Chapter 50
Biological Synthesis of Silver Nanoparticles and their Functional Properties

Veluchamy Prabhawathi
Indian Institute of Technology Madras, India

Ponnurengam Malliappan Sivakumar
Indian Institute of Technology Madras, India

Mukesh Doble
Indian Institute of Technology Madras, India

ABSTRACT
A nanoparticle is defined as a small object between 1 and 100 nanometer in size and has a large surface to volume ratio. Silver nanoparticles (AgNPs) could be synthesized using various chemical and physical processes. However, these methods lead to hazardous by-products. In the recent past, AgNPs are produced by biological means. The size, shape and composition of AgNPs have significant effect on their biological applications. Aqueous solution of AgNP is not stable and rapidly undergoes agglomeration which is prevented by electrostatic or steric stabilization techniques with the help of capping or protective agents. The biologically synthesized nanoparticles are now favoured because it is a green alternative, mild, and does not need toxic chemicals and solvents. The scope of this review is to provide an overview of the various biological means researched for the synthesis of AgNPs, different techniques and chemicals used to develop stable solution, various techniques for their characterization, and their biological. The future research directions in this subject area are also discussed.

1. INTRODUCTION
Nanoparticles are popular because of their small size and enormous applications. Unlike bulk materials, they have characteristic physical, chemical, electrical, mechanical, electronic, magnetic, thermal, dielectric, optical and biological properties (Daniel & Astruc, 2004; Schmid, 1992). Their distinct properties including optoelectronic, physicochemical and electronic properties are determined by their size, shape and crystallinity. The synthesis of nanoparticle of varying size is a challenge. Although various physical and chemical means are extensively researched, the use of toxic...
Biological Synthesis of Silver Nanoparticles and their Functional Properties

This chapter provides a brief overview on the biological means of synthesis of nanoparticles, functionalization and stabilization of nanoparticles, various techniques involved in the analysis of nanoparticles and their biological applications.

2. BACKGROUND

The size-controlled synthesis of nanoparticle remains a challenge in material science (Reddy et al., 2009). The size and shape are critical factors that decide the biological activity and specificity. Several factors contribute to the controlled synthesis of AgNPs like, the concentration of AgNO₃ used; the media components, pH and temperature. (Gurunathan et al., 2009; Huang et al., 2007). Although this is an important aspect, there is very little literature available on the controlled synthesis of AgNPs. This chapter will focus on the various means in which controlled synthesis could be made possible. Since nanoparticles have high surface energy, they are less stable leading to agglomeration. The use of stabilizer will result in stable nanoparticles. This chapter will also focus on the different means in which stable nanoparticles could be produced. The use of biosurfactants is one possible green alternate for the synthesis and stabilization of nanoparticles (Kiran et al., 2010).

3. DIFFERENT SYNTHETIC PROCEDURES

Abundant resource that are available in the nature including fungi, bacteria, yeast, plant and plant products are used for the synthesis of silver nanoparticles.

3.1. Fungi Mediated Synthesis

Several types of fungi including Fusarium oxysporum (Mukherjee et al., 2002), Aspergillus fumigatus (Bhainsa & D’Souza, 2006), Asper-
Related Content

An Assessment of Random Dynamical Network Automata for Nanoelectronics
[www.igi-global.com/article/assessment-random-dynamical-network-automata/40365?camid=4v1a](www.igi-global.com/article/assessment-random-dynamical-network-automata/40365?camid=4v1a)

Diverse Applications of Nanotechnology in Biomedicine, Chemistry, and Engineering
[www.igi-global.com/chapter/diverse-applications-of-nanotechnology-in-biomedicine-chemistry-and-engineering/116835?camid=4v1a](www.igi-global.com/chapter/diverse-applications-of-nanotechnology-in-biomedicine-chemistry-and-engineering/116835?camid=4v1a)

Spinal Cord Injury (SCI) Rehabilitator
[www.igi-global.com/article/spinal-cord-injury-sci-rehabilitator/63612?camid=4v1a](www.igi-global.com/article/spinal-cord-injury-sci-rehabilitator/63612?camid=4v1a)

Nanobiotechnology and Therapeutics
[www.igi-global.com/chapter/nanobiotechnology-and-therapeutics/165223?camid=4v1a](www.igi-global.com/chapter/nanobiotechnology-and-therapeutics/165223?camid=4v1a)