustainable and optimal resource utilization in the Danish fish industry**

National Food Institute
Division of Industrial Food Research
Danish Seafood Association
Skagerak Salmon A/S
Period: 01/07/2012 → 30/06/2016
Number of participants: 5
Acronym: BOPFISK
Project participant:
Frosch, Stina (Intern)
Nielsen, Michael Engelbrecht (Intern)
Adler-Nissen, Jens (Intern)
Dissing, Bjørn Skovlund (Intern)
Phd Student:
Johansson, Gine Ørnholt (Intern)

**Financing sources**
Source: Public research programme (public)
Name of research programme: GUDP
Amount: 5,309,520.00 Danish Kroner
Year of approval: 2012

**Relations**
Activities:
Danish Seafood Association (DSA)
Danish Seafood Association (DSA)

**Improved Cutting Operations in Food Processing**

Precise and reproducible cutting depends on 1) the proper geometrical design of the blade (sharpness), 2) the material properties of the cutting tool and 3) the mechanical and tribological interaction between the tool, the food material as well as a third party material (e.g. cutting board). While the patent literature in the field is extensive, fundamental mechanical studies of cutting operations are rare.

National Food Institute
Research Group for Food Production Engineering
Period: 01/08/2011 → 31/08/2015
Number of participants: 1
Project participant:
Adler-Nissen, Jens (Intern)

**Financing sources**
Source: Other public support (public)
Name of research programme: InSPIRe
Amount: 3,074,000.00 Danish Kroner
Integrated Modelling of Food Production Chains (a part of the inSPIRe Food)

A current challenge in the food industry is to improve both flexibility and productivity in the production and supply chain. In Integrated Modelling of Food Production Chains, generic, robust models suitable for industrial use will be researched and developed in a long-term collaboration with a consortium of industry partners. The models are primarily developed as tools for improving productivity and flexibility in addition to reduce waste in the food production chain. Focus will be entirely on the production line and individual unit operations e.g. cooking, baking, frying, chilling and freezing, within the factory and abandon from integrating out-of factory logistics, as this appears not to be an urgent need for the involved industrial partners.

The overall objective of the project is to develop a cross-disciplinary framework for studying and developing process optimization in relation to the food production industry. It requires an interdisciplinary approach combining food science, food engineering, industrial statistics, management and industrial production knowledge. The objective is to develop and validate through experiments robust models, which are easy to use in industry and which describe important processes. The important processes will be identified through comprehensive production analysis.

A parallel objective is to encourage production managers in the Danish food industry to systematically apply such models, whether existing or developed in this project, for improving productivity and flexibility in addition to reduce waste.

The output of the project will be multifaceted and cover both scientific and innovative issues.

• Exploring the need for data / information.
• Describing and discussing tools and techniques for the improvement of productivity and flexibility in addition to reduce waste.
• Generic, robust models and methods suitable for industrial use will be researched and developed.

National Food Institute
Research Group for Food Production Engineering
Period: 01/01/2011 → 31/12/2016
Number of participants: 5
Project participant:
Frosch, Stina (Intern)
Adler-Nissen, Jens (Intern)
Feyissa, Aberham Hailu (Intern)
Pedersen, Søren Juhl (Intern)
Christensen, Martin Gram (Intern)

Financing sources
Source: Public research council
Name of research programme: Danish Council for Strategic Research and the Danish Council for Technology (now The Danish Innovation Foundation)
Amount: 10,444,444.00 Danish Kroner
Project

Food process modeling with integration of process impact and quality mapping

National Food Institute
Period: 01/12/2009 → 04/02/2015
Number of participants: 6
Phd Student:
Christensen, Martin Gram (Intern)
Supervisor:
Leje, Hanne (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Frosch, Stina (Intern)
Ahnré, Lilia Maria (Ekstern)
Jensen, Bo Boye Busk (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD
Modelling of food processes and Quality Analysis

National Food Institute
Division of Industrial Food Research
Period: 01/12/2009 → 31/12/2014
Number of participants: 2
Number of related Ph.D. students: 1
Project participant:
Adler-Nissen, Jens (Intern)
Project Manager, academic:
Christensen, Martin Gram (Intern)

