

Food Engineering Series

Series Editors

Gustavo V. Barbosa-Cánovas, Washington State University, USA

Advisory Board

José Miguel Aguilera, Catholic University, Chile

Kezban Candoğan, Ankara University, Turkey

Richard W. Hartel, University of Wisconsin, USA

Albert Ibarz, University of Lleida, Spain

Micha Peleg, University of Massachusetts, USA

Shafiur Rahman, Sultan Qaboos University, Oman

M. Anandha Rao, Cornell University, USA

Yrjö Roos, University College Cork, Ireland

Jorge Welti-Chanes, Tecnológico de Monterrey, Mexico

Springer's *Food Engineering Series* is essential to the Food Engineering profession, providing exceptional texts in areas that are necessary for the understanding and development of this constantly evolving discipline. The titles are primarily reference-oriented, targeted to a wide audience including food, mechanical, chemical, and electrical engineers, as well as food scientists and technologists working in the food industry, academia, regulatory industry, or in the design of food manufacturing plants or specialized equipment.

More information about this series at <http://www.springer.com/series/5996>

Ertan Ermiş
Editor

Food Powders Properties and Characterization

 Springer

Editor

Ertan Ermiş
Food Engineering Department
Faculty of Engineering and Natural Sciences
Istanbul Sabahattin Zaim University
Istanbul, Turkey

ISSN 1571-0297

Food Engineering Series

ISBN 978-3-030-48907-6

ISBN 978-3-030-48908-3 (eBook)

<https://doi.org/10.1007/978-3-030-48908-3>

© Springer Nature Switzerland AG 2021

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Due to recent developments and progress in food powder technology and significant advancement in the analytical and processing possibilities, there has been a gap in the literature in this field. For this reason, we would like to introduce *Food Powders Properties and Characterization* with a great pleasure to our respected readers. The students, industrialists, and researchers studying or dealing with food powders may benefit from this book which presents the fundamental properties of food powders and methods of characterization. The chapters include relevant aspects of particle properties as well as bulk powder properties. The main focus of this book was to give a comprehensive overview of powder characterization and an insight into recent research work related to food powders.

In this book, the physical and chemical properties of food powders and their effect on food powder behaviour are discussed. In addition, some chapters were focused on particle properties, modification of particles, caking–anticaking mechanisms, powder from fruit waste, and microbiological assessment of food powders. We have also included a chapter about rehydration behaviour of food powders which particularly have high protein content. We hope that this book will help to fill the knowledge gap in the literature.

We are very grateful to Springer Nature for their valuable guidance and cooperation. I would like to thank all authors for agreeing to be a part of this book project.

Istanbul, Turkey
April 2020

Ertan Ermiş

Contents

1 Food Powders Bulk Properties	1
Banu Koç, Mehmet Koç, and Ulaş Baysan	
2 Food Powders Particle Properties	37
Ulaş Baysan, Mehmet Koç, and Banu Koç	
3 Adhesion of Food Powders	53
Ertan Ermiş	
4 Characterization of the Caking Behaviour of Food Powders	73
John J. Fitzpatrick	
5 Characterisation of the Rehydration Behaviour of Food Powders	91
John J. Fitzpatrick, Junfu Ji, and Song Miao	
6 Anticaking Additives for Food Powders	109
Emine Yapıcı, Burcu Karakuzu-İkizler, and Sevil Yücel	
7 Modification of Food Powders	125
Nasim Kian-Pour, Duygu Ozmen, and Omer Said Toker	
8 Powders from Fruit Waste	155
Sahithi Murakonda and Madhuresh Dwivedi	
9 The Microbiological Safety of Food Powders	169
E. J. Rifna and Madhuresh Dwivedi	
Index	195