

FOOD ENGINEERING SERIES

# Electronic Irradiation of Foods

An Introduction  
to the Technology

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R. B. MILLER



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# Electronic Irradiation Of Foods An Introduction To The Technology

**Vicente M. Gómez-López, Rajeev Bhat**



## **Electronic Irradiation Of Foods An Introduction To The Technology:**

**Electronic Irradiation of Foods** R. B. Miller, 2006-12-26 Food irradiation the use of ionizing radiation to destroy harmful biological organism in food is a safe proven process that has many useful applications It has been endorsed by numerous health organizations and has now been approved for many applications by governments around the world Electronic Irradiation of Foods describes all the key aspects of electron accelerator technology in detail It emphasizes the physical science and technology aspects of food irradiation using machine sources of ionizing radiation The book provides significant technical depth for interested workers and present descriptive introductory material that should help demystify technology for businessmen to make informed choices regarding important investments decisions Introductory chapters summarize the effects of ionizing radiation on biological organisms and the organic compounds comprising foods and give an overview of the food irradiation process Subsequent chapters cover the details of the electron beam and x ray energy deposition electron accelerator technologies beam scanning systems material handling systems shielding design and process control considerations Important appendices cover radiation dosimetry induced radioactivity and ozone generation

**Irradiation of Food Commodities** Ioannis S. Arvanitoyannis, 2010-06-25 The irradiation of food is a low cost highly effective method of ensuring food safety and extending shelf life Public acceptance of irradiation despite its benefits however has been a significant challenge Irradiation of Food Commodities is the first holistic book that looks not only at the techniques application and legislation of this method but also addresses the concern of public opinion Organized into logical themes and written by experts from industry academia and research this book will meet the needs of those working or considering the use of irradiation in their work Sections focus on legislation irradiation techniques and materials detection and risk assessment application of irradiation on food and consumer opinion Insights into regulations from a variety of countries provides important information on government strategies Extensive coverage of applications from animal food to food for human consumption and disinfestation explores the various potential application opportunities available for consideration Addresses risk assessment key to governmental and more importantly consumer acceptance All topics in one volume for the first time provides complete vision of the technology Electromagnetic Technologies in Food Science

Vicente M. Gómez-López, Rajeev Bhat, 2021-12-13 A comprehensive source of in depth information provided on existing and emerging food technologies based on the electromagnetic spectrum Electromagnetic Technologies in Food Science examines various methods employed in food applications that are based on the entire electromagnetic EM spectrum Focusing on recent advances and challenges in food science and technology this is an up to date volume that features vital contributions coming from an international panel of experts who have shared both fundamental and advanced knowledge of information on the dosimetry methods and on potential applications of gamma irradiation electron beams X rays radio and microwaves ultraviolet visible pulsed light and more Organized into four parts the text begins with an accessible overview of the physics

of the electromagnetic spectrum followed by discussion on the application of the EM spectrum to non thermal food processing The physics of infrared radiation microwaves and other advanced heating methods are then deliberated in detail supported by case studies and examples that illustrate a range of both current and potential applications of EM based methods The concluding section of the book describes analytical techniques adopted for quality control such as hyperspectral imaging infrared and Raman spectroscopy This authoritative book resource Covers advanced theoretical knowledge and practical applications on the use of EM spectrum as novel methods in food processing technology Discusses the latest progress in developing quality control methods thus enabling the control of continuous fast speed processes Explores future challenges and benefits of employing electromagnetic spectrum in food technology applications Addresses emerging processing technologies related to improving safety preservation and overall quality of various food commodities

*Electromagnetic Technologies in Food Science* is an essential reading material for undergraduate and graduate students researchers academics and agri food professionals working in the area of food preservation novel food processing techniques and sustainable food production

*Food Processing Technology* P.J. Fellows, 2009-06-22 The first edition of Food processing technology was quickly adopted as the standard text by many food science and technology courses This completely revised and updated third edition consolidates the position of this textbook as the best single volume introduction to food manufacturing technologies available This edition has been updated and extended to include the many developments that have taken place since the second edition was published In particular advances in microprocessor control of equipment minimal processing technologies functional foods developments in active or intelligent packaging and storage and distribution logistics are described Technologies that relate to cost savings environmental improvement or enhanced product quality are highlighted Additionally sections in each chapter on the impact of processing on food borne micro organisms are included for the first time 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

*Trends in Vital Food and Control Engineering* Ayman Amer Eissa, 2012-04-05 This book is an example of a successful addition to the literature of bioengineering and processing control within the scientific world The book is divided into twelve chapters covering selected topics in food engineering advances in food process engineering food irradiation food safety and quality machine vision control systems and economics processing All chapters have been written by renowned professionals working in food engineering and related disciplines

