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Selected Topics in Food Process Engineering

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Preface

This book is based on the oral presentations at CIBIA XIII (Ibero-American Congress on Food Engineering XIII) held at Universidad de Antioquia, Medellin, Colombia. All the chapters were reviewed by experts in their respect fields and copyedited.

These CIBIA events are taking place since 1995 and they are held every 2–3 years in different countries from Latin America, Spain, and Portugal. SIBIA (Sociedad Iberoamericana de Ingeniería de Alimentos) is the organization in charge of selecting place and date for these Conferences, and it also plays a role in the planning of these events. In the case of CIBIA XIII, CAFE (Colombian Association of Food Engineering) was instrumental for the success of this Congress.

The book is titled *Selected Topics in Food Process Engineering*, and it was conceived to cover some traditional and novel topics that are currently impacting the world of food engineering and beyond.

At the time of designing this book, one of Editors, Professor Ricardo Simpson, Universidad Técnica Federico Santa María, Chile, passed away while spending vacation time with his family. As a scientist he is known and recognized for his incredible talent, dedication, and productivity in food engineering topics mainly thermal processing. He was an exceptional instructor as recognized by the students that attended his courses as well as colleagues worldwide. Besides being a remarkable professional, he was an excellent colleague who worked with a number of us in several international projects. After his passing, all his co-editors are dedicating this book to him as a tribute to his outstanding professional career and for the wonderful friendship we developed through the many years of interacting with him.

This book includes 24 chapters in a number of areas of current interest to food scientist, food engineers, and allied disciplines. These chapters are thorough, up-to-date; they were written mostly by well-recognized scientists from Ibero America with diverse backgrounds. Some of the topics addressed include a bird's-eye view of food science and technology and where it is headed to; circular economy; high pressure processing; photoinactivation of pathogens; 3D food printing; engineering aspects of selected unit operations; green extraction; recent developments in

biotechnology, nanotechnology, and bioingredients as applied to foods. In addition to the scientific/technical components, each chapter includes, whenever appropriate, considerations on the environment, carbon food-prints, circular economy, the food supply chain, health, and well-being, all of them quite relevant in today's food processing world.

The Editors and Associate Editors are thankful to the authors, reviewers, and the copyeditor Jeannie Bagby for their contributions to make this book project a reality. We sincerely hope this book will be a meaningful contribution to the body of knowledge in food engineering.

Medellin, Colombia

Valparaiso, Chile

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This book was inadvertently published without including the below two sections in the book. These have now been added in this updated version of the book.

- An Acknowledgment page to Ricardo Simpson, one of the editors who passed away, inserted in the front matter
- Biographical sketches of the editors inserted in the front matter

Acknowledgment

Ricardo J. Simpson
March 19, 1954 – February 3, 2022



It is with great sadness that we announce the passing of Ricardo J. Simpson, our dear Chilean colleague who dedicated most of his professional career to Food and Chemical Engineering. Everyone who met Ricardo will remember him as a great man, an extraordinary engineer, a highly dedicated scientist, and an excellent teacher. He was a true gentleman who recognized and elevated the talents of others. He was very friendly, a family man, and very much loved and admired by his students, his peers, family members, and friends.

Ricardo was a Professor at the Department of Chemical and Environmental Engineering, Federico Santa María Technical University, Valparaíso, Chile. He received his BS in Biochemical Engineering from Valparaíso Catholic University, Chile, and MS and PhD in Food Engineering at the Department of Food Science and Technology, Oregon State University, USA. He was an IFT Fellow, IAFoST Fellow (International Academy of Food Science and Technology), and Chilean Representative within IAEF (International Association for Engineering and Food). He was Co-Chair of very relevant international events in his home country such as ICEF X

(International Congress on Engineering and Food, 2008), CIBIA IV (Ibero American Congress on Food Engineering, 2003), and CIBIA XI (2017). In his country he provided leadership to a number of professional societies dealing with food and chemical engineering. Among many executive positions, it is worth mentioning he was twice the President of the Chilean Institute of Food Engineering (ICHIA).

