SECOND EDITION

FOOD PROCESSING OPERATIONS MODELING

Design and Analysis

EDITED BY

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Preface

The second edition of *Food Processing Operations Modeling: Design and Analysis* has its unique value far beyond an extension of the previous edition. The key focus of the second edition is to address novel food processing technologies that are of immense interest in relation to food safety and quality. With rapid adaptation, modification, and infusion of new processes and instrumentation, tomorrow's consumers will have access to safe, nutritious, high-quality products via novel food processing technologies. High pressure processing (HPP), pulsed electric field (PEF), ohmic heating, ozone and pulsed ultraviolet treatments are representative novel techniques to alternate the traditional food processing methods. The fundamental principles and associated numerical approaches are some of the key elements addressed in this edition.

Chapter 7 on HPP includes modeling studies to describe microbial kinetics and computational fluid dynamics (CFD) in which the pressure dependence of latent heat and physical properties of foods can be efficiently interpreted. As described in Chapter 8, PEF processing is a non-thermal method of food preservation that uses short bursts of electricity for microbial inactivation with little detrimental effect to food quality. Along with the fundamentals of the PEF system and operation, novel food applications and supportive numerical models have been described. Accurate prediction and analysis of fouling dynamics based on an understanding of chemistry and fluid mechanics useful in predicting how real process equipment is likely to respond is discussed in Chapter 9. An introduction to fouling models for heat exchangers accounting for the hydrodynamics and thermodynamics of fluid flow, coupled with the reaction scheme of milk protein under fouling, is also detailed. The bactericidal effects of ozone have been documented for a wide variety of organisms, including Gram positive and Gram negative bacteria as well as spores and vegetative cells. In Chapter 10, chemical and physical properties of ozone, its generation, and the antimicrobial power of ozone have been explained as well as many advantages of ozone use in the food industry.

UV-light used as a bactericidal agent is a portion of electromagnetic spectrum ranging from 100 to 400 nm wavelengths and has the potential to denature the microbial DNA by forming thymine dimmers, leading to microbial inactivation. Chapter 11 will elaborate on various models available and the influence of different factors on microbial inactivation.

In addition, new modeling approaches for infrared heating that include the temperature dependence of spectral distribution and ohmic heating coupled with CFD tools have been addressed. Modeling of multi-phase food products with various electrical conductivities has been introduced in the chapter on ohmic heating. Distortion of electric field due to several factors such as heterogeneous food materials and irregular domain shapes is one of key interests to food engineers whose effort it is to predict the accurate thermal performance of ohmic heaters.

We have seen very few books available on modeling the complexities involved in different food processing operations at this level. This book is unique in the sense

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of applying the theories to solve practical problems relevant to food process engineering at a higher level. This book is not intended to be a complete book on modeling the numerous food processing operations. In providing the theoretical basis for selected operations along with case studies, the reader can gain a clear and intuitive understanding of the concepts and factors involved in modeling food systems. Using this opportunity, the chapter contributors also wish to engage readers with further in-depth discussions about challenging subjects.

We would like to thank all the authors for their sincere contribution of time and effort in making this possible. It has been our pleasure to put together all of their efforts in one single stage. Many thanks again.

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