

Plants: Emerging as Nanofactories towards Facile Route in Synthesis of Nanoparticles

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ABSTRACT

Plant mediated nanoparticles' synthesis has led to a remarkable progress via unfolding a green synthesis protocol towards nanoparticles' synthesis. It seems to have drawn quite an unequivocal attention with a view of reformulating the novel strategies as alternatives for popular conventional methods. Hence, the present review summarizes the literature reported thus far and envisions towards plants as emerging sources of nanofactories.

Introduction

Nanotechnology is an interdisciplinary area of science which has been burgeoning interest across the globe with huge momentum to usher in forming nano revolution. An important area in nanotechnology deals with the synthesis of nanoparticles which has encountered immense progress due to innumerable applications in recent decades.¹ Nanoparticles are particles less than 100 nm in diameter that exhibit new and enhanced size-dependent properties compared to its bulk material.² The recent development and implementation of advance technologies have emerged the nano-revolution which provides the tools and technology as platforms for the investigation of biological entities which offer inspiration models for bio-assembled components toward synthesis of nanoparticles. Biosynthesis of nanoparticles is a type of bottom up approach which employs a biological system or its components for the formation of nanoparticles, where the main reaction is reduction of raw metal into nanoparticles. The process of biological route is due to metal tolerance of biological entities.³ Biological entities in synthesis of nanoparticles may vary from simple prokaryotic bacteria to eukaryotes such as fungi and plants. Compared to microorganisms, plants have better advantages wherein plant mediated synthesis is a one-step protocol towards synthesis whereas microorganisms during the course of

time may lose their ability to synthesize nanoparticles due to mutations. Further preservation of microorganisms and maintenance of cultures in active form are very laborious and time consuming. While in plants it is easy and safe with one step protocol towards synthesis; hence research on plants has expanded rapidly.^{4,5} The use of plants in synthesis of nanoparticles has become one of the popular alternatives for conventional methods. In recent years, epoch research on plants has gone through the remarkable progress with current upsurge in plant research in synthesis of nanoparticles with controlled size and shape. It is a well-known natural phenomenon of heavy metal tolerance by plants which has resulted in phytomining and phytoremediation. Thus, these unique properties of metal tolerance by plants have been exploited with respect to nanoparticles' synthesis.⁶ Plant mediated synthesis of nanoparticles is conferred due to the presence of biomolecules such as proteins, amino acids, vitamins, polysaccharides, polyphenols, terpenoids, and organic acids such as citrates etc. present in the plants as their phyto chemicals. Apart from mediating the synthesis, these molecules also stabilize the nanoparticles formed with desired size and shape. Studies have indicated that biomolecules not only play a role in reducing the ions to the nanosize, but also play an important role in the capping of nanoparticles.^{7,8}

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