Ricardo dedicated significant amount of time to teaching where he excelled as demonstrated by the numerous awards he received in his institution such as “Teacher of Excellence” in two occasions. Former students always highlight the mark Ricardo left on them, not only as a superior teacher, but for the values he conveyed to them on how to face personal and professional life with integrity, determination, and faith. As a contribution to undergraduate education, among many others, he published together with Sudhir Sastry an excellent book titled *Chemical and Bioprocess Engineering, Fundamental Concepts for First-Year Students*. Among many other administrative positions, he was Department Chair and Director of the Master Program in his department for a number of years, was instrumental in putting together a multidisciplinary doctoral program in Applied Engineering, and served as a Member of the Academic Council as well as the Superior Council, all at Federico Santa María Technical University.

He made significant contributions to the body of knowledge in thermal processing and packaging of food as evidenced by his more than 100 peer-reviewed scientific articles, 20 book chapters, and countless invited and volunteered presentations. Specifically he has outstanding contributions in the field of modeling, simulation, control, and process optimization of low acid foods. He published either as an author or editor excellent books that became classics, essentials for those working on engineering topics, mainly, as mentioned, in thermal processing. These are the most relevant ones,

- Holdsworth, D., and Simpson, R. *Thermal Processing of Packaged Foods* – 2nd Edition, Springer, 2007
- Simpson, R. (Editor) *Engineering Aspects of Thermal Processing*, CRC Press, 2009
- Aguilera, J.M., Barbosa-Cánovas, G.V., Simpson, R., Welti-Chanes, J., and Bermudez-Aguirre, D. (Editors) *Food Engineering Interfaces*, Springer, 2011
- Simpson, R. and Sastry, S. *Chemical and Bioprocess Engineering, Fundamental Concepts for First-Year Students*, Springer, 2013
- Holdsworth, D., and Simpson, R. *Thermal Processing of Packaged Foods* – 3rd Edition, Springer, 2015

Ricardo was a highly decorated colleague who received numerous awards, scholarships, and recognitions like the Chilean President scholarship to conduct graduate studies at Oregon State University, two Andes Foundation scholarships to spend time at US institutions, two scholarships granted by the Government of France to conduct research at CIRAD and IFREMER, and sabbatical leaves at Ohio State University, USA; University of California-Davis, USA; McGill University, Canada; and Unilever-Vlaardingen, The Netherlands. It should be highlighted that Ricardo received from the Chilean Engineering Academy the major award it grants, the National Award.

In terms of professional contributions, Ricardo was continuously working with food companies in Chile and abroad. As an example of his meaningful contribution to the food industry it should be mentioned that in 1998 he collaborated in a preliminary study with scientists from Malloa-Unilever, San Fernando, Chile, to improve tomato concentration. This project resulted in a major change the way tomato concentration is conducted. This preliminary work continued at Unilever-Vlaardingen where a unique simulation and optimization software for thermal processing of foods was developed. Based on this software it was possible for the first time to implement a variable retort process which optimizes food quality of canned foods at the industrial scale.

We tried to highlight some of the immense number of scientific and technical contributions by Ricardo Simpson throughout his prolific professional career. By no means this is a comprehensive recount of all what he did, but an effort to recognize his involvement with the profession in many different capacities. All his accolades will not overshadow what he was as a human being but let's take these words as a tribute to a man of integrity who honored our profession throughout his life.

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About the Editors

Oscar A. Vega-Castro is a professor and scientist at Universidad de Antioquia, Colombia, as well as the coordinator of the Research Group BIOALI. He received a BS degree in Agricultural Engineering at Universidad Nacional de Colombia, followed by a master's degree in Food Technology and a PhD in Engineering. Dr. Vega-Castro specializes in unit operations in food engineering and experimental design for food processes. He has served as a Guest Editor for *Journal of Food Process Engineering*, has published around 40 scientific articles, and was recognized as the Best Professor in the Health Area at University of Antioquia in 2014.

