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# Encapsulation Technologies for Active Food Ingredients and Food Processing

 Springer

# Encapsulation Technologies For Active Food Ingredients And Food Processing

**Munmaya Mishra**



## **Encapsulation Technologies For Active Food Ingredients And Food Processing:**

**Encapsulation Technologies for Active Food Ingredients and Food Processing** N.J. Zuidam, Viktor Nedovic, 2009-10-30 Consumers prefer food products that are tasty healthy and convenient Encapsulation is an important way to meet these demands by delivering food ingredients at the right time and right place For example encapsulates may allow flavor retention mask bad tasting or bad smelling components stabilize food ingredients and increase their bioavailability Encapsulation may also be used to immobilize cells or enzymes in the production of food materials or products such as fermentation or metabolite production This book provides a detailed overview of the encapsulation technologies available for use in food products food processing and food production The book aims to inform those who work in academia or R D about both the delivery of food compounds via encapsulation and food processing using immobilized cells or enzymes The structure of the book is according to the use of encapsulates for a specific application Emphasis is placed on strategy since encapsulation technologies may change Most chapters include application possibilities of the encapsulation technologies in specific food products or processes The first part of the book reviews general technologies food grade materials and characterization methods for encapsulates The second part discusses encapsulates of active ingredients e g aroma fish oil minerals vitamins peptides proteins probiotics for specific food applications The last part describes immobilization technologies of cells and enzymes for use within food fermentation processes e g beer wine dairy meat and food production e g sugar conversion production of organic acids or amino acids hydrolysis of triglycerides Edited by two leading experts in the field Encapsulation Technologies for Food Active Ingredients and Food Processing will be a valuable reference source for those working in the academia or food industry The editors work in both industry or academia and they have brought together in this book contributions from both fields Encapsulation technologies for active food ingredients and food processing ,2010

**Encapsulation Technologies and Delivery Systems for Food Ingredients and Nutraceuticals** Nissim Garti, D. Julian McClements, 2012-10-19 Improved technologies for the encapsulation protection release and enhanced bioavailability of food ingredients and nutraceutical components are vital to the development of future foods Encapsulation technologies and delivery systems for food ingredients and nutraceuticals provides a comprehensive guide to current and emerging techniques Part one provides an overview of key requirements for food ingredient and nutraceutical delivery systems discussing challenges in system development and analysis of interaction with the human gastrointestinal tract Processing technologies for encapsulation and delivery systems are the focus of part two Spray drying cooling and chilling are reviewed alongside coextrusion fluid bed microencapsulation microencapsulation methods based on biopolymer phase separation and gelation phenomena in aqueous media Part three goes on to investigate physicochemical approaches to the production of encapsulation and delivery systems including the use of micelles and microemulsions polymeric amphiphiles liposomes colloidal emulsions organogels and hydrogels Finally part four reviews characterization and

applications of delivery systems providing industry perspectives on flavour fish oil iron micronutrient and probiotic delivery systems With its distinguished editors and international team of expert contributors Encapsulation technologies and delivery systems for food ingredients and nutraceuticals is an authoritative guide for both industry and academic researchers interested in encapsulation and controlled release systems Provides a comprehensive guide to current and emerging techniques in encapsulation technologies and delivery systems Chapters in part one provide an overview of key requirements for food ingredient and nutraceutical delivery systems while part two discusses processing technologies for encapsulation and delivery systems Later sections investigate physicochemical approaches to the production of encapsulation and delivery systems and review characterization and applications of delivery systems

*Spray Drying Techniques for Food Ingredient Encapsulation* C. Anandharamakrishnan, Padma Ishwarya S., 2015-07-23 Spray drying is a well established method for transforming liquid materials into dry powder form Widely used in the food and pharmaceutical industries this technology produces high quality powders with low moisture content resulting in a wide range of shelf stable food and other biologically significant products Encapsulation technology for bioactive compounds has gained momentum in the last few decades and a series of valuable food compounds namely flavours carotenoids and microbial cells have been successfully encapsulated using spray drying Spray Drying Technique for Food Ingredient Encapsulation provides an insight into the engineering aspects of the spray drying process in relation to the encapsulation of food ingredients choice of wall materials and an overview of the various food ingredients encapsulated using spray drying The book also throws light upon the recent advancements in the field of encapsulation by spray drying i e nanospray dryers for production of nanocapsules and computational fluid dynamics CFD modeling Addressing the basics of the technology and its applications the book will be a reference for scientists engineers and product developers in the industry

