

HOW DOES HEAT WORK  
ON FOOD PROCESSING?

# NON-THERMAL FOOD PROCESSING INNOVATION



# Thermal Technologies In Food Processing

**P Richardson**



## **Thermal Technologies In Food Processing:**

*Emerging Thermal and Nonthermal Technologies in Food Processing* Prem Prakash Srivastav, Deepak Kumar Verma, Ami R. Patel, Asaad Rehman Al-Hilphy, 2020-05-06 This new volume provides a comprehensive overview of thermal and nonthermal processing of food with new and innovative technologies Recent innovations in thermal as well as nonthermal technologies which are specifically applied for potable water and fluid foods milk juice soups etc are well documented for their high bioavailability of macro and micronutrients and are very promising This volume brings together valuable information on fluid and microbial characteristics and quality dynamics that facilitate the adoption of new technology for food processing Some new technologies and methods covered include the application of microwaves in heating drying pasteurization sterilization blanching baking cooking and thawing microwave assisted extraction of compounds using low electric fields alternation of temperature and pressure of supercritical carbon dioxide ultrasound assisted osmotic dehydration hydrodynamic cavitation high pressure processing gamma irradiation and more The nonthermal technologies discussed have been developed as an alternative to thermal processing while still meeting required safety or shelf life demands and minimizing the effects on nutritional and quality attributes

**Thermal Technologies in Food Processing** P Richardson, 2001-04-24 Thermal technologies have long been at the heart of food processing The application of heat is both an important method of preserving foods and a means of developing texture flavour and colour An essential issue for food manufacturers is the effective application of thermal technologies to achieve these objectives without damaging other desirable sensory and nutritional qualities in a food product Edited by a leading authority in the field and with a distinguished international team of contributors Thermal technologies in food processing addresses this major issue Part one of the collection begins with reviews of conventional retort and continuous heat technologies Part two then looks at the key issues of effective measurement and control in ensuring that a thermal process is effective whilst minimising any undesirable changes in a food There are chapters on temperature and pressure measurement validation of heat processes modelling and simulation of thermal processes and the measurement and control of changes in a food during thermal processing The final part of the book looks at emerging thermal technologies which becoming more widely used in the food industry There are chapters on radio frequency heating microwave processing infrared heating instant and high heat infusion and ohmic heating A final chapter considers how thermal processing may be combined with high pressure processing in producing safe minimally processed food products Thermal technologies in food processing provides food manufacturers and researchers with an authoritative review of thermal processing and food quality

**Food Processing** Kshirod Kumar Dash, Sourav Chakraborty, 2021-08-09 Advances in thermal and non thermal food processing aims to discuss emerging trends based on the future scope and challenges and to explain uncertain challenges in food processing In thermal processing different operations in food engineering namely advance drying methods evaporation extrusion cooking different extraction

