

Food and Package Engineering

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Scott A. Morris

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Dedication

To my parents, Frances Stearns Morris and the late Dr. Allan J. Morris, and to my wife Kathleen and stepson Michael. Also, to my sister and brother-in-law, Pamela Morris-Carlson and Ross Carlson, as well as my nephews Grant and Pierce, who have all been eternally good hosts and have somehow managed to keep their general amusement reasonably well contained.

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Preface

Books that seek to cover broad expanses of knowledge are like kitchen appliances that promise to do dozens of different tasks. The truth is that they cannot do each job as well as a specialized implement, and this book is no exception. Each chapter subheading is an entire field of study, a career, and an industry unto itself, and to cover each topic comprehensively would deplete the world's trees (or its electrons). This book is intended to give a useful overview of the food processing and packaging industries, touching on important points and technical concepts, and unfortunately must omit a good amount of detail. Worse, when trying to describe an entire constellation of subjects that are connected together to a relatively common purpose, the end result is something like a map projection – a sphere flattened onto paper, with all the distortions that it implies, and then linearized into a sequence of words, distorting the picture still further. I can hope that the result informs and interests people enough to spend time re-expanding the content into a larger and more complete picture.

This particular book is the result of teaching introductory packaging and food engineering classes, often to students who do not have a deep mathematics background (or have not used it recently). It is intended to give a general framework for teaching such classes, and a reasonable amount of introductory material, since an utterly complete and unified text on these subjects would be both unmanageably large and would not leave room for individual interests.

Isaac Newton is credited with saying, “If I have seen further, it is by standing on the shoulders of giants” when writing to a rival scientist, the hunchbacked Robert Hooke, with whom he both competed and collaborated. That this was originally attributed to Bernard of Chartres in 1130, who was repeating a current sentiment, does not matter, because it reflects a fundamental truth – a broad perspective is only possible when you have the work of many others to refer to. I urge the reader to search for more information on the topics presented because this is a fast-changing field, but I would also hope that the framework presented will hold fast and provide a good navigational chart for finding one's way through the easily published fog of information that is often doubtful in its accuracy and objectivity.

Many hundreds of publications were reviewed during the writing of this book, but a complete bibliography has been intentionally omitted. The citations contained in each chapter's references section have been included because they should provide the reader with additional useful information or data sources, and as many of these as possible are available via the Internet. This brings up the inevitable problem of “link rot” – the changing or elimination of archival Internet

material – and is the eternal bane of publishing links on paper. In as many cases as possible, searchable titles or headings have been provided so that the items may be found either under new headings or in archival websites such as www.archive.org that, as of this writing, maintains old postings.

Scott A. Morris
Urbana, Illinois

Acknowledgments

This book would not exist – for better or worse – without the persistent and very patient urging of several people: Mark Barrett of Wiley-Blackwell (now part of John Wiley & Sons), and Mary Ellen O’Shaughnessey of the University of Illinois, both of whom have alternately prodded and cheered over the very long time that this book was not being written, and with the addition of Susan Engelken, who has answered annoying questions and dealt with general nonsense over the last two years when it really was. Thank you. Credit should also go to the Hulme family who have provided a continuing respite from the flatlands and a safe harbor in several storms of different sorts.

I am also most grateful to:

Mr. Timothy Yost, who taught me, years ago, to never fear a blank page of paper when physical sheets of paper sat in mechanical typewriters. The jury is still out on whether the result was a good thing or not.

Mr. William Knapp, who demonstrated just how cool physics was. The fire department does not show up at my classes nearly so often these days, so I must be getting the hang of it.

Mrs. Linda Allen, who put up with a gaggle of pre-Silicon Valley punch-card nerds, just for the fun of it.

Dr. William D. O’Brian Jr. for taking on a moderately annoying new faculty member and intermittently encouraging and castigating him as the situations warranted.

The University of Illinois at Urbana-Champaign for sabbatical leave to begin this book in earnest during the 2008–2009 academic year.

The University of Illinois at Urbana-Champaign libraries’ staff, and particularly the staff of the Grainger Engineering Library, for their general patience, assistance, and good humor.

Many of the helpful donors of images for the book.

And an endless array of smart, challenging examples of good scholarship and clear thinking given to me by my own teachers, friends, professors, mentors, students, and a few of my colleagues – you did your best. Anything good here is yours, the bad stuff and omissions are solely mine.