

Contents

1	Introduction to Nanocrystallites, Properties, Synthesis, Characterizations, and Potential Applications	1
1.1	Nanoscience and Nanotechnology: An Overview	1
1.2	Properties of Nanomaterials	3
1.2.1	Optical Properties	3
1.2.2	Fluorescence Properties	4
1.2.3	Magnetic Properties	4
1.2.4	Mechanical Properties	5
1.2.5	Thermal Properties	5
1.2.6	Catalytic Properties	5
1.3	Synthesis of Nanocrystallites	6
1.3.1	Synthesis Using Chemical and Physical Methods	7
1.3.2	Synthesis Using Biological Methods	10
1.4	Characterization of Nanomaterials	10
1.4.1	X-ray Diffraction	10
1.4.2	Scanning Electron Microscopy	11
1.4.3	Transmission Electron Microscopy	11
1.4.4	Ultraviolet and Visible Spectroscopy	12
1.4.5	Dynamic Light Scattering and Zeta Potential Measurements	12
1.4.6	Fluorescence Spectroscopy	13
1.4.7	Fourier Transform Infrared Spectroscopy	13
1.4.8	X-ray Photoelectron Spectroscopy	14
1.4.9	Atomic Absorption Spectrometry	14
1.4.10	Atomic Force Microscopy	15
1.5	Applications of Nanomaterials	15
1.5.1	Nanoparticles in Imaging	16
1.5.2	Nanoparticles in Drug Delivery	19
1.6	Summary	21
	References	21

2	Facile Green Biofabrication of Nanocrystallites	25
2.1	Biofabrication	25
2.1.1	Biofabrication of Silver Nanoparticles	29
2.1.2	Characterization of the Silver Nanoparticles	30
2.2	Summary	34
	References	35
3	Engineered Metal Nanoparticles and Bactericidal Properties	37
3.1	Nanoparticles as Bactericidal Agents	37
3.2	Bacteriological Toxicity Assessment	39
3.2.1	Disk Diffusion Tests	39
3.2.2	Minimum Inhibitory Concentration	41
3.2.3	Colony Forming Units	42
3.2.4	Live/Dead Toxicity Assay	43
3.3	Mechanistic Investigations of Bacterium-Silver Nanoparticle Interaction	43
3.3.1	Transmission Electron Microscopy Measurements	43
3.3.2	Atomic Force Microscopy Measurements	44
3.4	Summary	45
	Reference	46
4	Biocompatibility and Inertness of Gold Nanocrystallites	47
4.1	Inert Nature of Gold Nanocrystallites	47
4.2	Biosynthesis of Gold Nanocrystallites	49
4.2.1	Biofabrication Process	49
4.3	Characterization of Gold Nanoparticles	50
4.4	Summary	53
	References	54
5	Engineered Metal Oxide Nanocrystallites: Antibacterial Activity and Stress Mechanism	55
5.1	Engineered Nanoparticles and the Environment	55
5.2	Synthesis and Characterization of Cerium Oxide Nanoparticles	57
5.3	Bacteriological Toxicity Assessment	60
5.3.1	Disk Diffusion and Minimum Inhibitory Concentration Assays	60
5.4	Mechanism of Toxicity	62
5.4.1	Reactive Oxygen Species Generation	62
5.4.2	Mode of Interaction Based on Transmission Electron Microscopy	63
5.4.3	Transcriptional Microarray Analysis	64
5.5	Summary	67
	Reference	67

Metallic Nanocrystallites and their Interaction with
Microbial Systems

Suresh, A.K.

2012, XVI, 67 p. 26 illus., 11 illus. in color., Softcover

ISBN: 978-94-007-4230-7