**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

Encapsulation in Food Processing and Fermentation Steva Lević,Viktor Nedović,Branko Bugarski,2022-08-18 Food technology has adopted new principles and practices that are rapidly changing the food sector New foods are now available under more uniform standards and better quality control Globalised food market offers opportunities for manufacturers to increase production and profit and at the same time consumers benefit from the choice of food products like never before All this is possible only because of the innovations in the food sector One of such innovations is encapsulation technology which aims to preserve food quality enhance the sensorial properties of food and increase the efficiency in food processing This book discusses the uses of encapsulation technology in food practices and conventional processes and also highlights new directions in food processing In the introductory chapters review of encapsulation technologies carrier materials and criteria for their selection analytical methods for characterisation of encapsulated products and some aspects of product design and process optimisation The most important achievements of encapsulation technology in the food sector are reviewed in the later chapters related to encapsulation of food ingredients food biocatalysts and examples of usage of encapsulated active ingredients in the dairy and meat industry beverage production etc In addition the implementation of nanotechnology in the food sector is reviewed emphasizing the most important materials and technologies for the production of nanoencapsulates The book is a valuable source of information on encapsulation technology for academia and industry especially the food sector with the aim of enhancing knowledge transfer

Food Processing Technology P.J. Fellows,2022-06-18 Food Processing Technology Principles and Practice Fifth Edition includes emerging trends and developments in food processing The book has been fully updated to provide comprehensive up to date technical information For each food processing unit operation theory and principles are first described followed by

equipment used commercially and its operating conditions the effects of the operation on micro organisms and the nutritional and sensory qualities of the foods concerned Part I describes basic concepts Part II describes operations that take place at ambient temperature Part III describes processing using heat Part IV describes processing by removing heat and Part V describes post processing operations This book continues to be the most comprehensive reference in the field covering all processing unit operations in a single volume The title brings key terms and definitions sample problems recommended further readings and illustrated processes Presents current trends on food sustainability environmental considerations changing consumer choices reduced packaging and energy use and functional and healthy plant based foods Includes highly illustrated line drawings and or photographs to show the principles of equipment operation and or examples of equipment that is used commercially Contains worked examples of common calculations

*Microencapsulation in the Food Industry* Robert Sobel, 2014-06-30 Microencapsulation is being used to deliver everything from improved nutrition to unique consumer sensory experiences It s rapidly becoming one of the most important opportunities for expanding brand potential Microencapsulation in the Food Industry A Practical Implementation Guide is written for those who see the potential benefit of using microencapsulation but need practical insight into using the technology With coverage of the process technologies materials testing regulatory and even economic insights this book presents the key considerations for putting microencapsulation to work Application examples as well as online access to published and issued patents provide information on freedom to operate building an intellectual property portfolio and leveraging ability into potential in licensing patents to create produce pipeline This book bridges the gap between fundamental research and application by combining the knowledge of new and novel processing techniques materials and selection regulatory concerns testing and evaluation of materials and application specific uses of microencapsulation Practical applications based on the authors more than 50 years combined industry experience Focuses on application rather than theory Includes the latest in processes and methodologies Provides multiple starting point options to jump start encapsulation use

*Advances in Food Process Engineering Research and Applications* Stavros Yanniotis, Petros Taoukis, Nikolaos G. Stoforos, Vaianos T. Karathanos, 2013-10-21 This is the second publication stemming from the International Congress on Engineering in Food the first being Food Engineering Interfaces based on the last ICEF10 The theme of ICEF 11 held in Athens Greece in May 2011 is Food Process Engineering in a Changing World The conference explored the ways food engineering contributes to the solutions of vital problems in a world of increasing population and complexity that is under the severe constraints of limited resources of raw materials energy and environment The book comprised of 32 chapters features an interdisciplinary focus including food materials science engineering properties of foods advances in food process technology novel food processes functional foods food waste engineering food process design and economics modeling food safety and quality and innovation management

