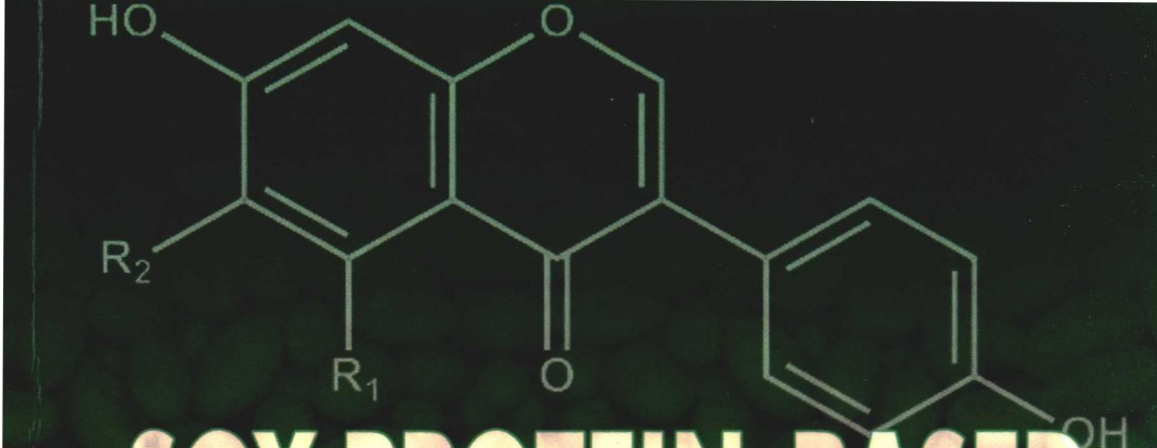

SOY PROTEIN-BASED BLENDS, COMPOSITES AND NANOCOMPOSITES

Edited by
Visakh P. M
Olga Nazarenko

Scrivener Publishing
WILEY

This unique book will enable engineers and natural-based polymer scientists to achieve multi-functionality in products using soy protein and various nano- and micro-sized biobased materials and reinforcements.

Many of the recent research accomplishments in the area of soy-based blends, composites and bionanocomposites are presented in this book. In addition to introducing soy protein and its structure and relationship properties, the book covers many other relevant topics such as the state-of-the-art, new challenges, advances and opportunities in the field such as: biomedical applications of soy protein; electrospinning of soy protein nanofibers, their synthesis and applications; soy protein-based materials rheology; soy proteins as a potential source of active peptides of nutraceutical significance; soy protein isolate-based films; and use of soy protein-based carriers for encapsulating bioactive ingredients.

Audience

The book's main audience is research scholars and engineers working on soy protein and natural/renewable materials. It should be applicable for many industries including construction, biomedical, packaging and automotive/aerospace fields. It will also be a valuable resource for postgraduate and undergraduate students

Visakh P. M is working as post doc. researcher at Tomsk Polytechnic University, Russia. He obtained his PhD, MPhil and MSc degrees from the School of Chemical Sciences, Mahatma Gandhi University, Kottayam, Kerala, India. He has edited 15 books for a variety of international publishers and has been a visiting researcher in many countries since 2011. His research interests include polymer nanocomposites, bio-nanocomposites and rubber based nanocomposites, fire retardant polymers, liquid crystalline polymers and silicon sensors.

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Cover design by Russell Richardson
Front cover images from Pixabay.com

WILEY

www.wiley.com

www.scrivenerpublishing.com

Also available as an e-book

ISBN 978-1-119-41830-6

9 781119 418306

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This edition first published 2017 by John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA and Scrivener Publishing LLC, 100 Cummings Center, Suite 541J, Beverly, MA 01915, USA

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Wiley Global Headquarters
111 River Street, Hoboken, NJ 07030, USA

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Library of Congress Cataloging-in-Publication Data
ISBN 978-1-119-41830-6

Cover image: Pixabay.Com
Cover design by Russell Richardson

Set in size of 11pt and Minion Pro by Exeter Premedia Services Private Ltd., Chennai, India

10 9 8 7 6 5 4 3 2 1

Soy Protein-Based Blends, Composites and Nanocomposites

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Beverly, MA 01915-6106

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Preface

Many of the recent research accomplishments in the area of soy-based blends, composites and bionanocomposites are presented in this book. In addition to introducing soy protein and its structure and relationship properties, an attempt has been made to cover many other relevant topics such as the state-of-the-art, new challenges, advances and opportunities in the field; biomedical applications of soy protein; electrospinning of soy protein nanofibers, their synthesis and applications; soy proteins as a potential source of active peptides of nutraceutical significance; soy protein isolate-based films; and use of soy protein-based carriers for encapsulating bioactive ingredients.

