# Organic-Based Nanomaterials in Food Packaging

Kaiser Younis • Owais Yousuf • Shahid Ul Islam
Editors

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*Dedicated to our teachers from the first day of school to the last day of university and for their continued support*

# Preface

In the burgeoning field of nanotechnology, organic nanomaterials represent a significant stride forward, offering unprecedented opportunities to enhance food packaging technologies. The intersection of organic nanomaterials and food packaging is a vibrant area of research and development, promising to bring about sustainable, efficient, and innovative solutions that address the current limitations of conventional packaging methods. This edited volume, *Advances in Organic Nanomaterials for Food Packaging*, endeavors to encapsulate organic nanomaterials' state-of-the-art synthesis, characterization, properties, and applications for food packaging, aiming to bridge the gap between fundamental research and its practical applications.

The book is thoughtfully structured to provide a comprehensive overview of the field, beginning with the foundational aspects of organic nanomaterial synthesis. Progressing through the text, the reader is introduced to a diverse array of organic nanomaterials, each discussed in terms of their unique properties and specific relevance to food packaging applications. This includes exploring their mechanical properties such as strength, flexibility, and barrier performance against moisture and gases, which are critical in preserving the quality and safety of packaged food products.

Further, the text investigates into the innovative applications of these materials, showcasing how they can be utilized as active agents in food packaging, ripening controllers, scavengers for moisture and oxygen, and as constituents of advanced packaging films and sensors. This book not only highlights the versatility of organic nanomaterials in enhancing the functionality of food packaging but also underscores their potential in contributing to the sustainability of packaging solutions.

A pivotal aspect of the book addresses the conjugation of various organic nanomaterials, illustrating how the synergy between different materials can lead to enhanced performance characteristics. Additionally, exploring nanoemulsions for edible coatings opens new avenues for creating protective, yet edible barriers for food products, marrying convenience with sustainability.

The book's final sections are dedicated to the critical considerations of safety and regulatory issues surrounding the use of organic nanomaterials in food packaging.

This discussion is essential in ensuring that the advancements in nanomaterials are effective, safe for consumers, and compliant with global regulatory standards.

*Advances in Organic Nanomaterials for Food Packaging* is curated to serve as a valuable resource for researchers, industry professionals, and students who are navigating the complex landscape of food packaging technologies. It is our hope that this book will spur further research and innovation in the field, contributing to the development of food packaging solutions that are both effective and environmentally responsible.

As the editor, we extend our heartfelt gratitude to all the contributors whose expertise and dedication have been instrumental in shaping this book. Their insights have enriched the content and paved the way for future explorations in this dynamic field.

Awantipora, Jammu and Kashmir, India — Kaiser Younis
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# About the Editors

**Kaiser Younis, Ph.D.** is an esteemed academician and expert in Food Technology, whose roots trace back to the picturesque valley of Kashmir, India. Embarking on his academic journey at the Islamic University of Science and Technology, Kashmir, he earned a bachelor's degree in food technology. His quest for knowledge continued as he pursued a master's in food engineering from Guru Jambheshwar University of Science and Technology, Hisar, culminating in a Ph.D. in Post-Harvest Engineering and Technology from Aligarh Muslim University, Aligarh. His doctoral research made significant strides in the innovation of dietary fiber-enriched meat products with extended shelf life. Beginning his career in 2016, Younis joined Integral University, Lucknow, as an assistant professor. There, he was not only revered for his unique teaching methodology but also for his considerable contributions to research in food engineering and technology. As an author of 50 manuscripts and a mentor to 2 Ph.D. and 5 M.Tech. students, his influence has propelled his students to make significant contributions to the food technology sector. In 2023, Younis returned to his alma mater, the Islamic University of Science and Technology, Kashmir, as an assistant professor in the Department of Food Technology, where he continues to inspire and guide the next generation of food technologists. Additionally, Younis serves as a consultant for Flavin Private Ltd., Lucknow, providing his expertise in developing novel nutraceuticals and processing techniques. Kaiser Younis's dedication and contributions to food engineering and technology have made him a respected and admired figure among peers and students alike.

**Owais Yousuf, Ph.D.** has been enriching the academic and research landscape with his expertise since 2019, initially as an assistant professor in the field of food technology. In 2023, Dr. Yousuf embarked on a new chapter in his professional journey by joining the Islamic University of Science and Technology, Awantipora, as an assistant professor. Prior to this, he served in the Department of Bioengineering at Integral University, Lucknow, India, where he made significant contributions through his teaching and research endeavors. Dr. Yousuf's principal research and teaching interests lie in the field of Food Engineering and Technology, a passion that was formally recognized with his Ph.D. in Process & Food Engineering awarded in

2019 from G. B. Pant University of Agriculture & Technology, Pantnagar, India. Beyond the classroom and laboratory, he is known for his skills in writing and his avid reading habits, contributing frequently to magazines and newspapers. His engagement with the academic community extends to active participation in over 30 conferences, workshops, and training programs at both National and International levels. Leading a research group with a focus on food by-product utilization, Dr. Yousuf and his team have achieved notable advancements in the development of edible films from food waste over the last two years. Their research aims to create practical applications that benefit a wide range of stakeholders, including consumers, farmers, agricultural organizations, environmentalists, government agencies, and industry. His research in various fields of food processing, including agro-waste valorization, extraction, minimal processing in foods, and food safety, often involves collaboration with local food companies, showcasing a commitment to forging connections between academia and industry for the betterment of the food technology field.

**Shahid Ul Islam, Ph.D.** is a Fulbright Fellow at the University of California, Davis, United States. Before joining the University of California, he was a principal scientist at the Indian Institute of Technology Delhi, India, where he led projects funded by the Science and Engineering Research Board (DST-SERB) and the Council of Scientific and Industrial Research (CSIR), Govt. of India. He is a lifetime fellow of the International Society for Development and Sustainability (ISDS), Japan, and a member of many groups, including the American Chemical Society (USA), and is a life member of the Asian Polymer Association. His scientific recognition includes being among the world's top 2% of scientists on the Stanford University list (2020), winning the prestigious Fulbright grant (2020), winning the Shastri-Indo Canadian fellowship to pursue research at McGill University Canada, receiving postdoctoral offers from RWTH Aachen University, Germany and South-West University, China, winning the DST-SERB (National Postdoctoral) and the CSIR (Research Associate) awards, and being a recipient of several other prestigious national and international awards for his academic achievements. He has also received a Young Researcher Award from the University of Kashmir and an international travel grant for young scientists from the Department of Science and Technology (DST), Govt. of India to present his work at the University of Leeds, United Kingdom. He is the author of numerous scientific articles, including peer-reviewed journal papers, reviews, chapters, patents, and books published by the American Chemical Society, Royal Society of Chemistry, Elsevier, Wiley, Springer, etc. His research goals are interdisciplinary, with a main emphasis on sustainable chemistry and green engineering practices.