



# **Dimensional Analysis of Food Processes**

**Guillaume Delaplace, Karine Loubière  
Fabrice Ducept and Romain Jeantet**

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# Dimensional Analysis Of Food Processes

**Patrick J. Cullen, Brijesh K.  
Tiwari, Vasilis Valdramidis**



## **Dimensional Analysis Of Food Processes:**

*Dimensional Analysis of Food Processes* Guillaume Delaplace, Karine Loubière, Fabrice Ducept, Romain Jeantet, 2015-09-18 This book deals with the modeling of food processing using dimensional analysis When coupled to experiments and to the theory of similarity dimensional analysis is indeed a generic powerful and rigorous tool making it possible to understand and model complex processes for design scale up and or optimization purposes This book presents the theoretical basis of dimensional analysis with a step by step detail of the framework for applying dimensional analysis with chapters respectively dedicated to the extension of dimensional analysis to changing physical properties and to the use of dimensional analysis as a tool for scaling up processes It includes several original examples issued from the research works of the authors in the food engineering field illustrating the conceptual approaches presented and strengthen the teaching of all Discusses popular dimensional analysis for knowledge and scaling up tools with detailed case studies Emphasises the processes dealing with complex materials of a multiphase nature Introduces the concept of chemical or material similarity and a framework for analysis of the functional forms of the property Food Processing Operations and Scale-up Kenneth J. Valentas, J. Peter Clark, Leon Levin, 2020-08-11 Intended for students and practitioners who have a basic education in chemical engineering or food science Contains basic information in each area and describes some of the fundamental ideas of processing development and design Examines the food industry structure how it works consumer products **Fundamentals and Operations in Food Process Engineering** Susanta Kumar Das, Madhusweta Das, 2019-03-08 Fundamentals and Operations in Food Process Engineering deals with the basic engineering principles and transport processes applied to food processing followed by specific unit operations with a large number of worked out examples and problems for practice in each chapter The book is divided into four sections fundamentals in food process engineering mechanical operations in food processing thermal operations in food processing and mass transfer operations in food processing The book is designed for students pursuing courses on food science and food technology including a broader section of scientific personnel in the food processing and related industries **Unit Operations in Food Processing** Mr. Rohit Manglik, 2024-05-18 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels **Physical Properties of Foods and Food Processing Systems** M J Lewis, 1990-01-01 This book is an invaluable introduction to the physical properties of foods and the physics involved in food processing It provides descriptions and data that are needed for selecting the most appropriate equipment in food technology and for making food processing calculations *Handbook of Food Process Design* Jasim Ahmed, Mohammad Shafiur Rahman, 2012-02-27 In the 21st Century processing food is no longer a simple or straightforward matter Ongoing advances in manufacturing have placed new demands on the design and methodology of food processes A

highly interdisciplinary science food process design draws upon the principles of chemical and mechanical engineering microbiology chemistry nutrition and economics and is of central importance to the food industry Process design is the core of food engineering and is concerned at its root with taking new concepts in food design and developing them through production and eventual consumption Handbook of Food Process Design is a major new 2 volume work aimed at food engineers and the wider food industry Comprising 46 original chapters written by a host of leading international food scientists engineers academics and systems specialists the book has been developed to be the most comprehensive guide to food process design ever published Starting from first principles the book provides a complete account of food process designs including heating and cooling pasteurization sterilization refrigeration drying crystallization extrusion and separation Mechanical operations including mixing agitation size reduction extraction and leaching processes are fully documented Novel process designs such as irradiation high pressure processing ultrasound ohmic heating and pulsed UV light are also presented Food packaging processes are considered and chapters on food quality safety and commercial imperatives portray the role process design in the broader context of food production and consumption

**Introduction to Food Process Engineering** P. G. Smith, 2011-02-11 This is a new book on food process engineering which treats the principles of processing in a scientifically rigorous yet concise manner and which can be used as a lead in to more specialized texts for higher study It is equally relevant to those in the food industry who desire a greater understanding of the principles of the food processes with which they work This text is written from a quantitative and mathematical perspective and is not simply a descriptive treatment of food processing The aim is to give readers the confidence to use mathematical and quantitative analyses of food processes and most importantly there are a large number of worked examples and problems with solutions The mathematics necessary to read this book is limited to elementary differential and integral calculus and the simplest kind of differential equation

