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Electrotechnologies for Extraction from Food Plants and Biomaterials

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Preface

Solvent and pressure extraction are the major unit operations in many food and related industries (production of sugar, wine, vegetable oils, and fruit juices), recuperation of valuable plant components (proteins, antioxidants, and flavors), dehydration of fibrous materials and biological wastes, etc.

Recently, electrotechnologies, based on effects of pulsed electric fields (PEF), ohmic heating (OH), and DC electric field, gained the real interest in relation to the processing of foods. These techniques allow enhancement of efficient extraction from food plants and dehydration of biosolids. PEF and pulsed OH preserve nutritional, functional, structural, and sensory properties of products better than conventional extraction technologies. Electrofiltration and electro-osmotic dewatering can be very effective for separation of bioproducts and dehydration of food wastes. This book overviews fundamental principles of the said electrical techniques, electrophysical properties of foods and agricultural products, and application of various emerging electrotechnologies for enhancing the solid?liquid separation and drying processes, extraction of pigments, processing of different in-plant tissues and biosolids, electro-osmotic dewatering and electrofiltration of biomaterials, recent industrial-scale gains, and other aspects.

In Chapter 1 the main mechanisms of electroporation, important differences between single-cell and tissue electroporation, and effects of the treatment parameters and media composition are discussed. Various applications of electroporation in biotechnology, medicine, food preservation, and tissue ablation are also reviewed. In Chapter 2, the fundamental aspects of electroporation in application to electrically induced damage of plant tissues are critically discussed, and recent experiments in PEF-induced acceleration of expression, diffusion, and drying processes are analyzed. Chapter 3 reviews perspectives of the moderate electric field (MEF) application for improvement of extraction, dehydration, and fermentation operations. In Chapter 4, the effects of the low-intensity DC electrification of vegetative and animal materials in food and agricultural applications are presented. In Chapter 5, the electric field applications for electro-osmotic dewatering of biomaterials, food processing products and wastes, and biomass sludge, are covered in details. Chapter 6 reviews different examples of electrofiltration application for dewatering of biopolymers and fractionation of different polymer colloids. The general guidelines to operation of the press electrofiltration, based on the practical

experience of the authors with this technology, are also summarized. Chapter 7 contains illustrations of the potential of PEF application for food preservation, enhancement of mass transfer processes, and softening of the plant tissues. The energy requirements and cost-effectiveness are also analyzed. Chapter 8 analyzes application of high-voltage electrical discharges for enhancing kinetics and quantity of extracted matter extracted from the oilseeds and other food plants. And, finally, in Chapter 9 the technical requirements and perspectives of industrial-scale electroporation of the plant cell tissues are discussed. The recent industrial applications for sugar beet treatment, green biomass conditioning, and extraction of aromas and flavors from the wine grapes are also considered.

We sincerely hope that this book will be useful for the engineers and scientists searching the new efficient methods for extraction and separation of desired components from plant materials.

Eugène Vorobiev — Compiègne Cedex, France
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