

Smart Nanomaterials Technology


Azamal Husen *Editor*

Nanomaterials from Agricultural and Horticultural Products

 Springer

Smart Nanomaterials Technology

Series Editors

Azamal Husen , Wolaita Sodo University, Wolaita, Ethiopia

Mohammad Jawaid, Laboratory of Biocomposite Technology, Universiti Putra Malaysia, INTROP, Serdang, Selangor, Malaysia

Editor
Azamal Husen
Wolaita Sodo University
Wolaita, Ethiopia

ISSN 3004-8273 ISSN 3004-8281 (electronic)
Smart Nanomaterials Technology
ISBN 978-981-99-3434-8 ISBN 978-981-99-3435-5 (eBook)
<https://doi.org/10.1007/978-981-99-3435-5>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023

This work is subject to copyright. All rights are solely and exclusively licensed 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 Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Contents

Nanomaterials and Nanocomposites in Agricultural and Horticultural Sectors	1
Y. D. Franco-Aguirre, W. Y. Villastrigo-Lopez, M. D. Davila-Medina, M. E. Castañeda-Flores, R. I. Narro Cespedes, S. C. Esparza Gonzalez, R. Herrera-Rodriguez, and A. Sáenz-Galindo	
Synthesis of Metal Nanoparticles from Vegetables and Their Waste Materials for Diverse Application	13
Shivam Sharma, Anuj Choudhary, Viveka Katoch, D. R. Chaudhary, Radhika Sharma, Antul Kumar, Payal Sharma, Satyakam Guha, Anand Sonkar, and Sahil Mehta	
Synthesis of Metal-Oxide Nanoparticles from Vegetables and Their Waste Materials for Diverse Applications	31
A. P. C. Ribeiro, Isabelle Zheng, and M. M. Alves	
Synthesis of Metal Nanoparticles from Fruits and Their Waste Materials for Diverse Applications	49
Radhika Sharma, Manik Devgan, Arshdeep Kaur, Antul Kumar, Taruna Suthar, Anuj Choudhary, Satyakam Guha, Anand Sonkar, and Sahil Mehta	
Green Synthesis of Metal-Oxide Nanoparticles from Fruits and Their Waste Materials for Diverse Applications	81
Anam Khan, Reena Vishvakarma, Poonam Sharma, Swati Sharma, and Archana Vimal	
Palm Waste Utilisation for Nanoparticles Synthesis and Their Various Application	121
Radwa A. El-Salamony	
Rice Straw Waste Utilization for Nanoparticles Synthesis and Their Various Applications	139
Daljeet Kaur, Amarjit Singh, Sunita Dalal, and Jitender Sharma	

Wheat Straw Waste Utilization for Nanoparticles Synthesis and Their Various Applications	163
Aditi Sharma, Abhinav Sharma, Priyanka Kashyap, Payal Dhyani, and Manu Pant	
Maize Waste Utilization for Nanoparticles Synthesis and Their Various Application	179
Harshita Shand, Rittick Mondal, Suvankar Ghorai, and Amit Kumar Mandal	
Various Metabolites and or Bioactive Compounds from Vegetables, and Their Use Nanoparticles Synthesis, and Applications	187
Noureddine Chaachouay, Abdelhamid Azeroual, Bouchaib Bencherki, Allal Douira, and Lahcen Zidane	
Various Metabolites and Bioactive Compounds from Fruits, and Their Use in Nanoparticles Synthesis and Applications	211
Arshi Siddiqui, Pragyesh Dixit, Hira Moid, and Uzma Afaq	
Various Agriculture Crop Plant-Based Bioactive Compounds and Their Use in Nanomaterial Synthesis and Applications	223
Anil Patani, Ashish Patel, Dharmendra Prajapati, Noopur Khare, and Sachidanand Singh	
Fruit and Vegetable Peels for Nanoparticles Synthesis and Applications	243
Samandeep Kaur, H. K. Chopra, and P. S. Panesar	
Grass and Their Waste Products for Nanoparticles Synthesis and Applications	261
Anurag Tiwari, Kajal Pandey, Sachidanand Singh, and Sonam Chawla	
Future Prospective and Risk Factors Associated with the Use of Nanoparticles	273
Senari N. Wijesooriya, Nadun H. Madanayake, and Nadeesh M. Adassooriya	

Green Synthesis of Metal-Oxide Nanoparticles from Fruits and Their Waste Materials for Diverse Applications



Anam Khan, Reena Vishvakarma, Poonam Sharma, Swati Sharma, and Archana Vimal

Abstract Nanotechnology is the state-of-the-art technology providing new horizons of ideas and scope to unlimited possibilities in almost all genres of day-to-day life ranging from diagnostic, therapeutic, agricultural, chemical to microelectronics, sensors, etc. In this connection, one of the main concerns regarding the metal-oxide nanoparticles is their synthesis, application in a safe mood to protect the overall toxic impact on the food web. To resolve this concern, a greener and cleaner method of producing the nanoparticles is being looked upon as a favorable alternative more commonly referred to as green chemistry or green synthesis. The metal-oxide nanoparticles synthesized from biological sources have demonstrated fulfilling properties and shown antibacterial, antiviral, antifungal, drug delivery, catalytic activity, etc., response. In this chapter, the role of fruits and their wastes in the green synthesis of metal-oxide nanoparticles is discussed. This could efficiently reduce the cost and is safer for the environment thus allowing us to implore more on their benefits without impending much harm to the environment.

Keywords Nanotechnology · Flavonoids · Anti-microbial · Polyphenols · Drug delivery · Biosensor

List of Abbreviations

ATP	Adenosine triphosphate
COD	Chemical oxygen demand
DO	Dissolved oxygen
DPW	Date pulp waste
FESEM	Field-emission scanning electron microscopy

A. Khan · R. Vishvakarma · P. Sharma · A. Vimal (✉)
Department of Bioengineering, Integral University, Lucknow, UP, India
e-mail: vimal.archana@gmail.com

S. Sharma
Department of Biosciences, Integral University, Lucknow, UP, India

© The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023
A. Husen (ed.), *Nanomaterials from Agricultural and Horticultural Products*,
Smart Nanomaterials Technology,
https://doi.org/10.1007/978-981-99-3435-5_5