

Chapter 5

Nanotechnology, Metal Nanoparticles, and Biomedical Applications of Nanotechnology

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ABSTRACT

Nanotechnology has emerged as an important field of modern scientific research due to its diverse range of applications in the area of electronics, material sciences, biomedical engineering, and medicines at nano levels such as healthcare, cosmetics, food and feed, environmental health, optics, biomedical sciences, chemical industries, drug-gene delivery, energy science, optoelectronics, catalysis, reprog-raphy, single electron transistors, light emitters, nonlinear optical devices, and photoelectrochemical applications and other applications. Due to these immense applications of nanotechnology in biomedical science, it has become possible to design the pharmaceuticals in such a way that they could directly treat diseased cells like cancer and make microscopic repairs in hard-to-operate-on areas of the body. The nanomachines have been designed to clean up toxins or oil spills, recycle all garbage, eliminate landfills, etc. The chapter summarizes the present and future applications of nanotechnology for human welfare but needs further study in catalysis, optical devices, sensor technology, cancer treatment, and drug delivery systems.

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INTRODUCTION

Nowadays technical and engineering activities have a significantly greater impact on the natural laws and rules once considered as changeless. Nonetheless we have been approaching the same pattern that we followed in the past – we get inspired by the nature. Nanoscience is currently a fast growing field and Nanotechnology is at the cutting edge of this rapidly evolving area (Mandal et al., 2006). Nanomaterials and nanotechnologies include molecules and atoms, biosensors and multisensory systems measure the required biological parameters and processes with a relatively high accuracy, the electronic systems and computers create artificial intelligence that is integrated into diagnostic, measuring or control systems etc likely to change the way almost everything from vaccines to computers to automobile tires to objects not yet imagined is designed and made. Nanotechnology collectively describes technology and science involving nano-scale particles (nanoparticles) that increases the scope of investigating and regulating the interplay at cell level between synthetic materials and biological systems (Du et al., 2007), which can be applied as an efficient tool to explore the finest process in biological processes (Sondi & Salopak, Sondi, 2004) and in biomedical sciences (Hutten et al., 2004).

The word “nano” means dwarf in Greek language and is used to indicate one billionth of a meter or 10^{-9} and a world of things is built up from the tiny scale of nanometers. The term nanotechnology was coined by Norio Taniguchi a, researcher at the University of Tokyo, Japan. Nano science and technology is a broad and interdisciplinary area of research and development activity that has been growing explosively worldwide in the past few years and making an impact in all spheres of human-life (Vaidyanathan et al., 2009). Besides this, It has the potential for revolutionizing the ways in which materials and products are created and the range and nature of functionalities that can be accessed. Nanotechnology plays an indispensable role in drug delivery, diagnostics, imaging, sensing, gene delivery, artificial implants and tissue engineering, has significant commercial impact, which will be assuredly increased in the future. (Marones et al., 2004).

The nanotechnology has also shown major developments in is the production and application of nanoparticles in biology. Novel techniques and methods are being are constantly being studied to produce nanoparticles. The enormous interest has developed green synthesis of NPs is due to their unusual optical (Krotiknowska et al., 2003), chemical (Kumar et al., 2003), Photochemical (Chandrasekharan et al., 2000), electronic (Peto et al., 2002) and magnetic (Watson et al., 1999), properties. In the chapter we would like the emphasizes the importance of metallic nanoparticles synthesised through various methods and the other applications of nanotechnology with respect to biomedical applications.

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