Kontinuerlige bagning: Robust modelling af bageprocesser

National Food Institute
Period: 15/12/2008 → 28/08/2013
Number of participants: 6
PhD Student:
Stenby Andresen, Mette (Intern)
Supervisor:
Løje, Hanne (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Frosch, Stina (Intern)
Skjöldebrand, Ewa Christina Ericsdottir (Ekstern)
Wiium, Helle (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

New vision technology for multidimensional quality monitoring of food processes

Department of Informatics and Mathematical Modeling
Period: 01/05/2008 → 31/08/2011
Number of participants: 6
PhD Student:
Dissing, Bjørn Skovlund (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Jørgensen, Bo Munk (Intern)
Christensen, Lars Bager (Intern)
Parkkinen, Jussi (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Enzymatic Production of Dietary Fibres and Prebiotics from Potato Pulp

Department of Chemical and Biochemical Engineering
Period: 01/04/2008 → 24/08/2011
Number of participants: 5
Phd Student: Stouby, Lise (Intern)
Main Supervisor: Meyer, Anne S. (Intern)
Examiner: Adler-Nissen, Jens (Intern)
Hotchkiss, Arland (Ekstern)
Lærke, Helle Nygaard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Professionelt tilberedte måltider
National Food Institute
Division of Industrial Food Research
National Institute of Aquatic Resources
Department of Management Engineering
Period: 01/02/2008 → 31/12/2012
Number of participants: 1
Project Manager, organisational: Adler-Nissen, Jens (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: Fødevareforskningsprogrammet 2007
Amount: 4,470,000.00 Danish Kroner
Project: PhD

Robust Modelling of Mass and Heat Transfer in Food Processing
National Food Institute
Period: 01/02/2008 → 22/06/2011
Number of participants: 6
Phd Student: Feyissa, Aberham Hailu (Intern)
Supervisor: Gernaey, Krist V. (Intern)
Main Supervisor: Adler-Nissen, Jens (Intern)
Examiner: Friis, Alan (Intern)
Ahnré, Lilia Maria (Ekstern)
Borggaard, Claus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Globaliseringsmidler
Project: PhD

Advanced Planning in Food Supply Chains
Department of Management Engineering
Period: 01/09/2007 → 31/08/2011
Number of participants: 6
Phd Student:
Frying in the food industry is today based on equipment and processes that in many ways are not satisfactory for the production of refined foodstuffs of high culinary quality and low fat content. The process technological problems are fundamental and demand e.g. better surface materials than the ones used today - which is stainless steel or Teflon coated steel. Both materials lack substantial properties (on stainless steel burnt layers are created that are fixed, Teflon has low durability and cannot tolerate temperatures that are high enough). In this project it will be investigated how the surface material influences the frying process as well as the tendency to create burnt layers. The achieved knowledge will be used to choose and test different surface coatings in order to enhance the influence of surface coatings on the product quality, to enhance the durability of the surface coating and to reduce or hinder the creation of burnt layers.

Division of Food Production Engineering
National Food Institute

Accoat A/S
Period: 01/08/2007 → 31/07/2010
Number of participants: 2
Project participant:
Ashokkumar, Saranya (Intern)
Project Manager, organisational:
Adler-Nissen, Jens (Intern)
New vision technology for multidimensional quality monitoring of food processes

The trained process operator plays a key role in today's food industry. His or her ability to judge processes such as continuous baking, roasting and frying processes by visual inspection is crucial. Automation has been slow due to inadequate technology. New forms of vision technology where the product is illuminated uniformly over a large area (50 cm²) and at specified wavelengths have the potential of matching much closer the visual judgement made by the trained process operator. The technology has proven its ability to difficult tasks in particle sorting and recent results indicate its large potential in food process control. The aim of the project is to investigate the potentials of this new vision technology and develop the technical/scientific basis for widespread use in process control of continuous baking, roasting and frying processes.

