

Contents

Preface	IX
1. Applications of Biodegradable Nanocomposite Films for Food Packaging	1
<i>Vikas S. Hakke, Shirish H. Sonawane, Irina Potoroko and Irina Kalinina</i>	
1.1 Introduction	1
1.1.1 Synthetic and Natural Polymers used for Food Packaging	2
1.1.2 Nanotechnology in Food Processing	3
1.1.3 Micro- and Nano-encapsulation Techniques	4
1.2 Encapsulation Technologies for Preserving Properties of Bioactive Substances in Food Matrix	6
1.3 Characteristics of Nanocomposite Films	9
1.3.1 Anti-oxidant Nanocomposite Films	11
1.3.2 Nanosensors for Pathogen Detection	12
1.3.3 Anti-microbial Food Packaging	12
1.4 Preparation Methods of Nanocomposite Films	13
1.5 Limitations of Nanocomposite Films and Future Scope	13
1.6 Conclusions and Future Aspects	16
References	16
2. Nanotechnology Developments in Food Packaging	23
<i>K. Radha Krishnan, Prakash Kumar Nayak, S. Babuskin and C. Chandramohan</i>	
2.1 Introduction	23
2.1.1 Limitations of Present Packaging Systems and Prospects for Nanotechnology based Packaging Systems	24
2.2 Nanoparticles and Nanocomposites	25
2.2.1 Clay	28
2.2.2 Silver	29
2.2.3 Zinc Oxide (ZnO)	31

2.2.4	Titanium Oxide	31
2.2.5	Copper Oxide	32
2.2.6	Carbon Nanotubes	32
2.3	Bionanocomposites	32
2.4	Food Packaging Developments	34
2.4.1	Active Packaging	34
2.4.2	Intelligent Packaging	38
2.5	Regulatory Issues	42
2.6	Conclusion	43
References		43
3.	Nanosensors for Detection of Toxins and Pathogens in Food	55
	<i>B. Ramya Sree and K. Divakar</i>	
3.1	Introduction	55
3.2	Magnetic Nanoparticles (MNPs) as Bacterial Sensors	56
3.3	Nano-biosensors	57
3.3.1	Immuno-based Nanosensors	57
3.3.2	Nanosensors based on Bacteriophages	58
3.3.3	Nanosensors based on Aptamers	59
3.3.4	Nanosensors based on Peptides (Anti-microbial Peptides)	63
3.4	3D Printing Technologies for Nanobiosensors	63
3.5	Conclusions	64
References		64
4.	Recent Developments in Nanomaterials based Diagnostics, Targeted Drug Delivery, their Efficiency and Potential	75
	<i>Shadab Ahmed, Naeem Shaikh, Nachiket Pathak and Akshay Sonawane</i>	
4.1	Introduction	75
4.2	Nanomaterials based Targeted Drug Delivery and their Potential	75
4.3	Three dimensional or 3D Nanofabrication for Biomedical Applications	78
4.3.1	Fabrication Methods	78

<i>Contents</i>	VII
4.3.2 Device Structures	79
4.3.3 Biomedical Applications of 3D Fabricated Nanobiosensors	82
4.3.4 Advantages over Traditional Diagnostic Tools	83
4.4 Advances in Applications of Virus-based Nanoparticles for Biomedical Applications	83
4.4.1 Advent of Virus-based Nanoparticles for Therapeutic Applications	84
4.4.2 Drug Delivery using Virus-based Nanoparticles	85
4.4.3 Virus-based Imaging Probes	87
4.5 Outlook	88
References	89
5. Recent Advances in the Treatment of Infectious Diseases Using Nanoparticles	97
<i>Santanu Sasidharan, Shweta Raj and Prakash Saudagar</i>	
5.1 Introduction	97
5.1.1 Different Types of Nanoparticles	99
5.2 Characteristics of Nanoparticles	102
5.2.1 Morphological Characterization	103
5.2.2 Structural Characterization	103
5.2.3 Surface Area and Particle Size Characterization	103
5.2.4 Optical Characterization	104
5.3 Classification of Nanoparticles	104
5.3.1 Inorganic Nanoparticles	104
5.3.2 Organic Nanoparticles	108
5.4 Role of Nanotechnology Against Infectious Diseases	111
5.4.1 Leishmaniasis	111
5.4.2 Malaria	112
5.4.3 Trypanosomiasis	112
5.5 Nanoparticles as Effective Drug Delivery Systems	113
5.6 Current Clinical Trials and Market Analysis	115
5.7 Conclusions and Future Perspective	115
References	116

