American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Short Communication

Massive Progress of Green Synthesized Silver Nanoparticles in Cancer Application

Sameh A Mohammed*

[1]*Department of Pharmacology and Toxicology, Beni-Suef University, Egypt*

[2]*Department of Micro-Nano Mechanical Science and Engineering, Nagoya University, Japan*

***Corresponding author:** Sameh Abdelmoneem Mohammed Ali, Ass. Prof. of Pharmacology & Toxicology, Faculty of Pharmacy, Beni-Suef University, Egypt. Graduate School of Engineering, Nagoya University, Japan.

To Cite This Article: *Sameh A M. Massive Progress of Green Synthesized Silver Nanoparticles in Cancer Application. Am J Biomed Sci & Res. 2022 - 16(5). AJBSR.MS.ID.002276.* DOI: 10.34297/AJBSR.2022.16.0022756

Received: July 07, 2022; **Published:** July 19, 2022

Short Communication

Nanobiotechnology has become one of the hottest sections in nanoscience allowing the utilization of multiple nanoplatforms for a variety of biomedical technologies and applications. These nanoparticles play an effective role in solving several scientific dilemmas and in assisting in treating diverse diseases over the recent years due to their unique physicochemical features along with their higher delivery ability of cargoes into diseased targets [1]. Amongst these nanoparticles, silver nanoparticles (AgNPs), are metal-based nanoparticles possessing remarkable characterizations, for instance, good conductivity, comparatively lower toxicity, chemically structured stability, and potentially therapeutic option as antimicrobial, anticancer, or anti-inflammatory activity [2]. AgNPs are mainly synthesized by different biological, chemical, photochemical, electrochemical methods [3]. There are numerous biological principles of AgNPs synthesis, while the difference among them is due to the source of the biological route. Moreover, some microorganisms and plant extracts have been employed for biological AgNPs synthesis (AgNPs Biogenethesis) to ensure higher degree of AgNPs efficacy and safety. Interestingly, biogenic AgNPs have possessed a great impact as an antimicrobial candidate against gram-positive, gram-negative bacteria and several viruses such as herpes simplex virus, hepatitis B virus, and human immunodeficiency virus, thus this makes AgNPs have powerful capability to exert their cytotoxic activity for combating the diseases [4]. On the other hand, biogenic AgNPs have taken the researcher's and scientist's considerations either alone or in combination, for ameliorating the unfavorable toxicities results of conventional chemotherapies [5]. These serious side effects which are related to using chemotherapy include cardiovascular disturbances, whole-body fatigue, multidrug resistance, and high relapse rate.

Alternatively, various research has shown positive results on the recruitment of biogenic AgNPs as a prospective anticancer agent paving a new way for therapeutic directions in the field of cancer medications [6]. AgNPs could disturb the function of mitochondria by the stimulation of reactive oxygen species production and induce the synthesis of ATP [7]. A study on different human breast cancer and lung cancer cell lines has demonstrated that AgNPs could induce significant inhibition of cancer cell proliferation and growth [8]. Another in vitro study indicated robust cytotoxicity of biogenic AgNPs against various cancer cells [9]. Furthermore, several studies have mentioned the possibility of AgNPs to suppress glioblastoma cells and induce mitochondria-related apoptosis through activation of JNK pathway and ROS production in NIH3T3 cells [10,11]. Recently, a few research have revealed the incidence of oxidative hepatocellular damage caused by the induced cytotoxicity of accumulated AgNPs [12]. Excessive ROS production has been regarded as one of the most important mechanisms for cellular apoptosis induced by AgNPs treatment either at lower concentrations or exposure to shorter incubation time [13].

Green Synthesis and Anticancer Activity of Silver Nanoparticles

At the present, there are a lot of limitations in using the chemical approach for AgNPs synthesis via adding hazardous

