Processing Fruits

Second Edition

Science and Technology

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Edited by

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Preface

Fruits are botanically similar plant organs in that they are all composed of seeds surrounded by a juicy, colorful, and aromatic ovary which we humans consume as food. Some things we traditionally consider to be "vegetables", such as tomatoes, cucumbers, corn, and squash, are actually fruits from the botanical point of view. However, fruits vary widely in their shape, size, color, texture, flavor, nutritional properties, potential for extended shelf-life, and ability to withstand different types of processing. While fruits are delicious, nutritious and therefore desirable components of our diet, they suffer from being extremely perishable. For this reason, it is often advantageous to preserve them for longer shelf-life and easier transport to locations distant to the site of production. Processing also transforms the raw material into new, and perhaps improved, product. This book endeavors to serve as a single source of information about the biology of fruit and a description of the various methods used to preserve fruit. The book covers both traditional methods of preservation, such as canning, freezing, and drying, and looks to the future of novel processes such as high pressure, pulsed electric fields, and ohmic processing. The second half of the book focuses on the major processed fruit products and describes the diverse methods that may be used to preserve them.

This book is the second edition of a two-volume book series published in 1996. The first edition separated the biology, principles, and applications into volume one and the major processed products in volume two. When we were asked to consider the editorship of a second edition, we readily agreed because it was clear that an even more detailed and current publication could result given new research and technology. In this second edition, we have introduced new technologies that appear to show promise for the preservation of fruit, such as the production of fresh-cut fruit. There are two brand new chapters addressing these topics. In many cases, we have gone back to the first edition authors and asked for their assistance in updating their chapters. We have added new authors to some chapters, in order to broaden the scope of what was written previously.

For this second edition, we decided to put both of the original volumes into one complete package, allowing the reader to consult one succinct resource for anything he or she wants to know about fruit processing. This book is unique in comparison to others currently available because it covers a greater breadth of topics, and includes detailed descriptions of the processing of over 20 different major fruits. No other book published in the last 25 years (with the exception perhaps of the first edition of this series) comes close to providing the same degree of information on methods for the preservation of fruit.

We begin the book with a description of different fruit classes, and the principles of preserving fruits in their most fresh-like state, that are stored as whole fruit (under either refrigerated or controlled atmosphere conditions) or lightly processed as fresh-cut fruit. Then the chapters progress through methods that involve increasing degrees of process severity. For example, the production of fruit juice involves mild pasteurization treatments in combination with refrigerated storage, and drying may be carried out in the sun. Freezing typically involves a mild blanching step, while ionizing radiation and canning involve treatments that are relatively more intense. A new chapter on novel processing technologies has been added.

The last chapters in Part I of the book describe other topics relevant to the preservation of fruit, e.g., microbiology, food additives, quality assurance, packaging, grades and standards, and residue management. Part II covers more than 22 major processed fruits, including apples, peaches and apricots, sweet and sour cherries, plums, prunes, strawberries, raspberries, cranberries, grapes, oranges and tangerines, grapefruit, lemons and limes, bananas, tropical fruit, coconut, avocadoes, olives, and nuts.

This book will fill a critical need for students and professors, industry personnel, government agents and others working on the preservation of fruit. It is intended as a resource for both individuals familiar with fruit processing who want to expand their horizons, and as an introduction to the diversity of preservation methods for the inexperienced individual. It has been a joy, and a continuing learning experience, for us to be involved in its creation.

Diane M. Barrett
Laszlo P. Somogyi
Hosahalli Ramaswamy

Acknowledgments

This book is dedicated to the students, scientists, and food processing industry professionals who strive to produce attractive, nutritious processed fruit products for the international consumer. Diane Barrett is indebted to Dr. Laszlo Somogyi for his initiation of this project, and to her husband Pieter and daughter Jodie for their continuing love, support, and understanding.

Editors

Diane M. Barrett graduated with a B.S. in Food Science & Technology from the University of California, Davis, where she is currently on faculty. She received her M.S. in Food Chemistry from the University of Wisconsin, Madison and her Ph.D. in Food Biochemistry from Cornell University, Ithaca, NY. After acquiring her M.S., Dr. Barrett spent four years doing food science research and education in Indonesia as a consultant with the World Bank and U.S. Agency for International Development.

At U.C. Davis, Dr. Barrett conducts extension courses for the fruit and vegetable processing industry and carries out applied research. Extension courses include the Better Process Control School, Freezing Technology Workshop, Juice Processing Course, Tomato Processing School, Fresh-Cut Products Workshop and Aseptic Processing & Packaging Workshop. Her research focuses on the effects of raw materials and processing conditions on the quality of fruit and vegetable products. She is particularly interested in the relationship between endogenous enzymes and the color, texture, flavor, and nutritional quality of fruits and vegetables. When she is not harvesting tomatoes or processing fruit, Dr. Barrett enjoys swimming, kayaking, and traveling with her family.

Laszlo P. Somogyi specializes in the technical, regulatory, and nutritional aspects of food processing operations, techno-economic studies of food ingredients, and post-harvest handling of fruits. During his 40 years experience in working for and consultation to food industry firms he worked at Hunt-Wesson Foods, Vacu-Dry Company, Finn-Cal Products, and SRI International. Dr. Somogyi has published over 40 technical papers and has contributed to a number of textbooks on subjects of food ingredients, additives, food and beverage processing technologies, fruit quality, and food irradiation, and has been the lead author for SRI's *Chemical Economics Handbook* and *Specialty Chemical Economics Update,* multiclient reports dealing with food additives and flavors and fragrances. Since his retirement from SRI in 1998 he has been participating in U.S. Agency for International Development programs in Egypt and Lebanon and consulting for several food ingredient manufacturers.

Dr. Somogyi received a B.S. degree from the University of Agricultural Sciences in Budapest, Hungary, holds M.S. and Ph.D. degrees from Rutgers University; and was a post-doctoral fellow at the University of California, Davis. He was elected as Fellow of the Institute of Food Technologists, and is a member of the American Association of Cereal Chemists, and the American Oil Chemist's Society.

Dr. Hosahalli Ramaswamy is a Professor in the Department of Food Science at McGill University in Montreal, Canada with teaching and research responsibilities in the areas of Food Processing and Post Harvest Technology. He obtained his M.Sc. and Ph.D. in Food Science from the University of British Columbia, Vancouver. Dr. Ramaswamy's primary research area is thermal and non-thermal processing. In his research activities, he has explored the use of conventional thermal processing as well as thin profile, rotational, microwave, RF, ohmic and aseptic processing. In the area of non-thermal processing, his research focus has been application of high pressure processing for food systems. He has also carried out extensive research in the area of computer modeling, rheology and use of artificial neural networks for process characterization and optimization. Dr. Ramaswamy is a professional member of several organizations such as IFT, CIFST, IFTPS, ASAE and CSAE. He has served as Chair of the Heat Penetration Committee of the Institute for Thermal Processing Specialists, Chair of the Radiation Committee of ASAE, and has been serving as an

associate editor of *Transactions of ASAE* (ASAE) and *Journal of Food Science.* He is also on the editorial board of *Food Research International, Food Science and Technology Journal,* and *Journal of Food Process Engineering.* He has published over 175 refereed scientific papers and supervised over 30 graduate students. He has received the 1999 W.J. Eva Award by the Canadian Institute of Food Science and Technology, the 2002 John Clark Award of the Canadian Society of Agricultural Engineering, and is a 2002 Fellow of the Association of Food Scientists and Technologists (India).

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