Division of Food Production Engineering
National Food Institute
Department of Systems Biology
Department of Informatics and Mathematical Modeling
Period: 15/03/2007 → 01/01/2012
Number of participants: 2
Project participant:
Adler-Nissen, Jens (Intern)
Project Manager, organisational:
Dissing, Bjørn Skovlund (Intern)

Online måling af visuelle kvalitetsparametre efter varmebehandling

National Food Institute
Division of Industrial Food Research
Videometer A/S
Technical University of Denmark
Nakskov Mill Foods A/S
Period: 01/01/2007 → 30/04/2011
Number of participants: 1
Project Manager, organisational:
Adler-Nissen, Jens (Intern)

Online measurement of visual quality parameters after heat treatment

Many foodstuffs have the shape of small pieces or particles that are heat treated in continuous open processes (corn flakes e.g.). Such processes are monitored by trained process operators who visually evaluate the product quality. There is a great need to support the evaluations of the process operators with vision technological systems that quickly are able to reveal deviations from the desired visual quality and adjust the process hereafter. In the project a new advanced form of vision technology will be investigated, the device can because of its special design be expected to detect small differences in color and wrongly colored small particles. This vision technology differs from NIR (near infrared reflection) by giving detailed picture information and not just sporadic measurements. The aim is to obtain a robust, flexible vision technological solution that later can be implemented in different industrial food productions.

Division of Food Production Engineering
National Food Institute
Department of Informatics and Mathematical Modeling
Videometer A/S
Nakskov Mill Foods A/S
Period: 01/01/2007 → 30/04/2011
Number of participants: 1
Project Manager, organisational:
Adler-Nissen, Jens (Intern)
The continuous wok
In Chinese cuisine the preparation of fine cut ingredients by stir-frying in a shallow cooking vessel (wok) is widespread. Optimal sensory quality is reached by a combination of intense heat transfer, rapid stirring, and short process time. Because the stir-frying process is characterized by high rates of heat and mass transfer, automation and scale-up of this process is difficult, however. Conventional industrial cooking and frying equipment cannot match the dynamics of the stir-frying process in small scale. In collaboration with industrial partners we invented a set of new principles for carrying out continuous stir-frying successfully in large scale, and we have applied internationally for a patent. Based upon one of

Division of Food Production Engineering

National Food Institute
Period: 01/01/2007 → 01/01/2012
Number of participants: 1
Project Manager, organisational:
Adler-Nissen, Jens (Intern)

Enzymatic Lipophilisation of Bioactive Compounds

National Food Institute
Period: 01/04/2006 → 30/06/2008
Number of participants: 7
Phd Student:
Lue, Bena-Marie (Intern)
Supervisor:
Jacobsen, Charlotte (Intern)
Jørgensen, Bo Munk (Intern)
Meyer, Anne S. (Intern)
Xu, Xuebing (Intern)
Guo, Zheng (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Enzymatic Modification of Palm Oil For Margarine Fat Production

National Food Institute
Period: 01/01/2004 → 16/05/2008
Number of participants: 5
Phd Student:
Ibrahim, Nuzul Amri Bin (Intern)
Main Supervisor:
Xu, Xuebing (Intern)
Examiner:
Adler-Nissen, Jens (Intern)
Adlercreutz, Patrick (Ekstern)
Fredriksen, Henrik K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Process Development for the Enzymatic Production of Partial Acylglycerol

National Food Institute
Period: 01/11/2003 → 27/10/2008
Number of participants: 9
Phd Student:
Damstrup, Marianne (Intern)
Supervisor:
Jensen, Anker Degn (Intern)
Kiil, Søren (Intern)
Sparsø, Flemming Vang (Ekstern)
Xu, Xuebing (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Jacobsen, Charlotte (Ekstern)
Adlercreutz, Patrick (Ekstern)
Balchen, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Den kontinuerlige wok
Food Biotechnology and Engineering Group
Department of Systems Biology
Period: 03/07/2003 → 30/06/2004
Number of participants: 1
Project ID: 45552
Project Manager, organisational:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 819,000.00 Danish Kroner
Project