techniques crystallizations are covered in terms food engineering and process modeling aspect For non thermal processing high pressure processing ultrasound ohmic heating pulse electric field pulse light technology osmotic dehydration and so forth are discussed Relevant mathematical modeling and numerical simulations has been included in every chapter Features Presents engineering focus on thermal and non thermal food processing technologies Discusses sub classification for recent trends and relevant industry information examples Describes advances in drying evaporation blanching crystallization and ohmic heating Covers high pressure processing pulse electric field pulse light technology irradiation and ultrasonic techniques Includes mathematical modeling and numerical simulations The book is aimed at graduate students professionals in food engineering and food technology biological systems engineering *Food Processing* Kshirod Kumar Dash, Sourav Chakraborty, 2021-06-27 In food processing thermal operations are the most common and conventional methods for obtaining and treating different products This book covers basics and advances in thermal processing of food These include drying processes evaporation blanching deep fat frying crystallization extraction and ohmic heating in terms of food engineering and process design aspect It further describes theoretical aspects the basics of rate kinetics and their application for the analysis of food quality indices including practical oriented issues related to food technology Traditional and new extraction techniques are also covered Key features Presents engineering focus on thermal food processing technologies Discusses sub classification for recent trends and relevant industry information examples Different current research oriented results are included as a key parameter Covers advances in drying evaporation blanching crystallization and ohmic heating Includes mathematical modeling and numerical simulations *Food Processing Advances in Thermal Technologies* is aimed at graduate students and professionals in food engineering food technology and biological systems engineering Thermal Food Processing Da-Wen Sun, 2012-05-16 Thermal processing remains one of the most important processes in the food industry Now in its second edition *Thermal Food Processing New Technologies and Quality Issues* continues to explore the latest developments in the field Assembling the work of a worldwide panel of experts this volume highlights topics vital to the food industry today an Non-Thermal Technologies for the Food Industry C. Anandharamakrishnan, V. R. Siniya, R. Mahendran, 2024-02-29 Depending on the mechanisms involved in non thermal technologies such as ozonization irradiation ultrasound processing plasma processing and advanced oxidative processes interaction with food molecules differs which might lead to desirable reactions *Non Thermal Technologies for the Food Industry Advances and Regulations* explores the possibility of using non thermal technologies for various purposes such as shelf life extension reduced energy consumption adhesion and safety improvement Further it reviews the present status of these technologies international regulations and sustainability aspects in food processing including global case studies Features Provides a comprehensive overview of all the non thermal processing technologies that have potential for use within food manufacturing Covers novel disinfectant technologies and packaging methods for non thermal processing Includes electro spraying and electrospinning low

temperature drying techniques cold plasma techniques hydrodynamic cavitation oscillating magnetic field processing and so forth Focus on topics such as the valorization of agri food wastes and by products and sustainability Reviews CIO2 in combined hybrid technologies for food processing This book is aimed at researchers and graduate students in food and food process engineering

**Food Processing** Kshirod Kumar Dash, Sourav Chakraborty, 2021-06-27 Non thermal operations in food processing are an alternative to thermal operations and similarly aimed at retaining the quality and organoleptic properties of food products This volume covers different non thermal processing technologies such as high pressure processing ultrasound ohmic heating pulse electric field pulse light membrane processing cryogenic freezing nanofiltration and cold plasma processing technologies The book focuses both on fundamentals and on recent advances in non thermal food processing technologies It also provides information with the description and results of research into new emerging technologies for both the academy and industry Key features Presents engineering focus on non thermal food processing technologies Discusses sub classification for recent trends and relevant industry information examples Different current research oriented results are included as a key parameter Covers high pressure processing pulse electric field pulse light technology irradiation and ultrasonic techniques Includes mathematical modeling and numerical simulations

**Food Processing Advances in Non Thermal Technologies** is aimed at graduate students professionals in food engineering food technology and biological systems engineering

**Application of Novel Thermal Technology in Foods Processing** Indrawati Oey, Sze Ying Leong, 2022-01-29 Advanced and novel thermal technologies such as ohmic heating dielectric heating e g microwave heating and radio frequency heating and inductive heating have been developed to improve the effectiveness of heat processing whilst guaranteeing food safety and eliminating undesirable impacts on the organoleptic and nutritional properties of foods Novel thermal technologies rely on heat generation directly inside foods which has implications for improving the overall energy efficiency of the heating process itself The use of novel thermal technologies is dependent on the complexity and inherent properties of the food materials of interest e g thermal conductivity electrical resistance water content pH rheological properties food porosity and presence of particulates Moreover there is a need to address the combined use of thermal processing with emerging technologies such as pulsed electric fields high hydrostatic pressure and ultrasound to complement the conventional thermal processing of fluid or solid foods This Special Issue provides readers with an overview of the latest applications of various novel technologies in food processing A total of eight cutting edge original research papers and one comprehensive review paper discussing novel processing technologies from the perspectives of food safety sustainability process engineering bio chemical changes health nutrition sensory issues and consumers are covered in this Special Issue