*Advances in Fruit Processing Technologies* Sueli Rodrigues, Fabiano Andre Narciso Fernandes, 2012-05-18 One of the main concerns of the food industry is the need for high quality fresh fruits and fruit products with good sensory quality long shelf life and high nutritional value To meet these demands new processing technologies are under investigation and development *Advances in Fruit Processing Technologies* incorporates fundamentals

in food processing as well as the advances made in recent years to improve final product quality With contributions from a panel of international researchers who present a blend of classical and emerging technologies the book explores Ozone ultrasound irradiation pulsed electric field vacuum frying and high pressure processing Ultraviolet and membrane processing Enzymatic maceration freeze concentration and refrigeration The effect of processing on sensory characteristics and nutritional value New trends in modified atmosphere packaging The use of fruit juices as a vehicle for probiotic microorganisms Prebiotic oligosaccharides as an alternative for dairy products Incorporating a series of case studies on the application of various technologies the book reviews their advantages limitations successes and failures The contributors also examine the implications of food processing technologies on waste production energy use and resource requirements This comprehensive survey of methods for optimizing fruit quality is an ideal resource for those in the fruit and vegetable industry looking for innovations that can improve efficiency reduce waste and cut costs

**Applications of Radiation Chemistry in the Fields of Industry, Biotechnology and Environment** Margherita Venturi, Mila D'Angelantonio, 2017-03-06 The series Topics in Current Chemistry Collections presents critical reviews from the journal Topics in Current Chemistry organized in topical volumes The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology medicine and materials science The goal of each thematic volume is to give the non specialist reader whether in academia or industry a comprehensive insight into an area where new research is emerging which is of interest to a larger scientific audience Each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed The coverage is not intended to be an exhaustive summary of the field or include large quantities of data but should rather be conceptual concentrating on the methodological thinking that will allow the non specialist reader to understand the information presented Contributions also offer an outlook on potential future developments in the field

*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.

Novel Technologies in Food Science Navnidhi Chhikara, Anil Panghal, Gaurav Chaudhary, 2023-02-01

NOVEL TECHNOLOGIES IN FOOD SCIENCE Presenting cutting edge information on new and emerging food engineering processes. Novel Technologies in Food Science the newest volume in the ground breaking new series Bioprocessing in Food Science is an essential reference on the modelling, quality, safety and technologies associated with food processing operations today. Novel Technologies in Food Science the latest volume in the series Bioprocessing in Food Science is based on the novel technologies in usage and requirements for handling, processing, storage and packaging of food. Novel bioprocessing technologies are gaining more interest among researchers and industries due to the minimal impact on product quality in comparison to conventional methods. These techniques are also superior in terms of energy, time saving and extended shelf life and thus can replace the conventional technologies partially or completely. Practical application of these technologies by the food industry however is limited due to higher costs, lack of knowledge in food manufacturers for the implementation of technologies and validation systems. An in depth discussion on consumer needs and rights, industry responsibilities and future prospectus of novel technologies in food science are covered in this volume. The main objective of this book is to disseminate knowledge about the recent technologies developed in the field of food science to students, researchers and industry people. This will enable them to make crucial decisions regarding the adoption, implementation, economics and constraints of the different technologies. Different technologies like ultrasonication, pulse electric field, high pressure processing, magnetization, ohmic heating and irradiation are discussed with their application in food product manufacturing, packaging, food safety and

quality assurance Whether for the veteran engineer or scientist the student or a manager or other technician working in the field this volume is a must have for any library *Food Processing Technologies* Amit K. Jaiswal, 2016-08-05 The processing of food generally implies the transformation of the perishable raw food to value added products It imparts benefits such as the destruction of surface microflora and inactivation of deleterious enzymes such as peroxidase leading to a greater shelf life of the food It also enhances color and texture while maintaining quality of products and makes them edible However it also has an inevitable impact on nutritional quality attributes such as increase or decrease in certain vitamins and bioactive metabolites among others Food Processing Technologies Impact on Product Attributes covers a range of food processing technologies and their effect on various food product attributes such as bioactive compounds safety and sensory and nutritional aspects of the food upon processing There are eight major parts in the book Part I covers the conventional processing technologies Parts II III IV and V deal with various novel processing technologies including impingement processing technologies electro magnetic processing technologies physico mechanical processing technologies and electro technologies Part VI introduces chemical processing technologies Part VII comprise irradiation processing technology and the final part is focused on biological processing technology detailing the application of enzymes in food processing Numerous studies were carried out to find the impact of these processing technologies on various aspects of food and associated health promotion properties Both positive and negative results were obtained based on nature of foods processing type and duration of processing and this book covers these results in depth **Technologies for Sustainable Rural**