Production of magarine fats by lipase-catalysed interesterification a process, quality, and nutritional study for industrial application
Department of Systems Biology
Period: 01/10/2001 → …
Number of participants: 8
Phd Student:
Zhang, Hong (Intern)
Supervisor:
Jacobsen, Charlotte (Intern)
Nilsson, Jörgen (Ekstern)
Pedersen, Lars Saaby (Ekstern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Hellgren, Lars (Intern)
Adlercreutz, Patrick (Ekstern)
Mortensen, Børge (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD
Careful processing of milk products

Carefully processing of foods is a high focus area especially in cases when substantial quality improvement can be obtained or problems can be solved. The present project deals with careful processing of milk especially from an ecological origin. It has been observed that a portion of the fat globules in a milk product can be damaged during processing and thereby cause some of the product to appear unsatisfactory to the consumer. The traditional quality measures are not sensitive or specific enough to detect his problem. The aim of the project is therefore to develop measuring techniques, which can detect the degree of damage of the fat globules locally. This can then lead to optimisation of processing equipment at improved design and processing guidelines for the dairy industry.
Flavour Release from Model Systems - In Vitro and In Vivo Instrumental Measurements

Department of Systems Biology
Period: 01/06/1999 → 08/06/2005
Number of participants: 7
Phd Student:
Haahr, Anne-Mette (Intern)
Supervisor:
Bredie, Wender (Ekstern)
Stahnke, Louise Heller (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Nielsen, Kristian Fog (Intern)
Jørgensen, Bo Munk (Intern)
Marcussen, Jørn (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Funktionel kvalitet af hvede til produktion af kiks

Department of Systems Biology
Period: 01/06/1999 → 27/05/2003
Number of participants: 6
Phd Student:
Pedersen, Lene (Intern)
Supervisor:
Bergsøe, Merete Norsker (Intern)
Kaack, Karl (Ekstern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Meyer, Anne S. (Intern)
Hvidt, Søren (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Skånsom procesbehandling af mælk

Department of Systems Biology
Period: 01/06/1999 → 01/10/2007
Number of participants: 6
Phd Student:
Lindelev, Jesper Sæderup (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Friis, Alan (Intern)
Examiner:
Szabo, Peter (Ekstern)
Djejmek, Petr (Ekstern)
Qvist, Karsten (Intern)

Financing sources
Source: Internal funding (public)
Optimization of Hygienic Design of food Processing Equipment Using Computational Fluid Dynamics

Department of Systems Biology
Period: 01/04/1999 → 25/04/2003
Number of participants: 6
Phd Student:
Jensen, Bo Boye Busk (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Friis, Alan (Intern)
Examiner:
Jensen, Anker Degn (Intern)
Fryer, Peter Jonathan (Ekstern)
Wirtanen, Gun Linnea (Ekstern)

Financing sources
Source: Internal funding (public)

Hygienic Design of Food Processing Machinery
Hygienic design of machinery for production of foods is essential when producing high quality and safe foods. The project is concerned with optimisation of equipment design by studying the flow patterns inside closed equipment. The flow conditions will be related to deposit of fouling material and the subsequent removal of this. Computational Fluid Mechanics (CFD) is used to describe the flow and design a method for optimisation of equipment design. A correlation between wall shear stresses needed for removal of soil under well-defined flow conditions in a Radial Flow Cell (RFC) and CFD simulations is determined. A CFD model describing the flow pattern in a plug valve is in the progress of being modified to describe similar removal of soil in the valve. Preliminary results show that the wall shear stress is not the sole flow parameter, which influences cleaning. Flow phenomena like locally large turbulence are expected to contribute significantly to the mechanical cleaning effect. The project is a part of a larger centre contract from Erhvervsfremme Styrelsen.