reducing agents which pose a massive menace to the global ecosystem [14]. From all various approaches of AgNPs synthesis, green synthesis direction is represented as the most eco-friendly, sustainable, economic, and reliable [15]. Lower cost, higher safety for host health and an eco-friendly exogenous environment without the dire need for high pressure, high temperature, or toxic materials during the fabrication process are important advantages of this direction [16]. Harnessing non-hazardous materials, for example, plant extracts and microorganisms e.g., bacteria, fungi, and algae for biogenic AgNPs synthesis [17]. Comparatively, higher biocompatibility and non-complicated procedure when the utility of plant candidates in the fabrication of AgNPs make them better competitors than microbial ones, particularly for biomedical therapeutics [18]. The potential anticancer activity of synthesized AgNPs from Heliotropium bacciferum, banana leaves, and Mangifera indica seed have been shown significantly on HCT-116, MCF7, Siha, Hela cell lines, respectively [19,20]. In colon cancer cell lines e.g., HCT-116 and HCT 15, the spherically biogenic AgNPs shaped ones have been harnessed with 5-80nm and 5.5-100µg/mL in ranges of size and IC50 values, respectively [21,22]. Moreover, there were diverse shapes of biogenic AgNPs such as spherical, cuboidal, and pentagonal in the case of MCF-7 breast cancer cell lines, with 5-90 nm in size range and 3.04-250µg/mL in IC50 values [23,24]. Further studies mentioned the noticeable variation in IC50 values of biogenic AgNPs depending on dose of utilized extract [25,26]. In the case of the Siha cell lines, these biogenic AgNPs were triangular and hexagonal-shaped ones with a 1-20nm size range and ≤4.25µg/mL in terms of IC50 value [24]. However, biosynthesized AgNPs were spherical shaped ones and 5-125nm in size with several ranges in terms of IC50 value according to sort of plant extracts and AgNPs fabrication method [27].

It is strongly believed that these types of AgNPs will be massively applied as a promotive anticancer component in upcoming years along with the flourishing nanomedicine-based global market to anticipate the futuristic advances in cancer therapy.

Conflict of Interest

There is no conflict of interest.

References

1. Patra JK, Das G, Fraceto LF, Campos EVR, Rodriguez Torres, et al. (2018) Nano based drug delivery systems: recent developments and future prospects. J Nanobiotechnol 16: 71.
2. Zhang XF, Liu ZG, Shen W, Gurunathan S (2016) Silver Nanoparticles: Synthesis, Characterization, Properties, Applications, and Therapeutic Approaches. Int J Mol Sci 17(9): 1534.
3. Xu L, Wang YY, Huang J, Chen CY, Wang ZX, et al. (2020) Silver nanoparticles: Synthesis, medical applications and biosafety. Theranostics 10: 8996-9031.
4. Okafor F, Janen A, Kukhtareva T, Edwards V, Curley M (2013) Green synthesis of silver nanoparticles, their characterization, application and antibacterial activity. Int J Environ Res Public Health 10(10): 5221-5238.
5. Ferdous Z, Nemmar A (2020) Health Impact of Silver Nanoparticles: A Review of the Biodistribution and Toxicity Following Various Routes of Exposure. Int J Mol Sci 21(7): 2375.
6. Khan MS, Alomari A, Tabrez S, Hassan I, Rizwan Wahab, et al. (2021) Anticancer Potential of Biogenic Silver Nanoparticles: A Mechanistic Study. Pharmaceutics 13(5): 707.
7. Gurunathan S, Jeyaraj M, Kang MH, Kim JH (2019) Mitochondrial Peptide Humanin Protects Silver Nanoparticles-Induced Neurotoxicity in Human Neuroblastoma Cancer Cells (SH-SY5Y). Int J Mol Sci 20(18): 4439.
8. Rodríguez Razón CM, Yañez Sánchez I, Ramos Santillan VO, Velásquez Ordóñez C, Gutiérrez Rubio SA, et al. (2018) Adhesion, proliferation, and apoptosis in different molecular portraits of breast cancer treated with silver nanoparticles and its pathway-network analysis. Int J Nanomedicine 13: 1081-1095.
9. Krishna G, Srileka V, Singara Charya MA, Abu Serea ES, Shalan AE (2021) Biogenic synthesis and cytotoxic effects of silver nanoparticles mediated by white rot fungi. Heliyon 7(3): e06470.
10. Quan JH, Gao FF, Ismail HAHA, Yuk JM, Cha GH, et al. (2020) Silver Nanoparticle-Induced Apoptosis in ARPE-19 Cells Is Inhibited by Toxoplasma gondii Pre-Infection Through Suppression of NOX4-Dependent ROS Generation. Int J Nanomedicine 15: 3695-3716.
11. Yang H, Chen W, Ma J, Zhao J, Li D, et al. (2020) Silver Nanotriangles and Chemotherapeutics Synergistically Induce Apoptosis in Glioma Cells via a ROS-Dependent Mitochondrial Pathway. Int J Nanomedicine 15: 7791-7803.
12. Egbuna C, Parmar VK, Jeevanandam J, Ezzat SM, Patrick Iwuanyanwu KC, et al. (2021) Toxicity of Nanoparticles in Biomedical Application: Nanotoxicology. J Toxicol 2021: 9954443.
13. Rakowski M, Porębski S, Grzelak A (2021) Silver Nanoparticles Modulate the Epithelial-to-Mesenchymal Transition in Estrogen-Dependent Breast Cancer Cells In Vitro. Int J Mol Sci 22(17): 9203.
14. Patil S, Chandrasekaran R (2020) Biogenic nanoparticles: a comprehensive perspective in synthesis, characterization, application and its challenges. J Genet Eng Biotechnol 18(1): 67.
15. Ahmed SF, Mofijur M, Rafa N, Anika Tasnim Chowdhury, Sidratun Chowdhury, et al. (2022) Green approaches in synthesising nanomaterials for environmental nanobioremediation: Technological advancements, applications, benefits and challenges. Environ Res 204(Pt A): 111967.
16. Liao C, Li Y, Tjong SC (2019) Bactericidal and Cytotoxic Properties of Silver Nanoparticles. Int J Mol Sci 20(2): 449.
17. Zhang D, Ma XL, Gu Y, Huang H, Zhang GW (2020) Green Synthesis of Metallic Nanoparticles and Their Potential Applications to Treat Cancer. Front Chem 8: 799.
18. Agnihotri S, Dhiman NK (2017) Development of Nano-Antimicrobial Biomaterials for Biomedical Applications. Advances in Biomaterials for Biomedical Applications 66: 479-545.
19. Varghese R, Almalki MA, Ilavenil S, Rebecca J, Choi KC (2019) Silver nanopaticles synthesized using the seed extract of Trigonella foenum-graecum L. and their antimicrobial mechanism and anticancer properties. Saudi J Biol Sci 26(1): 148-154.
20. Balkrishna A, Sharma VK, Das SK, Mishra N, Bisht L, et al. (2020) Characterization and Anti-Cancerous Effect of Putranjiva roxburghii Seed Extract Mediated Silver Nanoparticles on Human Colon (HCT-116), Pancreatic (PANC-1) and Breast (MDA-MB 231) Cancer Cell Lines: A Comparative Study. Int J Nanomedicine 15: 573-85.