*Introduction to Food Process Engineering* Albert Ibarz, Gustavo V. Barbosa-Canovas, 2014-04-10 Consumer expectations are systematically growing with demands for foods with a number of attributes which are sometimes difficult for manufacturers to meet The engineering processes that are needed to obtain top quality foods are a major challenge due to the diversity of raw materials intermediates and final products As in any other enterprise the food industry must optimize each of the steps in the production chain to attain the best possible results There is no question that a very important aspect to take into consideration when developing a process designing a food factory or modifying existing facilities is the in depth knowledge of the basic engineering aspects involved in a given project Introduction to Food Process Engineering covers the fundamental principles necessary to study understand and analyze most unit operations in the food engineering domain It was conceived with two clear objectives in mind 1 to present all of the subjects in a systematic coherent and sequential fashion in order to provide an excellent knowledge base for a number of conventional and unconventional processes encountered in food industry processing lines as well as novel processes at the research and

development stages 2 to be the best grounding possible for another CRC Press publication Unit Operations in Food Engineering Second Edition by the same authors These two books can be consulted independently but at the same time there is a significant and welcomed match between the two in terms of terminology definitions units symbols and nomenclature Highlights of the book include Dimensional analysis and similarities Physicochemistry of food systems Heat and mass transfer in food Food rheology Physical properties Water activity Thermal processing Chilling and freezing Evaporation Dehydration Extensive examples problems and solutions      Concepts of Small-scale Food Processing Donald G.

Mercer,2021-02-08 Providing detailed information on key areas of post harvest technologies this book is written with small scale processors and entrepreneurs in food processing who have no formal training in Food Science or Food Engineering in mind Uniquely it will review the hands on aspects of food processing from a largely non academic viewpoint It is written in non technical language and covers everything from the basic science of why food is processed to a description of the main methods used Coverage includes all current technologies that are used at the small scale such as why food is processed the historical development of food processing background skills heating and cooling in food processing thermal processing basics and specialised calculations drying food materials statistical manufacturing control and sugar solution calculations in beverage making The target audience for this book is vastly under served with appropriate information and the abundant use of photographs showing the various concepts described in the text makes this book appealing to those required to understand their food process operations      **Transport Phenomena in Food Processing** Jorge Welte-Chanes,Jorge F.

Velez-Ruiz,2016-04-19 Specifically developed for food engineers this is an in depth reference book that focuses on transport phenomena in food preservation First it reviews the fundamental concepts regarding momentum heat and mass transfer Then the book examines specific applications of these concepts into a variety of traditional and novel processes and products

**Rheological Methods in Food Process Engineering** James Freeman Steffe,1996 Introduction to rheology Tube viscometry Rotational viscometry Extensional flow Viscoelasticity      **Food Process Engineering** Dennis R.

Heldman,2012-12-06 The Second Edition of Food Process Engineering by Dr Dennis Heldman my former student and co author Paul Singh his former student attests to the importance of the previous edition In the Foreword to the First Edition I noted the need for people in all facets of the food processing industry to consider those variables of design of particular importance in engineering for the food processing field In addition to recognizing the many variables involved in the biological food product being handled from production to consumption the engineer must oftentimes adapt equations developed for non biological materials As more and more research is done those equations are appropriately modified to be more accurate or new equations are developed specifically for designing to process foods This Edition updates equations used This book serves a very important need in acquainting engineers and technologists particularly those with a mathematics and physics background with the information necessary to provide a more efficient design to accomplish the

objectives Of prime importance at present and in the future is to design for efficient use of energy Now it is often economical to put considerably more money into first costs for an efficient design than previously when energy costs were a much smaller proportion of the total cost of process engineering **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 **Extrusion Cooking** Girish M. Ganjyal,2020-07-25 Extrusion Cooking provides a detailed description of extrusion processing with an in depth exploration of cereal grains processing In particular the book addresses the basic principles of extrusion processing various extruder parts and their design principles food ingredients and their characteristics as they relate to extrusion It also discusses physicochemical changes in the different

ingredient components as they are processed in an extruder modeling and control of extrusion process scale up aspects extrusion plant design food safety in extrusion new advancements in extrusion and a look into the future of extrusion This valuable text serves as a one volume reference on extrusion processing for food industry professionals and students Covers the engineering chemistry nutrition and food safety aspects of extrusion cooking Presents both the fundamental and applied aspects of extrusion processing Details the extrusion of whole grain high fiber and high protein foods Covers both expanded and texturized products Outlines extrusion processing of different ingredients Addresses new technologies that have expanded the extruder capabilities Analyzes new developments in the area of modeling of extrusion processing