Department of Biotechnology
Department of Chemical and Biochemical Engineering

Alfa Laval Flow
Period: 01/09/1998 → 31/12/2001
Number of participants: 4
Project participant:
Jensen, Bo Boye Busk (Intern)
Adler-Nissen, Jens (Intern)
Szabo, Peter (Intern)
Project Manager, organisational:
Friis, Alan (Intern)

Biologisk baserede emballager til levnedsmidler

Department of Systems Biology
Period: 01/05/1998 → 07/03/2002
Number of participants: 5
Phd Student:
Bergenholtz, Karina P. (Intern)
Main Supervisor:
Nielsen, Per Væggemose (Intern)
Examiner:
Adler-Nissen, Jens (Intern)
Arneborg, Nils (Ekstern)
Floros, John D. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Lugtproblemer i forbindelse med tøjvask
Department of Systems Biology
Period: 01/01/1998 – …
Number of participants: 6
PhD Student:
Jepsen, Signe Munk (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Stahnke, Louise Heller (Intern)
Examiner:
Gram, Lone (Intern)
Marcussen, Jørn (Ekstern)
Wilkins, Cornelius KendÁll (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Control of fouling and concentration polarisation during Microfiltration of skim milk
Department of Chemical and Biochemical Engineering
Period: 01/12/1997 – 07/06/2002
Number of participants: 7
PhD Student:
Guerra, Marie Alexandra (Intern)
Supervisor:
Nielsen, E. Waagner (Ekstern)
Rasmussen, Alan (Intern)
Main Supervisor:
Jonsson, Gunnar Eigil (Intern)
Examiner:
Adler-Nissen, Jens (Intern)
Madsen, Rud Frik (Ekstern)
Qvist, Karsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Aroma formation in fermented sausages - the influence of fungal growth
Department of Systems Biology
Number of participants: 7
PhD Student:
Sunesen, Lars Oddershede (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Production of Specific Structured Lipids by Lipase Catalyzed Interesterification

Department of Systems Biology
Period: 01/02/1997 → 17/07/2000
Number of participants: 4
Phd Student:
Xu, Xuebing (Intern)
Supervisor:
Høy, Carl-Erik (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Villadsen, John (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ef-Finansieret, Stipen.-SU
Project: PhD

Oxidationsmekanismer i fiskeolieholdige

Department of Systems Biology
Period: 01/11/1996 → ...
Number of participants: 4
Phd Student:
Jacobsen, Charlotte (Intern)
Supervisor:
Børresen, Torger (Intern)
Meyer, Anne S. (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Identifikation af kontrolpunkter i mikrobiel metabolisme

Department of Chemical and Biochemical Engineering
Period: 01/09/1996 → 28/02/2000
Number of participants: 3
Phd Student:
Jensen, Niels B.S. (Intern)
Main Supervisor:
Villadsen, John (Intern)
Examiner:
Adler-Nissen, Jens (Intern)
Modellering af ultra- og mikrofiltrerings-processen

Department of Chemical and Biochemical Engineering
Number of participants: 4
Phd Student:
Jakobsen, Sune (Intern)
Main Supervisor:
Jonsson, Gunnar Eigil (Intern)
Examiner:
Adler-Nissen, Jens (Intern)
Madsen, Rud Frik (Ekstern)

Oxidation mechanisms in fish oil enriched emulsions

The purpose of the project is to study the oxidation mechanisms in fish oil enriched emulsions in order to develop combined emulsifier and antioxidant systems which are more efficient in protecting fish oil enriched foods against oxidation than existing antioxidant systems. Results obtained in 1999 have shown that the low pH in mayonnaise is a very important factor for the initiation of the oxidation processes in mayonnaise. This is due to the fact that iron ions are released/loosened from the egg yolk components at the oil/water interface when pH is decreased to 4, which is the normal pH in mayonnaise. The released iron promotes decomposition of peroxides to volatiles, which are responsible for the off-flavour formation in mayonnaise. The metal chelator EDTA was observed to be a very efficient antioxidant in mayonnaise due to its ability to chelate iron. A HPLC method for determination of lipid peroxides has been further optimised and is now fully operational. By the aid of GC-MS a large number of volatiles that correlate to the fishy and rancid off-flavours in oxidised mayonnaise have been identified.