*Cyclodextrins* Sahar Amiri, Sanam Amiri, 2017-08-30 The comprehensive resource for understanding the structure

properties and applications of cyclodextrins Cyclodextrins Properties and Industrial Applications is a comprehensive resource that includes information on cyclodextrins CDs structure their properties formation of inclusion complex with various compounds as well as their applications The authors Sahar Amiri and Sanam Amiri noted experts in the field of cyclodextrins cover both the basic and applied science in chemistry biology and physics of CDs and offers scientists and engineers an understand of cyclodextrins Cyclodextrins are a family of cyclic oligosaccharides consisting of 1 4 linked D glucopyranose units The formation of inclusion complex between CDs as host and guest molecules is based on non covalent interaction such as hydrogen bonding or van der waals interactions and lead to the formation of supramolecular structures These supramolecular structures can be used as macroinitiator for initiating various type of reactions CDs are widely used in many industrial products such as pharmacy food and flavours chemistry chromatography catalysis biotechnology agriculture cosmetics hygiene medicine textiles drug delivery packing separation processes environment protection fermentation and catalysis This important resource Offers a basic understanding of cyclodextrins for researchers and engineers Includes information of the basic structure of cyclodextrins and their properties Reviews how cyclodextrins can be applied in a variety of fields including medicine chemistry textiles packing and many others Shows how encapsulate corrosion inhibitors became active in corrosive electrolytes to ensure delivery of the inhibitors to corrosion sites and long term corrosion protection Cyclodextrins offers research scientists and engineers a wealth of information about CDs with particular focus on how cyclodextrins are applied in various ways including in drug delivery the food industry and many other areas

Flavors for Nutraceutical and Functional Foods M. Selvamuthukumaran,Yashwant Pathak,2018-08-06 Flavors are an integral part of nutraceutical formulations Flavors offer significant advantage to Nutraceuticals when it comes to palatability and get an edge over other products in an extremely competitive nutraceutical market Flavors for Nutraceuticals and Functional Foods addresses different natural ingredients botanicals used in various functional foods and nutraceutical products The techniques of incorporating flavors in Nutraceutical products can be classified as conventional and using recently developed modern techniques such as nanotechnology are also covered in different chapters These techniques are mainly used for masking the taste of nutraceutical and functional food products The book discusses the basics of flavors and the significance of the flavor industry in relation to Nutraceuticals This book covers various processes involved in incorporating flavor and improving product acceptability It provides an overview on the potential applications of the main terpene based flavors as part of nutraceuticals formulations This book will serve as a reference to academicians and industry people who are involved in Nutraceutical formulations and marketing

**Flavor Development for Functional Foods and Nutraceuticals** M. Selvamuthukumaran,Yashwant V Pathak,2019-09-23 In a finished nutraceutical product flavors play an integral role Flavor Development for Functional Foods and Nutraceuticals is about the crucial role added flavors play in any nutraceutical product It describes the various extraction techniques that are being adopted for manufacturing flavors from natural raw

materials Yield and retention of aromatic components during several extraction methods and flavor encapsulation techniques for thermal degradable food components are discussed Advanced methods of flavor extraction techniques like supercritical CO<sub>2</sub> extraction are emphasized The safety and quality aspects of flavor incorporation in food processing industries are reviewed with respect to international regulations The importance of flavor in the nutraceuticals industry is also discussed In addition the book stresses the functional value and organoleptic acceptability towards product optimization formulation Features Explains how flavors play an integral role in a finished nutraceutical product Describes the various extraction techniques that are being adopted for manufacturing flavors from natural raw materials Covers flavor encapsulation techniques for thermal degradable food components Provides an introduction to the history of how some natural flavor ingredients botanicals and extracts were used in ancient times in Ayurveda and herbal medicine This is an ideal reference book for the flavor chemists food scientists nutraceutical formulators and students and academicians who are working in the area of nutraceutical supplement and functional food development and provides very useful information to help them select appropriate flavors for their products Also available in the Nutraceuticals Basic Research Clinical Applications Series Flavors for Nutraceuticals and Functional Foods edited by M Selvamuthukumaran and Yashwant Pathak ISBN 978 1 1380 6417 1 Antioxidant Nutraceuticals Preventive and Healthcare Applications edited by Chuanhai Cao Sarvadaman Pathak Kiran Patil ISBN 978 1 4987 3703 6 Food By product Based Functional Food Powders edited by zlem Toku o lu ISBN 978 1 4822 2437 5

