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Chapter 5

Green Nanotechnology—A Road Map to Safer Nanomaterials

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5.1 INTRODUCTION

5.1.1 Nanotechnology

Over the past few decades, nanomaterials have become immensely attractive for scientific research because of their diverse properties and applications. Considering the unlimited potential of these tiny materials in health care, many novel biomedical tools and techniques were developed for biomedical applications such as diagnosis and treatment. Apart from their promise, the unpredictable nature of nanomaterials has always been a critical concern. The uncertainty about possible side effects has limited the effective utilization of advanced biomaterials in clinical investigations. However, nanomaterials were gradually introduced to the biomedical implants industry owing to their excellent mechanical, chemical, optical, and biological properties. Due to their small size, <100 nm, nanomaterials can easily be uptaken by cells, and are even accessible to the blood brain barrier. Nanomaterials became a fascinating topic of study in medicine due to ease of loading drugs, competence in functionalization, potential for targeted delivery, tumor-homing nature, tumor-locating capability (optic/magnetic), diagnostic capability, therapeutic potential, etc. As a result of these properties, along with the evidence of clinical and preclinical investigations, many nanoproducts including bio-implants, drug delivery systems, pharmaceutical products, cosmetics, filters, biomarkers, imaging agents, biosensors, tissue engineering scaffolds, etc., were commercialized with the goal of improving the quality of human life [1–3]. On the other hand, some investigations into extended interactions of nanomaterials (metal, metal-oxide, ceramic, composite) within the body have revealed a certain level of toxic responses [4–9].

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