National Institute of Aquatic Resources
Department of Biochemistry and Nutrition
Department of Biotechnology
Danisco Ingredients
Association of Danish Fish Meal and Fish Oil Manufacturers
Royal Veterinary and Agricultural University
Period: 01/05/1996 → 31/12/1999
Number of participants: 11
Project participant:
Vu, Thi Thu Trang (Intern)
Jacobsen, Charlotte (Intern)
Hartvigsen, Karsten (Intern)
Lund, Pia (Intern)
Datta, Suvra (Intern)
Hølmer, Gunhild Kofoed (Intern)
Meyer, Anne S. (Intern)
Green, Else (Intern)
Reitz, Suzie (Intern)
Adler-Nissen, Jens (Intern)
Project Manager, organisational:
Børresen, Torger (Intern)
Biokonservering af "let konserverede fiskeprodukter"

Department of Systems Biology
Period: 01/03/1996 → …
Number of participants: 5
Phd Student:
Nilsson, Lilian (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Børresen, Torger (Intern)
Main Supervisor:
Filtenborg, Ole (Intern)
Examiner:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Numerisk simulering af varmeovergang i en co-roterende skræbevarmeveksler til levnedsmiddelproduktion

Department of Chemical and Biochemical Engineering
Period: 01/03/1995 → 05/05/1999
Number of participants: 4
Phd Student:
Karlson, Torben (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Hassager, Ole (Intern)
Examiner:
Sørensen, Ansgar (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Forædling af rapsolie

Department of Systems Biology
Period: 01/02/1995 → …
Number of participants: 4
Phd Student:
Balchen, Steen (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Nordstrøm, Leif (Ekstern)
Stenby, Erling Halfdan (Intern)

Financing sources
Source: Internal funding (public)
Application of enzymes for food protection

i) Enzymes as antioxidants

Enzyme catalysis can be employed as antioxidant principle by a) removal of active oxygen species, b) competitive removal of oxygen, c) reduction of lipid hydroperoxides. The effect of all three principles was tested by us in previous projects. We have thus shown that enzymatic removal of oxygen is an efficient and that reduction of lipid hydroperoxides is a workable principle. The present objectives are to study the efficacy of new oxidases and to continue the studies on application of peroxidases to reduce lipid hydroperoxides. ii) Inhibition of microbial growth by lytic enzymes

Lysozyme (EC 3.2.1.17) catalyses hydrolysis of peptidoglycan in bacterial cell walls. Lysozyme from hen egg white has been approved as a food additive in EU to inhibit late blowing of hard cheeses caused by Clostridium tyrobutyricum. We investigate the antibacterial effect of lysozyme. In particular the effects of various micro-environmental food parameters on stability and activity of the enzymes.

Department of Biotechnology

Danisco Ingredients
Period: 01/01/1995 → 31/12/1997
Number of participants: 2
Project participant:
Adler-Nissen, Jens (Intern)
Project Manager, organisational:
Meyer, Anne S. (Intern)

Application of plant cell wall degrading enzymes in food technology.

The overall purpose is to develop new enzyme processes to produce new, natural food ingredients from vegetable material. Presently we investigate the possibilities for employing new, specific, so-called mono-component enzymes to release functional food ingredients from plant material: a) To solubilise dietary fibre from complex polysaccharides, b) to modify selected, functional properties (texture enhancers) from non-starch polysaccharide material, c) to release antioxidant phytochemicals from fruit byproducts. There is a strong collaboration with the Rheology Group, of which Merete Norsker is also a member.

Department of Biotechnology

Novo Nordisk A/S
Period: 01/01/1995 → 31/12/1996
Number of participants: 3
Project participant:
Adler-Nissen, Jens (Intern)
Bergsæe, Merete Norsker (Intern)
Project Manager, organisational:
Meyer, Anne S. (Intern)

Continuous Heat Treatment Processes.

Continuous heat treatment processes are studied in pilot plant scale in new types of equipment of own design and construction. A co-rotating scraped surface heat exchanger is studied experimentally, and the flow pattern is modelled using computational fluid dynamics. This is done in collaboration with Department of Chemical Engineering (Ole Hassager). For the processing of particular foods, a continuous frying machine has been invented and a prototype has been constructed. Its performance has been investigated with positive result.

Department of Biotechnology
Period: 01/01/1995 → 31/12/2000
Number of participants: 2
Project participant:
Friis, Alan (Intern)
Project Manager, organisational:
Adler-Nissen, Jens (Intern)

Co-rotating disc scraped-surface heat exchanger.