**Thermal and Nonthermal Encapsulation Methods** Magdalini Krokida, 2017-09-27 Encapsulation is a topic of interest across a wide range of scientific and industrial areas from pharmaceuticals to food and agriculture for the protection and controlled release of various substances during transportation storage and consumption Since encapsulated materials can be protected from external conditions encapsulation enhances their stability and maintains their viability This book offers a comprehensive review of conventional and modern methods for encapsulation It covers various thermal and nonthermal encapsulation methods applied across a number of industries including freeze drying spray drying spray chilling and spray cooling electrospinning electrospraying osmotic dehydration extrusion air suspension coating pan coating and vacuum drying The book presents basic fundamentals principles and applications of each method enabling the reader to gain extended knowledge The choice of the most suitable encapsulation technique is based on the raw materials the required size and the desirable characteristics of the final products

**Handbook of Research on Food Science and Technology** Monica Chavez-Gonzalez, Jose Juan Buenrostro-Figueroa, Cristobal N. Aguilar, 2019-01-15 This Handbook of Research in Food Science and Technology consists of three volumes focusing on food technology and chemistry food biotechnology and microbiology and functional foods and nutraceuticals The volumes highlight new research and current trends in food science and technology looking at the most recent innovations emerging technologies and strategies focusing on taking food design to sustainable levels In particular the handbooks includes relevant information on the modernization in the food industry



sustainable packaging food bioprocesses food fermentation food microbiology functional foods and nutraceuticals natural products nano and microtechnology healthy product composition innovative processes bioprocesses for utilization of by products development of novel preservation alternatives extending the shelf life of fresh products alternative processes requiring less energy or water among other topics Volume 1 of the 3 volume set focuses on food technology and chemistry The chapters examine edible coatings bioactive compounds essential oils in active food packaging food industrial wastes as raw material for nanostructure production and more

**Engineering Foods for Bioactives Stability and Delivery** Yrjö H. Roos, Yoav D. Livney, 2016-12-01 This book introduces recovery and stabilization of common bioactive materials in foods as well as materials science aspects of engineering stable bioactive delivery systems The book also describes most typical unit operations and processes used in recovery and manufacturing of food ingredients and foods with stabilized bioactive components The 15 chapters of the book discuss in detail substances that need to be protected and delivered via foods and beverages to achieve good stability bioavailability and efficacy Dedicated chapters present current and novel technologies used for stabilization and delivery of bioactive components The material included covers formulation stability digestive release bioaccessability and bioavailability The text features a special emphasis on the materials science and technological aspects required for stabilization and successful production of foods with bioactive components Consumer demand for healthier yet satisfying food products is posing increasingly tough challenges for the food industry Scientific research reveals new bioactive food components and new functionalities of known components Food materials science has also developed to a stage where food materials can be designed and produced to protect sensitive components for their delivery in complex food products Such delivery systems must meet high safety and efficacy requirements and regulations as well as economic viability criteria and consumer acceptance