**Development: Having Potential of Socio-Economic Upliftment (TSRD-2014)** Jai Parkash Shukla, 2014-07-15 Rural development technologies are critically important for the country to improve the quality of life in villages In this context held a National Workshop on Technologies for Sustainable Rural Development Having Potential of Socio Economic Upliftment TSRD 2014 to frame a road map for the future which will lead to the development of rural areas and improve the socio economic condition of rural masses through the intervention of Science and Technology *Novel and Alternative Methods in Food Processing* N. Veena, Megh R. Goyal, Ritesh B. Watharkar, 2023-08-04 This new volume explores emerging and advanced techniques in the food processing sector Novel food processing methods such as ultrasound processing microwave heating advanced drying methods and nonthermal technologies are discussed in detail The volume also covers the application of irradiation and encapsulation methods microbial valorizing and other novel food processing and preservation methods Mathematical modeling concepts and case studies are also included to illustrate applications of modeling techniques in food processing The volume promotes the understanding of the thermodynamics of food polymers structural design principles structural hierarchy and the steps involved in food structuring and structure measurement techniques

**Nonthermal Processing in Agri-Food-Bio Sciences** Anet Režek Jambrak, 2022-09-26 This book addresses important questions on the legislation regulations sustainability technology transfer safety of biomaterials and mechanism of action of

nonthermal processing on the molecular level of biomaterials and its impact on health The chapters take an interdisciplinary approach that is of interest to specialists from engineering physics chemistry agriculture life sciences and beyond with a focus on further development of existing and new applications of nonthermal processing and their combination with other methods in the processing of biomaterials agriculture biotechnology and the re use of waste and by products Nonthermal Processing in Agri Food Bio Sciences Sustainability and Future Goals aims to boost further developments and applications of nonthermal technologies to develop healthier products to ensure consumer approval for these innovative technologies and to improve the sustainability of biomaterials production The industrial application of nonthermal processing has led to an increase in innovative value products and the overall improvement of production capacity Nonthermal processes use less energy and chemicals reduce processing times have less environmental impact produce less waste and have the potential for industrial scale up and a return on investment in under 5 years According to The United Nations and the 2030 Agenda for Sustainable Development 17 goals should be incorporated within development projects and researchers are starting to use novel techniques to meet them In covering the fundamental engineering theories underlying nonthermal processing this book will aid in this mission The book overviews the advantages and disadvantages of novel technologies over to sustainability goals to correct steps for the scale up and return on investment The book includes the chemistry and physics of nonthermal processing technologies dedicated to specialists and researchers from a wide range of subject areas Interdisciplinary scientists and engineers sustainability experts can use this text to aid in their work in green technologies

Food Process Engineering F. Xavier Malcata, 2020-12-13 Food Process Engineering Safety Assurance and Complements pursues a logical sequence of coverage of industrial processing of food and raw material where safety and complementary issues are germane Measures to guarantee food safety are addressed at start and the most relevant intrinsic and extrinsic factors are reviewed followed by description of unit operations that control microbial activity via the supply of heat supply or the removal of heat Operations prior and posterior are presented as is the case of handling cleaning disinfection and rinsing and effluent treatment and packaging complemented by a brief introduction to industrial utilities normally present in a food plant Key Features Overviews the technological issues encompassing properties of food products Provides comprehensive mathematical simulation of food processes Analyzes the engineering of foods at large and safety and complementary operations in particular with systematic derivation of all relevant formulae Discusses equipment features required by the underlying processes

**Non-thermal Food Processing Operations** Seid Mahdi Jafari, Nantawan Therdthai, 2022-11-03 Non thermal Food Processing Operations a volume in the Unit Operations and Processing Equipment in the Food Industry series explains the processing operations and equipment necessary for the recent invented non thermal processing of different food products Divided into six sections Ozonation operations Plasma processing operations Irradiation operations Pulsed electric fields processing operations High pressure processing operations and Radio frequency processing operations



all chapters emphasize basic texts relating to experimental theoretical computational and or applications of food engineering principles and the relevant processing equipment needed to low temperature unit operations Written by experts in the field of food engineering in a simple and dynamic way this book targets Industrial Engineers and food factory workers from the field of food processing Readers of the book will find information that will help them become more familiar with food processing operations and equipment Thoroughly explores new opportunities in food processing through non thermal processes Helps readers better understand equipment in non thermal unit operations Clarifies different non thermal processing facilities and equipment for various types of food products