Ricardo Simpson was a professor and scientist at Universidad Federico Santa María (UTFSM), Chile. He earned his PhD at Oregon State University, USA. After completing his doctoral studies, he worked in the Department of Chemical and Environmental Engineering at UTFSM. He was well known for his work on the thermal processing of food and was one of the co-organizers of the International Congress of Engineering and Food (ICEF 10) held in Viña del Mar, Chile. Among his many accolades, he was recognized as an IFT and IAFoST Fellow. He wrote a good number of articles that were highly regarded by the food engineering community and beyond.

María del Pilar Buera is a professor and scientist at the University of Buenos Aires, Argentina. She has a BS in Chemical Sciences from UBA and a PhD from FCEN-UBA, where she is now an Emeritus Professor of Food Chemistry. In addition, she is a senior researcher at ITAPROQ, Institute of Food Technology and Chemical Processes, FCEN-UBA, CONICET, Argentina. She was the main organizer of the 2004 ISOPOW in Buenos Aires, is an IAFoST Fellow, participated in an IUPAC Project on State Diagrams, and was a member of ISEKI-Mundus. Among other areas, she specializes in the circular economy and sustainable development.

Diana M. Granda-Restrepo is a professor and scientists at the University of Antioquia, Colombia. She is part of the BIOALI Research Group in the Faculty of Pharmaceutical and Food Sciences. She holds a PhD in Science, an MS in Biotechnology, and a BS in Food Science and Technology, all obtained from University of Antioquia. She specializes in food packaging and is a Senior Researcher at the Ministry of Science and Technology, Colombia. Her research focuses on active and intelligent food packaging with an emphasis on the valorization of agri-food wastes. Dr. Granda Restrepo has authored numerous scientific articles in national and international journals and several book chapters.

Cristian Camilo Villa Zabala is a professor and scientists at the University del Quindío, Colombia. He obtained his BS from this university and a PhD in Chemistry from Universidad Nacional Río Cuarto, Argentina. Upon his return to the University of Antioquia, he held several scientific positions related to nanomaterials and chemistry. He has published a number of scientific articles on topics including nanomaterials, antimicrobials, starch-based nanomaterials, photoinactivation, natural antimicrobials, bioactive food coatings, zeolites for food applications, [curcumin-based food packaging materials](#), molecularly imprinted polymers for food applications, [chemical, structural, and thermal characterization of various Arracacha starches](#).

Magda I. Pinzón-Fandiño is a professor and scientist at the University del Quindío, Colombia. She obtained her PhD from Polytechnic University of Valencia, Spain. She has been working at the University del Quindío for more than 38 years, dealing with a number of topics in food science, food technology and food engineering. She specializes in the economic aspects of coffee production. She is the Director of the Food Analysis and Sensory Evaluation programs at the Faculty of Agro-Industrial Sciences and the Leader of the Food Science and Technology Group. She has keen interest in the revalorization of some agricultural products for their conversion into edible films and biodegradable packaging.

Gustavo Fidel Gutiérrez-López is a professor and scientist in food engineering at the National Polytechnic Institute (IPN), Mexico. He holds a PhD and an MSc in Food Engineering from the University of Reading, UK. He specializes in the structure and functionality of foods at the macro, micro, and nano levels. He has published more than 200 scientific articles and book chapters and has edited eight books. Dr. Gutiérrez-López is an IUFoST Fellow, a two-time recipient of the Mexican Award in Food Science and Technology, and the recipient of the IPN Lázaro Cárdenas Medal and IAEF Lifetime Achievement Award. He is an ISOPOW Honorary Member and an ISEKI-Food Academy Member.

Gustavo Víctor Barbosa-Cánovas is a Professor of Food Engineering and Director of the Center for Nonthermal Processing of Food (CNPF), both at Washington State University, USA, and a Doctor Honoris Causa at the Polytechnic University of

Cartagena, Spain. His research focuses on novel alternative technologies, primarily nonthermal processes, where the main stress factor used to inactivate microorganisms is not thermal energy. In addition, he has developed research programs on the engineering properties of foods (powders, rheology, water activity), controlled release, food dehydration, and edible films. He has a keen interest in food security, well-being, sustainability, green processes, and mathematical modeling.

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