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Tiziana Fornari • Roumiana P. Stateva
Editors

High Pressure Fluid Technology for Green Food Processing

 Springer

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Foreword

The book *High Pressure Fluid Technology for Green Food Processing* provides an overview on the application of Green-Chemistry principles to production processes and analytical procedures related to food materials, mainly using supercritical fluids and pressurized phases. The book provides an excellent summary on the state of art for processes and fundamentals.

Experimental and processing techniques for supercritical fluids and for high pressure processing have been investigated extensively in the last decades. The number of publications on specialized applications is enormous, as is the number of papers on phase equilibria and solubility. Attention has also been dedicated to determine the properties of substances and mixtures, to kinetic issues, and to reactive transformations. The formulation of solid products by means of supercritical fluids has led to new products in the food sector, while the modification of surfaces is still in an early development state. Attention has also been directed to the application of Chemical Engineering methods for processes with supercritical fluids and pressurized phases.

Fundamentals such as phase equilibria, mass transfer kinetics, application of various supercritical fluids, basically carbon dioxide, but also including other compounds as modifying component or alternative to CO₂, solvent cycles, energy requirement, and more have been investigated and are known in principle and applied in commercial processes for quite a number of products. It is self-evident that knowledge on these topics must be acquired for many more feed materials, pure components as well as for extract mixtures, usually in connection with actual commercial projects.

It has been realized—and the book is paying attention to that—that supercritical fluid processes for themselves may not lead to the wanted products. Furthermore, a combination of supercritical fluid processing with conventional processes is necessary in most cases for a process sequence leading to the saleable product. Consideration must be given to economic aspects, mainly seen from an engineering point of view as processing cost, but a wider view is necessary since marketing of the products is an essential feature.

The book is divided into three major areas: Fundamentals (Chaps. 1–4), advances in high pressure food processing (Chaps. 5–8), and current and future applications (Chaps. 9–14). In the first part, phase equilibria and their application to processes, determination of thermophysical properties, and mass transfer aspects are treated. The complex nature of food related materials leads to a variety of methods that need to be selectively used depending on the feed material. In this part, the connection between fundamentals and process parameters is given thorough attention.

In the second part, specialized and emerging techniques are described, such as the formulation of solids using supercritical fluids or dense gases, the transformation of compounds by enzymatically catalyzed reactions in a supercritical fluid environment, the use of Supercritical Fluid Chromatography for analytical and preparative purposes, and the applications of water in the sub- and supercritical state for food analysis, with the prospect for process applications. This part shows the variability of high pressure processing techniques and makes clear the availability of many techniques that are nowadays only scarcely used for commercial processes.

In the third part, current and future applications are addressed, mainly extractive processes, such as recovery of bioactive compounds from by-products, extraction of compounds from spices and herbs, extraction of carotenoids, and processing of lipids. In this part also process technology and economic aspects are presented, like multiple unit processes in particular for biorefineries and the economic perspectives of high pressure processing.

This book is an excellent overview on the state of the art applying supercritical fluids and pressurized phases, or more general—High Pressure Techniques—to the production and analysis of food materials. It is a must for all persons, students, engineers, scientists, and managers working in the field or interested in production methods that comply with Green-Chemistry methods.

Gerd Brunner

Preface

High pressure separation and reaction processes have opened a wide range of new alternatives for the expansion of food technology. Their most attractive advantage is the application of food substances (carbon dioxide, water, ethanol) as solvents which can process both lipophilic and hydrophilic raw matters. This is currently of particular interest, since during the first decade of the twenty-first century the food industry has clearly focused on generating products with proved health benefits. Since meeting the targets of green processing and green products is a requirement in the production of functional foods, the use of high pressure green solvents is appropriate and desirable as they guarantee safe and high quality products.

Part I of this book presents the basics of the synthesis and design of high pressure processes, which are strongly dependent on the phase equilibrium scenario, which in turn, is highly sensitive to changes in the operating conditions. Part I also outlines recent advances in mass transfer models for representing supercritical fluid extraction kinetics, which are essential for the scaling-up of one of the first-born but still very important areas of application and current commercialization, i.e., the extraction of solid vegetal raw matters.

Part II of the book is devoted to some of the most recent but not less successful technological developments in high pressure food technology, while Part III collects a wide number of highly promising applications in the field of food processing innovation.

The book is addressed primarily to graduate students and scientists involved in education and research in food engineering. Additionally, Part III of the book offers broad and comprehensive information on current applications of high pressure technology to develop special foods and food ingredients, particularly attractive to persons related to the food producing systems and food market.

This book is a result of the consorted efforts of a team of chemical engineers, chemists, and food technologists who have extensive experience in research and development of high pressure processes for innovation in food technology. It has been a privilege and an honor for the editors to work with them and they thank each and every one of the authors, experts from all around the world, for their outstanding contributions.

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