**Novel Thermal and Non-Thermal Technologies for Fluid Foods** Patrick J. Cullen, Brijesh K. Tiwari, Vasilis Valdramidis, 2011-08-17 Chapter 1 Status and Trends of Novel Thermal and Non Thermal Technologies for Fluid Foods Chapter 2 Fluid Dynamics in Novel Thermal and Non Thermal Processes Chapter 3 Fluid

Rheology in Novel Thermal and Non Thermal Processes Chapter 4 Pulsed Electric Field Processing of Fluid Foods Chapter 5 High Pressure Processing of Fluid Foods Chapter 6 Ultrasound Processing of Fluid Foods Chapter 7 Irradiation of Fluid Foods Chapter 8 Ultraviolet and Pulsed Light Processing of Fluid Foods Chapter 9 Ozone Processing of Fluid Foods Chapter 10 Dense Phase Carbon Dioxide Processing of Fluid Foods Chapter 11 Ohmic Heating of Fluid Foods Chapter 12 Microwave Heating of Fluid Foods Chapter 13 Infrared Heating of Fluid Foods Chapter 14 Modelling the Kinetics of Microbial and Quality Attributes of Fluid Food during Novel Thermal and Non Thermal Processes Chapter 15 Regulatory and Legislative issues for Thermal and Non Thermal Technologies An EU Pers **Non-thermal Processing of Foods** O. P.

Chauhan,2019-01-10 This book presents the latest developments in the area of non thermal preservation of foods and covers various topics such as high pressure processing pulsed electric field processing pulsed light processing ozone processing electron beam processing pulsed magnetic field ultrasonics and plasma processing Non thermal Processing of Foods discusses the use of non thermal processing on commodities such as fruits and vegetables cereal products meat fish and poultry and milk and milk products Features Provides latest information regarding the use of non thermal processing of food products Provides information about most of the non thermal technologies available for food processing Covers food products such as fruits and vegetables cereal products meat fish and poultry and milk and milk products Discusses the packaging requirements for foods processed with non thermal techniques The effects of non thermal processing on vital food components enzymes and microorganisms is also discussed Safety aspects and packaging requirements for non thermal processed foods are also presented Rounding out coverage of this technology are chapters that cover commercialization regulatory issues and consumer acceptance of foods processed with non thermal techniques The future trends of non thermal processing are also investigated Food scientists and food engineers food regulatory agencies food industry personnel and academia including graduate students will find valuable information in this book Food product developers and food processors will also benefit from this book Improving the Thermal Processing of Foods P Richardson,2004-07-16 It has

long been recognised that thermal technologies must ensure the safety of food without compromising food quality *Food Processing* Kshirod Kumar Dash,2023 Advances in thermal and non thermal food processing set aims to discuss emerging trends based on the future scope and challenges and to explain uncertain challenges in food processing including common and conventional methods including mathematical modeling and numerical simulations

*Non-Thermal Technologies for the Food Industry* C. Anandharamakrishnan,V. R. Sinija,R. Mahendran,2024-02-29 Depending on the mechanisms involved in non thermal technologies such as ozonization irradiation ultrasound processing plasma processing and advanced oxidative processes interaction with food molecules differs which might lead to desirable reactions Non Thermal Technologies for the Food Industry Advances and Regulations explores the possibility of using non thermal technologies for various purposes such as shelf life extension reduced energy consumption adhesion and safety improvement Further it reviews the present status of

these technologies international regulations and sustainability aspects in food processing including global case studies Features Provides a comprehensive overview of all the non thermal processing technologies that have potential for use within food manufacturing Covers novel disinfectant technologies and packaging methods for non thermal processing Includes electro spraying and electrospinning low temperature drying techniques cold plasma techniques hydrodynamic cavitation oscillating magnetic field processing and so forth Focus on topics such as the valorization of agri food wastes and by products and sustainability Reviews ClO<sub>2</sub> in combined hybrid technologies for food processing This book is aimed at researchers and graduate students in food and food process engineering