**Theoretical Treatment of Electron Emission and Related Phenomena** Benjamin Seznec,Tiberiu Minea,Philippe Dessante,Philippe Teste,Gilles Maynard,2022-06-14 This book introduces readers to the physics governing electron emission under high voltages and temperatures and highlights recent modeling and numerical developments for describing these phenomena It begins with a brief introduction presenting several applications that have driven electron emission research in the last few decades The authors summarize the most relevant theories including the physics of thermo field electron emission and the main characteristic parameters Based on these theories they subsequently describe numerical multi physics models and discuss the main findings on the effect of space charges emitter geometry pulse duration etc Beyond the well known photoelectric effect the book reviews recent advanced theories on photon metal interaction Distinct phenomena occur when picosecond and femtosecond lasers are used to irradiate a surface Their consequences on metal electron dynamics and heating are presented and discussed leading to various emission regimes in and out of equilibrium In closing the book reviews the effects of electron emission on high voltage operation in vacuum especially breakdown and conditioning as the most common examples The book offers a uniquely valuable resource for graduate and PhD students whose work involves electron emission high voltage holding laser irradiation of surfaces vacuum or discharge breakdown but also for academic researchers and professionals in the field of accelerators and solid state physics with an interest in this highly topical area

*Quantitative Microbiology in Food Processing* Anderson de Souza Sant'Ana,2017-02-06 Microorganisms are essential for the production of many foods including cheese yoghurt and bread but they can also cause spoilage and diseases Quantitative Microbiology of Food Processing Modeling the Microbial Ecology explores the effects of food processing techniques on these microorganisms the microbial ecology of food and the surrounding issues concerning contemporary food safety and stability Whilst literature has been written on these separate topics this book seamlessly integrates all these concepts in a unique and comprehensive guide Each chapter includes background information regarding a specific unit operation discussion of quantitative aspects and examples of food processes in which the unit operation plays a major role in microbial safety This is the perfect text for those seeking to understand the quantitative effects of unit operations and beyond on the fate of foodborne microorganisms in different foods Quantitative Microbiology of Food Processing is an invaluable resource for students scientists and

professionals of both food engineering and food microbiology      **Food Safety Management** Veslemøy Andersen, Huub L. M. Lelieveld, Yasmine Motarjemi, 2023-03-28 Food Safety Management A Practical Guide for the Food Industry Second Edition continues to present a comprehensive integrated and practical approach to the management of food safety throughout the production chain While many books address specific aspects of food safety no other book guides you through the various risks associated with each sector of the production process or alerts you to the measures needed to mitigate those risks This new edition provides practical examples of incidents and their root causes highlighting pitfalls in food safety management and providing key insights into different means for avoiding them Each section addresses its subject in terms of relevance and application to food safety and where applicable spoilage The book covers all types of risks e g microbial chemical physical associated with each step of the food chain making it an ideal resource Addresses risks and controls at various stages of the food supply chain based on food type including a generic HACCP study and new information on FSMA Covers the latest emerging technologies for ensuring food safety Includes observations on what works and what doesn't on issues in food safety management Provides practical guidelines for the implementation of elements of the food safety assurance system Explains the role of different stakeholders of the food supply      **Food Safety Management** Olga Martín-Belloso, Robert Soliva-Fortuny, Pedro Elez-Martínez, A. Robert Marsellés-Fontanet, Humberto Vega-Mercado, 2013-11-01 Every food manufacturing and processing operation has inherent risks affecting the safety of food products Non thermally processed foods are not exempt of those risks This chapter provides the reader with an overview of various non thermal technologies e g irradiation pulsed electric fields high hydrostatic pressure intense pulsed lights membrane filtration and hurdle technology Each of these technologies has specific critical process parameters that must be monitored as part of critical control points In depth understanding of these technologies is the key while considering their implementation The main challenge on non thermal processes is standardization when compared to thermal treatments Non thermal processes seem to be product specific resulting in additional research work to define process parameters Nevertheless a significant amount of research data are available and specific process conditions can be found in the literature      **Rheology of Fluid and Semisolid Foods: Principles and Applications** M. A. Andy Rao, 2010-04-28 The second edition of this fascinating work examines the concepts needed to characterize rheological behavior of fluid and semisolid foods It also looks at how to use various ingredients to develop desirable flow properties in fluid foods as well as structure in gelled systems It covers the crucially important application of rheology to sensory assessment and swallowing as well as the way it can be applied to handling and processing foods All the chapters have been updated to help readers better understand the importance rheological properties play in food science and utilize these properties to characterize food

## Decoding **Electronic Irradiation Of Foods An Introduction To The Technology**: Revealing the Captivating Potential of Verbal Expression

In an era characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Electronic Irradiation Of Foods An Introduction To The Technology**," a mesmerizing literary creation penned by way of a celebrated wordsmith, readers attempt an enlightening odyssey, unraveling the intricate significance of language and its enduring affect our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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