Current Pharmaceutical Biotechnology, 2023, 24, 86-109

REVIEW ARTICLE

Recent Advances in Biomedical Applications of Biogenic Nanomaterials

Devidas S. Bhagat[1], Wasudeo B. Gurnule[2,*], Gurvinder B. Bumbrah[3], Pankaj Koinkar[4,*] and Pooja A. Chawla[5]

[1]Department of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad 431 004, (MS), India; [2]Department of Chemistry, Kamla Nehru Mahavidyalaya, Nagpur 440024, (MS), India; [3]Department of Chemistry, Biochemistry and Forensic Science, Amity School of Applied Sciences, Amity University, 122413, Haryana, India; [4]Department of Optical Science, Tokushima University, Minamijosanjima-cho, Tokushima 770-8506, Japan; [5]Department of Pharmaceutical Chemistry and Analysis, ISF College of Pharmacy, Moga 142001, Punjab, India

ARTICLE HISTORY

Received: November 04, 2021
Revised: December 1, 2021
Accepted: January 10, 2022

DOI:
10.2174/1389201023666220111101618

Abstract: The synthesis of biogenic nanoparticles from readily available natural resources may have large demand in numerous fields including pharmaceuticals and medicine. The biogenic nanoparticles catch the attention of the scientific community due to their low cytotoxicity and biocompatibility. Chemical, physical, and greener methods are used for the synthesis of biogenic nanoparticles. Researchers used eco-friendly and nontoxic approaches in the synthesis of this nanoparticle. This nanomaterial-based medicine plays a vital role in the management of public health, including earlier detection of disease, therapeutics candidates in the treatment of cancer. Biogenic nanocomposites are environmentally benign candidates that include fabrication of various composites, detoxification, and act as a catalyst in the biodegradation process. In this review article, we emphasize the recently reported methods used for synthesis, summarizing their biomedical applications and commercial and environmentally benign applications. Synthetic strategies include greener, chemical, physical, and biogenic methods and their role in surface modifiers involves various biomedical, commercial, and environmental-related applications. Moreover, we glimpse existing status, key contests, and future perspectives.

Keywords: Biogenic nanocomposite, biomedical applications, biosynthesis, ecofriendly, mechanism, nanotechnology.

1. INTRODUCTION

Nanotechnology is advancing in all fields that benefit humans in the present decade. Nanocomposites range in size from 10 to 100 nanometers and have a large specific surface as well as radically distinct characteristics [1]. Those with a particle size of less than 10 nm are generally used in medicine, chemistry, and electronics-related fields [2]. For the last two decades, researchers have focused on the development of biogenic nanocomposite-based medicine for treatment and early detection of diseases like cancer [3]. The biogenic nanocomposites of Ag, Au, Au@Ag, Ag@Au, TiO_2 Cu, Pt, ZnO, Cu Pt, ZnO, CuO, CdS, Se, Fe_2O_3, and carbon dots have been extensively used in biomedical applications. Plant extracts are used in the development of biogenic nanocomposites, where they act as stabilising, reducing, and capping agents [4].

Due to the presence of functional molecules such as phenolic compounds, terpenoids, aldehydes, amides, and others, researchers prefer to use plant extract in the biogenic synthesis of nanoparticles, thereby overcoming issues associated with physical and chemical methods [5]. Synthesis of nanoparticles using plant extract is eco-friendly because it is biodegradable, is cost-effective, and less cytotoxic [6]. Table 1 gives an account of plant extract mediated synthesis of various nanocomposites along with their in vitro and in vivo applications [7]. In a study, scientists biosynthesized AgNPs from *Cucumis prophetarum* extract with antibacterial [8] and antiproliferative activity when tested in a cell line induced by *Aspergillus flavus* [9]. *Green synthesis of* gold nanoparticles using *Lemanea fluviatilis (L.) with significant* antioxidant activity has also been reported [10] Biosynthesis of the copper oxide nanocomposite in the presence of Galphimia *glauca* showed remarkable cytotoxic activity [11]. Synthesis of TiO_2 nano probe using *Lippia citriodora* [12], *Justicia gendarussa* [13], *Hylotelephium telephium* [14], *Hibiscus sabdariffa* [15], *Commelina nudiflora L.* [16] and *Coleus aromaticus* [17] has also been reported. In general, silver and zinc oxide nanoparticles possess anti-inflammatory and antidiabetic activities [18].

Keeping in view the medical applications of nanocomposites, we have tried to compile the biosynthesis and biomedical applications of nanocomposites in the current paper.

*Address correspondence to these authors at the Department of Chemistry, Kamla Nehru Mahavidyalaya, Nagpur 440024, (MS), India; E-mail: wbgurnule@gmail.com and Department of Optical Science, Tokushima University, Minamijosanjima-cho, Tokushima 770-8506, Japan; E-mail: koinkar@gmail.com

1389-2010/23 $65.00+.00