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*Eva Almenar, Muhammad Siddiq and Crispin Merkel*

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## 45 Food Quality and Safety Assurance by Hazard Analysis and Critical Control Point

*Tomás Norton and Brijesh Tiwari*

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*Gerard La Rooy*

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*Index to Volumes I and II*
Generally, a process is defined as a sequence of events that transforms the biological materials of food products, via biochemical changes, into stable forms with added value. This can create new products or modify existing ones. Process design refers to the design of food processes and manufacturing methods, while plant design refers to the design of the whole processing plant. The processing of food is no longer as simple or straightforward as in the past. Food process design is an interdisciplinary science that is highly regarded by the food industry. The architecture of food process engineering is based on the solid foundations of chemical and mechanical engineering, together with the basics of microbiology, chemistry, nutrition, and economics. Other related disciplines, including instrumentation, computer science and mathematics, complete the discipline. Process design is the core of food engineering, and frequently begins with a concept and eventually ends in fabrication. Many types of documentation are involved in the process to test theories, display results, and organize data.

Today, the food industry is one of the largest manufacturing industries in the world and the significant contribution of food engineers to the industry is well recognized. A professional food engineer should be well versed in the basic principles, processes, flow diagrams, instrumentation and process control. The Handbook of Food Process Design has been developed primarily for fulfilling these expectations and is intended to be used by students in undergraduate and graduate courses in food process engineering/food technology/biochemical engineering, as well as by professionals working in the food industry. It could also be used by graduates in other disciplines, such as chemical and/or mechanical engineering.

The editors of this book have vast experience in teaching, research, and extension activities related to the food industry and have long realized the need for such a handbook on process equipment design to fill the current gap in the basic and applied fields of food engineering. They have endeavoured to gather eminent academics and professionals from across the globe and have succeeded in securing their participation in this book. All the contributors have diverse backgrounds, ranging from electronic engineering to food science.

The book contains 46 chapters in two volumes, with chapters grouped according to their similar subject matter. Chapters 1–12 are devoted to the basic principles, starting with units and dimensions, moving on to thermodynamics and reaction kinetics pertaining to foods, and followed by sensors and instrumentation involved in process automation. The handbook is well balanced by its coverage of unit operations involved in conventional and novel processing technologies to be used by the food industry.
Each chapter is intended to provide concise up-to-date descriptions of fundamentals, applications, solved problems, and methods of cost analysis. Chapters 13–18 cover heating and cooling systems used in food processing, including pasteurization, sterilization, refrigeration, and freezing. Drying is considered one of the most successful unit operations used in the food industry. Process design related to the drying of food materials is covered in Chapters 19–22.

Some important process designs, such as crystallization, extrusion, aseptic processing, baking, and frying, are well discussed in Chapters 23–28. Chapters 29–32 cover mechanical operations related to food process industries, including mixing/agitation, size reduction, and extraction and leaching processes. Chapters 33–40 focus on novel process designs, including pulsed light, ultrasound, ohmic heating, pulsed electric field, high pressure, and irradiation. Food packaging is discussed in Chapters 41–44, while quality systems and cost analysis are covered in Chapters 45 and 46.

The editors are confident that this handbook will prove to be interesting, informative, and enlightening to readers in the field. They would appreciate receiving new information and comments to assist in future development of the next edition.

Jasim Ahmed
Mohammad Shafiur Rahman
We would like to thank Almighty Allah for giving us life and the opportunity to gain knowledge to write this important book. We wish to express our sincere gratitude to the Sultan Qaboos University, Polymer Source Inc. and Kuwait Institute for Scientific Research for providing the opportunity and facilities to execute such an exciting project, and for supporting us in research and other intellectual activities around the globe.

We sincerely acknowledge the sacrifices made by our parents during our early education. Appreciation is due to all our teachers in the course of our careers. Special thanks to our colleagues and other research team members for their support and encouragement. We are grateful to our contributors for their wonderful cooperation and, finally, we are indebted to our families for their continued support and patience throughout the project.

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Dr Ahmed has served as an editor of the *International Journal of Food Properties* for more than 5 years. Furthermore, he has served as special editor for a number of other journals. He is also associated with the editorial boards of three international journals. In 2010, he was invited to serve as a sub-panel member for the Food Processing and Packaging Section of the Institute of Food Technology (IFT), Chicago, USA.

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Dr Ahmed was awarded a gold medal by Jadavpur University, India for securing the top position in the M.Tech degree. He has received several grants from various funding agencies to carry out his research during his academic career. He received a best reviewers’ award by Elsevier in the area of food engineering in 2009.

Dr Ahmed has been involved in food processing teaching, research and industry over 18 years and has proved himself an active scientist in the area of food engineering. He has worked on food product development, food rheology and structure, novel food processing and the thermal behaviors of foods. His current research focus is on biopolymer and starch-based nanocomposites. Dr Ahmed’s work has been well recognized globally: there are more than 1000 citations of his work and his h-index is 20.
Mohammad Shafiur Rahman

Mohammad Shafiur Rahman, Professor at the Sultan Qaboos University, Sultanate of Oman, is the author or co-author of over 250 technical articles including 90 refereed journal papers, 87 conference papers, 58 book chapters, 34 reports, 12 popular articles, and seven books. He is the author of the internationally acclaimed and award-winning *Food Properties Handbook*, published by CRC Press, Boca Raton, Florida, which was one of CRC’s bestsellers in 2002. The second edition is now released under his editorship. He was also the editor of the popular book *Handbook of Food Preservation* published by CRC Press, Boca Raton, Florida. The first edition was one of CRC’s bestsellers in 2003, and the second edition is now on the market. He was invited to serve as one of the associate editors for the *Handbook of Food Science, Engineering and Technology*, and as one of the editors for the *Handbook of Food and Bioprocess Modeling Techniques* published by CRC Press.

Professor Rahman initiated the *International Journal of Food Properties* (published by Marcel Dekker) and has served as the founding editor for more than 10 years. He also serves on the editorial boards of eight international journals. He is a member on the Food Engineering Series Editorial Board of Springer Science, New York, and serves as a section editor for the Sultan Qaboos University Journal of Agricultural Sciences.

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Professor Rahman is an eminent scientist and academic in the area of food processing. He is recognized for his significant contributions to the basic and applied knowledge of food properties related to food structure, engineering properties and food stability. His total SCOPUS citation is more than 1200 and his h-index is 20, which indicates the high impact of his research in the international scientific community.
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