21. Gurunathan S, Qasim M, Park C, Yoo H, Kim JH, et al. (2018) Cytotoxic Potential and Molecular Pathway Analysis of Silver Nanoparticles in Human Colon Cancer Cells HCT116. Int J Mol Sci 19(8): 2269.

22. Majeed S, Aripin FHB, Shoeb NSB, Danish M, Ibrahim MNM, et al. (2019) Bioengineered silver nanoparticles capped with bovine serum albumin and its anticancer and apoptotic activity against breast, bone and intestinal colon cancer cell lines. Mater Sci Eng C Mater Biol Appl 102: 254-263.

23. Ratan ZA, Haidere MF, Nurunnabi M, Shahriar SM, Ahammad AJS, et al. (2020) Green Chemistry Synthesis of Silver Nanoparticles and Their Potential Anticancer Effects. Cancers 12(4): 855.

24. Andleeb A, Andleeb A, Asghar S, Zaman G, Tariq M, et al. (2021) A Systematic Review of Biosynthesized Metallic Nanoparticles as a Promising Anti-Cancer-Strategy. Cancers 13(11): 2818.

25. Ananda AP, Krishnamurthy NB, Savitha KR, BS Nagendra (2019) Biogenic synthesis of silver nanoparticles using Priva cordifolia leaf extract (PC@ AgNPs) a potent antioxidant, antibacterial and catalytic activity. SN Appl Sci 1: 800.

26. Chandraker SK, Lal M, Khanam F, Dhruve P, Singh RP, et al. (2022) Therapeutic potential of biogenic and optimized silver nanoparticles using Rubia cordifolia L. leaf extract. Sci Rep 12: 8831.

27. Siakavella IK, Lamari F, Papoulis D, Orkoula M, Gkolfi P, et al. (2020) Effect of Plant Extracts on the Characteristics of Silver Nanoparticles for Topical Application. Pharmaceutics 12(12): 1244.