Food Process Engineering and Technology Zeki Berk, 2018-02-13 Food Process Engineering and Technology Third Edition combines scientific depth with practical usefulness creating a tool for graduate students and practicing food engineers technologists and researchers looking for the latest information on transformation and preservation processes and process control and plant hygiene topics This fully updated edition provides recent research and developments in the area features sections on elements of food plant design an introductory section on the elements of classical fluid mechanics a section on non thermal processes and recent technologies such as freeze concentration osmotic dehydration and active packaging that are discussed in detail Provides a strong emphasis on the relationship between engineering and product quality safety Considers cost and environmental factors Presents a fully updated adequate review of recent research and developments in the area Includes a new full chapter on elements of food plant design Covers recent technologies such as freeze concentration osmotic dehydration and active packaging that are discussed in detail

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

Food Processing Handbook James G. Brennan, Alistair S. Grandison, 2012-05-07 The second edition of the Food Processing Handbook presents a comprehensive review of technologies procedures and innovations in food processing stressing topics vital to the food industry today and pinpointing the trends in future research and development Focusing on the technology involved this handbook describes the principles and the equipment used as well as the changes physical chemical microbiological and

organoleptic that occur during food preservation In so doing the text covers in detail such techniques as post harvest handling thermal processing evaporation and dehydration freezing irradiation high pressure processing emerging technologies and packaging Separation and conversion operations widely used in the food industry are also covered as are the processes of baking extrusion and frying In addition it addresses current concerns about the safety of processed foods including HACCP systems traceability and hygienic design of plant and control of food processes as well as the impact of processing on the environment water and waste treatment lean manufacturing and the roles of nanotechnology and fermentation in food processing This two volume set is a must have for scientists and engineers involved in food manufacture research and development in both industry and academia as well as students of food related topics at undergraduate and postgraduate levels From Reviews on the First Edition This work should become a standard text for students of food technology and is worthy of a place on the bookshelf of anybody involved in the production of foods Journal of Dairy Technology August 2008 This work will serve well as an excellent course resource or reference as it has well written explanations for those new to the field and detailed equations for those needing greater depth CHOICE September 2006

**Innovative Food Processing Technologies** Kai Knoerzer, PhD,Pablo Juliano, PhD,Peter Roupas, PhD,Cornelis Versteeg, PhD,2011-04-19 Part of the IFT Institute of Food Technologists series this book discusses multiphysics modeling and its application in the development optimization and scale up of emerging food processing technologies The book covers recent research outcomes to demonstrate process efficiency and the impact on scalability safety and quality and technologies including High Pressure Processing High Pressure Thermal Sterilization Radiofrequency Ultrasound Ultraviolet and Pulsed Electric Fields Processing Ideal for food and process engineers food technologists equipment designers microbiologists and research and development personnel this book covers the importance and the methods for applying multiphysics modeling for the design development and application of these technologies **Introduction to Advanced Food Process**

**Engineering** Jatindra Kumar Sahu,2014-03-24 Food materials are processed prior to their consumption using different processing technologies that improve their shelf life and maintain their physicochemical biological and sensory qualities Introduction to Advanced Food Process Engineering provides a general reference on various aspects of processing packaging storage and quality control **Confectionery and Chocolate Engineering** Ferenc A. Mohos,2010-11-29 Confectionery

and chocolate manufacture has been dominated by large scale industrial processing for several decades It is often the case though that a trial and error approach is applied to the development of new products and processes rather than verified scientific principles The purpose of this book is to describe the features of unit operations used in confectionary manufacturing In contrast to the common technology focused approach to this subject this volume offers a scientific theoretical account of confectionery manufacture building on the scientific background of chemical engineering The large diversity of both raw materials and end products in the confectionery industry makes it beneficial to approach the subject in



this way The industry deals with a variety of vegetable based raw materials as well as milk products eggs gelatin and other animal based raw materials A study of confectionery and chocolate engineering must therefore examine the physical and chemical as well as the biochemical and microbiological properties of the processed materials By characterizing the unit operations of confectionery manufacture the author who has over 40 years experience in confectionery manufacture aims to open up new possibilities for improvement relating to increased efficiency of operations the use of new materials and new applications for traditional raw materials The book is aimed at food engineers scientists technologists in research and industry as well as graduate students on relevant food and chemical engineering related courses

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