**Spray Drying Encapsulation of Bioactive Materials** Seid Mahdi Jafari, Ali Rashidinejad, 2021-09-12 Encapsulation of bioactives is a fast growing approach in the food and pharmaceutical industry Spray Drying Encapsulation of Bioactive Materials serves as a source of information to offer specialized and in depth knowledge on the most well known and used encapsulation technology i e spray drying and corresponding advances It describes the efficacy of spray drying in terms of its advantages and challenges for encapsulation of bioactive ingredients Discusses the potential of this technique to pave the way toward cost effective industrially relevant reproducible and scalable processes that are critical to the development of delivery systems for bioactive incorporation into innovative functional food products and pharmaceuticals Presents the latest research outcomes related to spray drying technology and the encapsulation of various bioactive materials Covers advances in spray drying technology that may result in a more efficient encapsulation of bioactive ingredients Includes computational fluid dynamics advanced drying processes as well as the morphology of the dried particles drying kinetics analyzers process controllers and adaptive feedback systems inline powder analysis technologies and cleaning in place equipment Aimed at food manufacturers pharmacists and chemical engineers this

work is of interest to anyone engaged in encapsulation of bioactive ingredients for both nutraceutical and pharmaceutical applications

**Encapsulations** Alexandru Grumezescu, 2016-05-27 Encapsulations a volume in the Nanotechnology in the Agri Food Industry series presents key elements in establishing food quality through the improvement of food flavor and aroma The major benefits of nanoencapsulation for food ingredients include improvement in bioavailability of flavor and aroma ingredients improvement in solubility of poor water soluble ingredients higher ingredient retention during production process higher activity levels of encapsulated ingredients improved shelf life and controlled release of flavor and aroma This volume discusses main nanoencapsulation processes such as spray drying melt injection extrusion coacervation and emulsification The materials used in nanoencapsulation include lipids proteins carbohydrates cellulose gums and food grade polymers Applications and benefits of nanoencapsulation such as controlled release protections and taste masking will be explained in detail Includes the most up to date information on nanoencapsulation and nanocontainer based delivery of antimicrobials Presents nanomaterials for innovation based on scientific advancements in the field Provides control release strategies to enhance bioactivity including methods and techniques for research and innovation Provides useful tools to improve the delivery of bioactive molecules and living cells into foods

**Carotenoids: Properties, Processing and Applications** Charis M. Galanakis, 2019-08-27 Carotenoids Properties Processing and Applications fills the gap of transfer knowledge between academia and industry covering integral information in three critical dimensions properties recovery and applications At the moment carotenoid research is directed at particular applications including colorants antioxidants and recovery from plant processing by products These trends take into account the health nutrition and functions of carotenoids the new recovery efforts from underutilized sources the extraction procedures using green solvents and technologies and their sustainability aspects Written by a team of experts in the field of food chemistry food science and technology as well as bioresource technologists mainly from academia the book covers the most recent advances in the field of carotenoids while also analyzing the potential of already commercialized processes and products Covers carotenoids properties in view of alternative sources plant by products microalgae etc recovery technologies and applications Thoroughly explores mechanistic aspects dietary intake and recommendations surrounding the health promoting effects of carotenoids Discusses the effect of processing and storage conditions in carotenoid levels and bioavailability Presents applications and case studies in the food industry

**Handbook of Encapsulation and Controlled Release** Munmaya Mishra, 2015-12-01 The field of encapsulation especially microencapsulation is a rapidly growing area of research and product development The Handbook of Encapsulation and Controlled Release covers the entire field presenting the fundamental processes involved and exploring how to use those processes for different applications in industry Written at a level comp

**Advances in Food Biotechnology** Ravishankar Rai V, 2015-10-12 The application of biotechnology in the food sciences has led to an increase in food production and enhanced the quality and safety of food Food biotechnology is a dynamic field and the continual progress

and advances have not only dealt effectively with issues related to food security but also augmented the nutritional and health aspects of food. *Advances in Food Biotechnology* provides an overview of the latest development in food biotechnology as it relates to safety, quality and security. The seven sections of the book are multidisciplinary and cover the following topics: GMOs and food security issues; Applications of enzymes in food processing; Fermentation technology; Functional food and nutraceuticals; Valorization of food waste; Detection and control of foodborne pathogens; Emerging techniques in food processing. Bringing together experts drawn from around the world, the book is a comprehensive reference in the most progressive field of food science and will be of interest to professionals, scientists and academics in the food and biotech industries. The book will be highly resourceful to governmental research and regulatory agencies and those who are studying and teaching food biotechnology.

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