The project concerns investigation of the Co-rotating Disc scraped-surface Heat Exchanger (CDHE) for possible applications in food production. The CDHE represents a new design of scraped-surface heat exchangers (SSHE). The
CDHE has rotating heating surfaces and a stationary scraping device whereas the opposite working principle is applied in a traditional SSHE. The CDHE has a high heat transfer capacity, and it is found that the performance when processing pseudo-plastic fluids are improved compared to Newtonian fluids. Based on experience with a laboratory size single chamber CDHE the design has been scaled up to a pilot plant scale CDHE with multiple processing chambers. - Experimental investigation of the heat transfer capacity and Residence-Time-Distributions (RTD) when processing pseudo-plastic fluids. The focus has been on highly viscous fluids since it has been determined that the flow patterns in the processing chamber develops most advantageous under such processing conditions. Methods for online detection of has been applied and optimised. - The flow patterns in the processing chamber of the CDHE has been modelled using a Finite Element Method (FEM). The FEM programme developed can calculate the flow field when processing pseudo-plastic fluids. Methods to compute RTD is under construction. - Application of the CDHE to heat process concentrated milk for Feta-cheese production has been successful. - The latest application of the CDHE is cooling of marmelade. The heat exchanger has proven highly suitable for controlled cooling in order to yield the desired rheological behaviour of the final product.

Cross-flow microfiltration.
Cross-flow microfiltration of beer, skim milk, and fruit juice is studied is pilot plant scale utilizing a new filtration principle developed jointly with Department of Chemical Engineering (Gunnar Jonsson). Computer controlled, brief back-flush pulses abate fouling and allow for a high flux and a 100% transmission af proteines, while energy consumption is reduced considerably. The technique will eventually replace conventional kiselguhr filtration, which presents hazards to both the working force and the environment.

Edible Oil Refining Technology.
New physical refining principles for edible oils are studied in pilot plant scale. The principle is thin-film stripping in a column of own design, with a view of replacing conventional batch refining processes. The new refining principle is anticipated to give a superior quality of rape seed oil. the project is carried out in collaboration with Department of Biochemistry and nutrition and a commercial producer of rape oil seed in Denmark. In a separate project continuous enzymatic interesterification is studied

Nutritional Effects of the Triacylglycerol structure of Dietary Fats
Triglycerides are synthesized by enzymatic interesterification. The effects of polyunsaturated fatty acids as well as of medium chain fatty acids are investigated in animal models for absorption.
**Polysaccharide functionality**
The physico-chemical properties of important food polysaccharides are studied with a view of understanding their performance as functional food ingredients. Potato starch is investigated in different food systems of increasing complexity, using a range of rheology and sensory techniques. The starches are obtained from different potato varieties, including a number of genetically modified varieties from Danisco. The functional properties of certain non-starch polysaccharides are also investigated.

Department of Biotechnology
Period: 01/01/1995 → 31/12/2000
Number of participants: 3
Project participant:
Muhrbeck, Per (Intern)
Young, Niall (Intern)
Project Manager, organisational:
Adler-Nissen, Jens (Intern)

**Syntese og hydrolyse af ATP i frossen fisk**
Department of Systems Biology
Period: 01/01/1995 → 24/07/2000
Number of participants: 3
PhD Student:
Cappeln, Gertrud (Intern)
Supervisor:
Jensen, Flemming (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)

**Inhibering af bakterier med enzymer og basiske proteiner**
Department of Systems Biology
Period: 01/01/1994 → ...
Number of participants: 4
PhD Student:
Vedel, Charlotte Johansen (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Molin, Søren (Intern)
Rosser, Lene (Ekstern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Erhvervsforskerordningen
- Project: PhD

**Undersøgelse af de enzymatiske modningsprocesser i saltsild**
- Department of Systems Biology
- Period: 01/06/1992 → 23/04/1996
- Number of participants: 3
- Phd Student: Nielsen, Henrik Hauch (Intern)
- Supervisor: Børresen, Torger (Intern)
- Main Supervisor: Adler-Nissen, Jens (Intern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Centerfinansieret
- Project: PhD

