

Kamil Kuca  
Lukas Peter  
Neetika Kimta *Editors*

# Medicinal Plants and Their Nanoparticles


A Double Blade Sword Against Human  
Diseases

 Springer

*Editors*

Kamil Kuca   
Department of Chemistry  
University of Hradec Kralove  
Hradec Kralove, Czech Republic

Lukas Peter  
Faculty of Materials Science  
and Technology  
Technical University of Ostrava  
Ostrava, Czech Republic

Neetika Kimta   
School of Biological and Environmental  
Sciences  
Shoolini University of Biotechnology  
and Management Sciences  
Solan, Himachal Pradesh, India

ISBN 978-3-032-03603-2      ISBN 978-3-032-03604-9 (eBook)  
<https://doi.org/10.1007/978-3-032-03604-9>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2025

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 Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

If disposing of this product, please recycle the paper.

<b>Part III Application of Medicinal Plant-Derived Nanoparticles Against Fungal Pathogens</b>	
<b>8 Global Burden of Fungal Infections and Medicinal Plant-Based Treatments</b> . . . . .	183
Upasana Sharma and Tikkam Singh	
<b>9 Medicinal Plant-Derived Nanoparticles Against Disease-Causing Fungi</b> . . . . .	209
Garima Bhanwala and Neetika Kimta	
<b>10 Medicinal Plant-Derived Nanoparticles Against Pathogenic <i>Candida</i> species</b> . . . . .	225
A. K. M. Shafiul Kadir, Farhana Faruque Zerin, Soumik Tripura, Tama Dutta, Abdul Malek, Ayesha Rasool, and Saudah Batool	
<b>Part IV Role of Medicinal Plant-Derived Nanoparticles Against Cancers</b>	
<b>11 Emerging Hope Beyond Chemotherapy: Phyto-Nanotechnology Fights Cancer</b> . . . . .	261
Subhabrata Guha, Debojit Talukdar, Rimi Mukherjee, and Gaurav Das	
<b>12 Role of Medicinal-Plant-Derived Nanoparticles Against Cancers</b> . . . .	287
Rajesh Kumar, Seetha Harilal, Bankatesh Kumar, Amit Kumar Singh, Raman Rajeshkumar, and Saritha Appukuttan	
<b>13 Boosting Immunotherapy: Nanoparticles Aiding Body's Defense</b> . . . .	317
Rohit Kumar, Rajni Thakur, Samriti Mehta, and Itika Kainthla	
<b>14 Mechanism of Action: Nanoparticles Targeting Tumors</b> . . . . .	335
Monika Sharma and Satyam Kumar Agrawal	
<b>Part V Role of Medicinal Plant-Derived Nanoparticles Against Chronic Diseases</b>	
<b>15 Shaping the Future of Chronic Diseases: A Phyto-Mediated Natural Approach</b> . . . . .	355
Priyanka Raju Chougule	
<b>16 Role of Medicinal Plant-Derived Nanoparticles Against Chronic Diseases</b> . . . . .	391
Mohd Aftab Siddiqui, Mohammad Saidurrahman, and Afreen Usmani	
<b>17 Phytomediated Nanoparticles and Diabetes</b> . . . . .	419
Sandhya Sharma, Geeta Jiwatram Gautam, Pratibha Gaurav, and Bhargawi Mishra	



# Role of Medicinal Plant-Derived Nanoparticles Against Chronic Diseases

# 16

Mohd Aftab Siddiqui, Mohammad Saidurrahman,  
and Afreen Usmani

## Abstract

Medicinal herbs have been discovered to contain medicinal properties, and the development in nanotechnology has improved their efficiency toward healing chronic diseases. This chapter discusses the synthesis and use of nanoparticles (MPNPs) from medicinal plants for treating diseases like diabetes, cardiovascular disease, cancer, neurodegenerative diseases, and inflammation. These nanoparticles are more bioavailable, site-directed, and less systemically toxic, avoiding the limitations of conventional treatment. The primary mechanisms of action include antioxidant, anti-inflammatory, and antimicrobial activity, as well as modulating key cellular pathways. The chapter also emphasizes pioneering nanoparticle synthesis approaches, including green and biogenic synthesis, and highlights their benefits as scalable and eco-friendly. Stability concerns, regulatory implications, and clinical translation are also discussed, along with directions for future studies to maximize the potential of MPNPs in personalized medicine.

## Keywords

Medicinal plants · Nanoparticles · Chronic diseases · Green synthesis · Targeted drug delivery · Antioxidant therapy

---

M. A. Siddiqui (✉)

Faculty of Pharmacy, Integral University, Lucknow, Uttar Pradesh, India

M. Saidurrahman

Rameshwaram Institute of Technology and Management, Lucknow, Uttar Pradesh, India

A. Usmani

MESCO Institute of Pharmacy, Amroha, Uttar Pradesh, India