This book is intended to serve as a one-stop reference resource for important research accomplishments in the area of soy protein-based biocomposites and bionanocomposites. It will be a very valuable reference source for university and college faculties, professionals, post-doctoral research fellows, senior graduate students, and researchers from R&D laboratories working in the area of soy protein and its biocomposites and bionanocomposites. Since the various chapters in this book have been contributed by prominent researchers from industry, academia and government/private research laboratories across the globe, it is an up-to-date record of the major findings and observations in the field. The first chapter acts as an introduction to soy protein-based blends, composites and nanocomposites, including their scope, state of the art, preparation methods, environmental concerns regarding nanoparticles and related challenges and opportunities.

Included in the second chapter introducing general aspects of soy proteins, is a discussion of their source, structure and relationship properties. Chemical modification and characterization of soy proteins are also included in this chapter along with a description of the applications of soy protein-based nanocomposites and blends. Advances in soy protein-based nanocomposites are addressed in the third chapter, in which the authors discuss how the incorporation of nanoparticles proves to be an effective way to improve physical properties, especially the mechanical properties

and water resistance which limit their extensive use. The properties of the resulting nanocomposites are highly dependent on the processing methods, nature of nanofillers, as well as the dispersion effect of the filler in the matrix. Therefore, the fabrication methods, property-structure relationship, and application of soy protein nanocomposites are also reviewed in this chapter.

The following chapter on applications of soy protein-based blends, composites and nanocomposites discusses many topics, including the particulars of soy protein applications, soy protein-based blends, and those of soy protein-based nanocomposites. The fifth chapter based on biomedical applications of soy protein summarizes many of the recent accomplishments in the area of biomedical research. In this chapter, the authors discuss various topics such as forms and properties of soy proteins, application of plant protein in biomedical applications, application of soy proteins in wound dressings, and the potential use of soy proteins in products and applications in regenerative medicine, tissue engineering, and drug delivery systems.

The following chapter is a good structural basis for the understanding of electrospinning of soy protein nanofibers. Discussed in the chapter are the production of nanofibers from different synthetic and natural polymers, the physical properties of soy proteins that affect their electrospinning, followed by a summary of relevant work that has been done in the area. The chapter closes with a discussion on possible applications of electrospun nanofibers from soy proteins. The use of soy proteins as a potential source of active peptides of nutraceutical significance is the subject of the seventh chapter, which introduces the main concepts along with examples to help readers understand them. This chapter is devoted to reviewing the literature to identify and describe the available methodologies for the identification and production of bioactive peptides from soybean proteins. In addition, potential applications of these peptides as functional foods and therapeutic agents are also highlighted.

The authors of the eighth chapter present a brief account of the topic of soy protein isolate-based films, including soy protein film preparation, characterization of soy protein films, modifications and applications. The last chapter of the book reviews recent progress in the preparation of soy protein-based carriers for bioactive ingredients encapsulation.

In conclusion, the editors would like to express their sincere gratitude to all of the contributors to this book for their excellent support in the successful completion of this venture. We are grateful to them for the commitment and sincerity they have shown towards their contributions. Without their enthusiasm and support, this book would not have been possible.

We would also like to thank all the reviewers who have taken their valuable time to make critical comments on each chapter. We also thank the publisher John Wiley and Sons Ltd. and Scrivener Publishing for recognizing the demand for such a book, realizing the increasing importance of the area of soy protein-based blends, composites and nanocomposites, and for starting such a new project, which not many other publishers have handled.

Visakh. P. M
Olga Nazarenko
Tomsk, Russia
June 2017

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1

Soy Protein: State-of-the-Art, New Challenges and Opportunities

Visakh P. M

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Abstract

This chapter deals with a brief account on various topics in rubber-based bionanocomposites: Preparation and state-of-the-art. It also discusses different topics such as soy protein: Introduction, structure and properties relationship, thermoplastic-based soy protein nanocomposites, applications of soy protein-based blends, composites, and nanocomposites, biomedical application of soy protein, preparation of soy protein nanofibers by electrospinning, physiologically active peptides derived from soy protein, soy protein polymer-based (film) membranes and encapsulation of bio actives using soy protein-based material.

Keywords: Rubber-based bionanocomposites, soy protein, soy protein nanocomposites, soy protein nanofibers

1.1 Soy Protein: Introduction, Structure and Properties Relationship

Soy proteins are one of the most abundant and most widely utilized plant proteins on this planet. With high content of essential amino acid and desirable functional properties, soy proteins have attracted persisting interest in food and pharmaceutical industry. The 11S and 7S globulins represent approximately 60% of the storage protein in soybeans. They are the most important contributors to the physicochemical and functional properties of

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Visakh P. M and Olga Nazarenko (eds.) Soy Protein-Based Blends, Composites and Nanocomposites, (1–22) 2017 © Scrivener Publishing LLC