*Nonthermal Light-Based Technologies in Food Processing* C. K. Sunil, Megh R. Goyal, Preeti Birwal, R. Mahendran, 2025-02-10 Food preservation has existed since time immemorial with techniques that focused on prolonging shelf life of food products The current challenge though is to preserve food in terms of loss of nutrients texture and sensorial characteristics along with prolonging its shelf life This new volume Nonthermal Light Based Technologies in Food Processing explores and provides in depth knowledge and understanding of current and emerging light based technologies and their application in food processing This book also introduces the role of nonthermal technology for novel food product development In four detailed parts this handbook covers light based technologies ultraviolet UV light technology pulsed light PL technology and light emitting diode LED technology It details a range of modern and emerging light based food preservation technologies that include ozone ohmic heating high pressure processing cold plasma pulsed electric field PEF microwave irradiation light based technologies ultraviolet pulsed light light emitting diode LED supercritical fluid extraction cold plasma and more Each technology is thoroughly covered starting with an introduction and proceeding to design applications and quality and regulatory aspects providing comprehensive knowledge and detailed explanations This book will be a valuable resource on nonthermal light based technologies in food processing for many academicians and professionals in the field of food science food technology and food engineering around the world It will also act as an important reference for researchers students scholars industries universities and research centers

Emerging Technologies in Food Preservation Santosh Kumar, Avik Mukherjee, Atanu Mitra, Dipankar Halder, 2023-03-14 Consumers worldwide are becoming increasingly aware of the significant impacts of food quality nutrition and food habits on their health Demands for fresh minimally processed foods foods subjected to less severe preservation and processing and for foods with no synthetic chemical preservatives are expanding rapidly Food businesses worldwide are innovating advanced processing and preservation technologies including natural bioactive preservatives to fulfill these emerging consumers demands Emerging Technologies in Food Preservation discusses the innovations and advancements in food processing and preservation that have emerged over the last two decades of the 21st century Various experts in the field examine different innovative food processing and preservation technologies including non thermal and minimal processing technologies particularly those that have least destructive impact on micronutrients Key Features

Describes the hurdles and challenges in commercialization of these novel processing technologies including their legal ramifications on food regulations and legislations Provides detail accounts of application of each of the novel food preservation principles as they are applied in commercial food processing food manufacturing lines worldwide Features a complete account on recent developments and advancements in food preservation and processing technologies including natural and biopreservatives Mindful of the increasing interest in alternatives to traditional thermal processing of foods and beverages this book is a valuable reference for students scholars researchers scientists food entrepreneurs as well as technical professionals working in food industries and associated businesses *Thermal Food Processing* Da-Wen

Sun,2005-12-12 The challenge of maintaining both quality and safety in the thermal processing of foods results from the degradation of heat sensitive quality attributes during processing The editor of *Thermal Food Processing New Technologies and Quality Issues* presents a comprehensive reference through authors that assist in meeting this challenge by explaining

**Innovative Food Processing Technologies** ,2020-08-18 Food process engineering a branch of both food science and chemical engineering has evolved over the years since its inception and still is a rapidly changing discipline While traditionally the main objective of food process engineering was preservation and stabilization the focus today has shifted to enhance health aspects flavour and taste nutrition sustainable production food security and also to ensure more diversity for the increasing demand of consumers The food industry is becoming increasingly competitive and dynamic and strives to develop high quality freshly prepared food products To achieve this objective food manufacturers are today presented with a growing array of new technologies that have the potential to improve or replace conventional processing technologies to deliver higher quality and better consumer targeted food products which meet many if not all of the demands of the modern consumer These new or innovative technologies are in various stages of development including some still at the R D stage and others that have been commercialised as alternatives to conventional processing technologies Food process engineering comprises a series of unit operations traditionally applied in the food industry One major component of these operations relates to the application of heat directly or indirectly to provide foods free from pathogenic microorganisms but also to enhance or intensify other processes such as extraction separation or modification of components The last three decades have also witnessed the advent and adaptation of several operations processes and techniques aimed at producing high quality foods with minimum alteration of sensory and nutritive properties Some of these innovative technologies have significantly reduced the thermal component in food processing offering alternative nonthermal methods *Food Processing Technologies A Comprehensive Review Three Volume Set* covers the latest advances in innovative and nonthermal processing such as high pressure pulsed electric fields radiofrequency high intensity pulsed light ultrasound irradiation and new hurdle technology Each section will have an introductory article covering the basic principles and applications of each technology and in depth articles covering the currently available equipment and or the current state of development food