**Systematisk design af en levnedsmiddelbioteknologisk proces**
- Department of Systems Biology
- Period: 01/04/1992 → 18/04/1995
- Number of participants: 4
- Phd Student: Moe, Tina (Intern)
- Main Supervisor: Adler-Nissen, Jens (Intern)
- Examiner: Olsen, Hans Sejr (Ekstern)
- Petersen, H J Styhr (Intern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Program-stipendium
- Project: PhD

**Glukose oxidase-catalase enzymystemet som levnedsmiddel antioxidant.**
- Department of Systems Biology
- Period: 01/03/1992 → 25/01/1996
- Number of participants: 2
- Phd Student: Isaksen, Anette (Intern)
- Main Supervisor: Adler-Nissen, Jens (Intern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: DTU-stipendium
- Project: PhD

**Funktionalitetsprofilering af stivelser**
- Department of Systems Biology
- Number of participants: 4
Phd Student:
Bergsøe, Merete Norsker (Intern)
Supervisor:
Jørgensen, O B (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)
Examiner:
Qvist, Karsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Program-stipendium
Project: PhD

Study of laboratory-size co-rotating disc scraped-surface heat exchanger for food processing
Department of Systems Biology
Period: 01/05/1991 → 22/06/1995
Number of participants: 3
Phd Student:
Friis, Alan (Intern)
Supervisor:
Hassager, Ole (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Program-stipendium
Project: PhD

Activities:

Chalmers University of Technology: Docent, evaluation of
Period: 18 Mar 2009 → 30 Apr 2009
Jens Adler-Nissen (external examiner)

National Food Institute
Activity: Examinations and supervision › External examination

Press clippings:

Procesteknologi – de store muligheder for Danmark
Jens Adler-Nissen
05/11/2014

Subject
Procesteknologi – de store muligheder for Danmark
National Food Institute, Division of Industrial Food Research

Media contribution (1)

Procesteknologi – de store muligheder for Danmark
05/11/2014
PlusProces, Web
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research
Press / Media
Fødevareteknologi og verdens ressourceproblemer
Jens Adler-Nissen
01/10/2014

Subject
Fødevareteknologi og verdens ressourceproblemer
National Food Institute, Division of Industrial Food Research

Media contribution (1)
Fødevareteknologi og verdens ressourceproblemer
01/10/2014
Messemagasinet Food Tech, Print
David Wedeege
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research
Press / Media

Modellering og eksperimental simulering af industrielle bageprocesser
Jens Adler-Nissen
15/11/2013
National Food Institute, Division of Industrial Food Research

Media contribution (1)
Modellering og eksperimental simulering af industrielle bageprocesser
15/11/2013
DR Videnskab, Television
Marie Hougaard
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research
Press / Media

Procesteknologi
Jens Adler-Nissen
01/11/2013
National Food Institute, Division of Industrial Food Research

Media contribution (1)
Procesteknologi
01/11/2013
Plus Proces, Print
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research
Press / Media

Kontrolvejninger af forskellige frosne fødevarer
Jens Adler-Nissen
07/10/2013
National Food Institute, Division of Industrial Food Research

Media contribution (1)
Kontrolvejninger af forskellige frosne fødevarer
07/10/2013
Ekstrabladet.dk, Web
Kerstin
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research
Press / Media
Fødevareprocesindustriens betydning for Danmark
Jens Adler-Nissen
14/05/2013
National Food Institute, Division of Industrial Food Research

Media contribution (1)

Fødevareprocesindustriens betydning for Danmark
14/05/2013
Ingeniøren, Print
Nicolai Østergaard
Jens Adler-Nissen
National Food Institute, Division of Industrial Food Research

Pasteurisering af pressede frugter
Jens Adler-Nissen
01/01/2009
National Food Institute, Division of Food Production Engineering

Media contribution (1)

Pasteurisering af pressede frugter
01/01/2009
Print
Jens Adler-Nissen
National Food Institute, Division of Food Production Engineering

Press / Media