quality and safety application to various sectors food laws and regulations consumer acceptance advancements and future scope It will also contain case studies and examples to illustrate state of the art applications Each section will serve as an excellent reference to food industry professionals involved in the processing of a wide range of food categories e g meat seafood beverage dairy eggs fruits and vegetable products spices herbs among others **Food Processing Technology** P.J. Fellows,2016-10-04 Food Processing Technology Principles and Practice Fourth Edition has been updated and extended to include the many developments that have taken place since the third edition was published The new edition includes an overview of the component subjects in food science and technology processing stages important aspects of food industry management not otherwise considered e g financial management marketing food laws and food industry regulation value chains the global food industry and over arching considerations e g environmental issues and sustainability In addition there are new chapters on industrial cooking heat removal storage and distribution along with updates on all the remaining chapters This updated edition consolidates the position of this foundational book as the best single volume introduction to food manufacturing technologies available remaining as the most adopted standard text for many food science and technology courses Updated edition completely revised with new developments on all the processing stages and aspects of food industry management not otherwise considered e g financial management marketing food laws and food industry regulation and more Introduces a range of processing techniques that are used in food manufacturing Explains the key principles of each process including the equipment used and the effects of processing on micro organisms that contaminate foods Describes post processing operations including packaging and distribution logistics Includes extra textbook elements such as videos and calculations slides in addition to summaries of key points in each chapter **Nonthermal Food Processing, Safety, and Preservation** Anand Prakash,Arindam Kuila,2024-04-29 NONTHERMAL FOOD PROCESSING SAFETY AND PRESERVATION This book is essential for learning how biological processes are translated into commercial products and services under food biotechnology and will significantly broaden users scope capabilities and application of bioprocess engineering food processes biochemical engineering nanotechnology biotechnology and microbiology Food engineering involves a variety of processes and technologies that deal with the construction design operations and associated engineering principles to produce valuable edible goods and byproducts There is a dearth of published cutting edge high quality original studies in the engineering and science of all types of processing technologies from the beginning of the food supply chain to the consumer s dinner table This book seeks to address multidisciplinary experimental and theoretical discoveries that have the potential to improve process efficiency improve product quality and extend the shelf life of fresh and processed food and associated industries This book is for the students and researchers who are interested in learning how biological processes are translated into commercial products and services with food biotechnology *Emerging Non-Thermal Food Processing Technologies* Asgar Farahnaky,Mahsa Majzoobi,Mohsen Gavahian,2024-01-11 There is a

strong consumer trend towards high quality and healthy foods with fresh like characteristics On the other hand thermal processing technologies especially conventional ones negatively affect both the sensory and nutritional properties of foods At the same time limited shelf life and safety concerns of fresh foods necessitate food processing Therefore scientists are exploring the possibility of using nonthermal technologies for various purposes such as shelf life extension and safety improvement However their applicability and scalability are still under intensive investigation This reprint presents examples of studies in non thermal emerging food processing technologies It provides practical examples that can help graduate students further understand the concepts involved in emerging non thermal technologies therefore it can be used as a teaching material reference in universities Moreover the benefits of these novel technologies highlighted in this reprint could be utilized by the food industry s R D to enhance academic industry collaborations and possible commercialization

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