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Phyto-assisted Synthesis and Assessment of Anticancer Properties of Selenium Nanoparticles Prepared Using Banana Stem Extracts-An In-vitro Study

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ABSTRACT

Due to their inquisitive properties as compared to other selenium compounds, selenium nanoparticles have become a critical prospect in the field of medicine. They outperform selenite compounds in terms of anticancer, nontoxicity, and biocompatibility. The invasion of apoptotic pathways and cell cycle arrest, which eventually lead to blockage of other pathways, are the primary mechanisms behind SeNps' anticancer properties. Antibiotics, biomolecules, or phytochemical compounds found in bacteria or plants improve the anticancer properties of selenium nanoparticles by conjugation or surface alteration.

Selenium, which is found in many enzymes including glutathione peroxidase (GPx), can improve chemotherapeutic activity by functioning as a functional division of the redox centre and protecting tissues from cellular damage caused by reactive oxygen species (ROS).

SeNps have the potential to open up new regular methods for treating illnesses like cancer, and this article explains why.

Key words: Nanotechnology, Nano medicine, Anticancer activities, Selenium nanoparticles, Chemotherapeutic agents

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INTRODUCTION

Nanotechnology has raised the bar in terms of care and diagnostics, and it is widely regarded as one of the most promising oncotherapy research areas. Cancer continues to be one of the most serious threats to human health. Despite the fact that tremendous efforts have been made in the past decades to cure cancer, it remains a daunting disease to overcome. Chemotherapy is the most widely used method for tumour treatment, but the toxins and reactions make chemotherapy very difficult to use. The lack of efficient delivery mechanisms for hydrophobic anticancer drugs, which are restricted in their intravenous administration due to their poor solubility in watery media, is one of the most basic deterrents to cancer chemotherapy. To solve these obstacles, researchers are turning to simpler techniques or agents that are less expensive and can fill all of the gaps in chemotherapeutic therapies. One such area is cancer nanotechnology, which is a new technique with application potential in cancer-targeted chemotherapy.

Nano drug delivery systems have been found to enhance anticancer drug cellular targeting and to have radio-sensitization properties. As a result, developing Nano drug delivery mechanisms for anticancer drugs to improve their solubility and action efficacy is critical.

Although major advancements have been made in the use of metal nanoparticles for diagnosis, imaging, and drug delivery, only minor applications have been reported. One of these nanoparticles is selenium nanoparticles (Nano-Se), which are gaining popularity due to their superior biological activities, improved biocompatibility, and low cost.

Adequate Se supplementation is linked to a lower risk of development, cardiovascular infections, diabetes, and male fertility, while Se deficiency is linked to an increased risk of mortality or poor immune ability. She has been shown to reduce the incidence of cancers such as mammary, breast, lung, colon, and prostate cancer as a result of epidemiological, preclinical, and clinical studies.

Although it has benefits, high doses of selenite, on the other hand, raise serious concerns about its toxicity because the beneficial and toxic effects are so close together. As a result, for the development of Se-based anticancer products, toxicity testing is always a top priority. To demonstrate the anticancer properties, several mechanisms have been proposed. Acceptance of cell apoptosis is one of selenium's activities, along with restraint of cell multiplication, regulation of redox state, detoxification of cancer-causing agent, stimulation of

immune system, and inhibition of angiogenesis. Over the last decade, a number of engineered frameworks have been developed for the production of Nano-Se. However, a repeatable but simple strategy for preparing Nano-Se with high stability is still a work in progress. Nanoparticles may be made using chemical or biological processes, all of which work on the principle of reducing complex chemicals to non-toxic elements. The only distinction between the two approaches is that chemical reduction uses reagents or additives that are harmful to the environment or human health [1-18].

MATERIAL AND METHODS

Preparation of banana extract

Freshly selected organic banana fruits were washed many times in distilled water. The fruit was chopped into small pieces with a sterilised knife and pounded into fine particles with a mortar and pestle. 1 gram of banana pulp was combined with 100 ml distilled water to get a 1 molar solution of banana extract.

Synthesis of Se nanoparticle

Nano composite synthesis was done by combining 100 ml of 1M selenium nanoparticle solutions, as indicated in the preceding procedures. Before the colour change was discovered, an orbital shaker was used to mix the nanoparticle solution overnight, followed by a magnetic hot stirrer. To trace the synthesis of selenium nano composites, hourly UV-vis spectrometric data were recorded. Selenium nanoparticles were obtained after centrifuging the resultant mixture.

RESULTS

UV-vis spectroscopy

As a result of integrated oscillations of conduction band electrons on the surface of metal nanoparticles in resonance with the light, the Surface Plasmon Resonance absorption band was identified. A UV-vis spectrometer was used to examine the Nano composite's formation. At a wavelength of 320-350 nm, a colour change was noticed at 1.000 absorption.

TEM scan analysis

The size and shape of the produced Nano composite were examined by transition electron microscopy. The Nano composite was 12-16 nm in size on average.

DISCUSSION

Nanotechnology is gaining popularity among researchers because of the following benefits in the medicinal and medical fields: less invasive, reduced risk and adverse effects, faster action with reduced dosage due to increased bioavailability, increased beneficial effects, and unsolved medical problems such as cancer have been one of the most important researches in the field of Nano medicine. Nano medicines are now being used in local drug delivery in dental disciplines, and not just for fatal systemic disorders like cancer.

Incorporating nanoparticles in dental dressings, suture materials, mouthwashes, and local drug delivery media has been a focus of dental nano research. The discovery of effective drug delivery methods that can improve the therapeutic profile and efficacy of therapeutic agents is one of the most pressing concerns in modern medicine.

Advances in Nano science and nanotechnology, which have permitted the creation of novel Nanomaterials, have facilitated the development of a number of innovative drug delivery systems.

In comparison to the early half of the century, nanoparticle synthesis has improved fast in recent years. Traditional methods were previously used to create the nanoparticles, and even though these traditional physical and chemical methods for synthesising vast amounts of nanoparticles take less time, hazardous substances are used as capping agents for stability.

These methods resulted in environmental toxicity due to the use of hazardous compounds. The Green Synthesis process was devised to avoid the use of such harmful chemicals, and it is now widely employed all over the world. It is a method that is both ecologically friendly and cost-effective. As a result, we did this study to see how harmful selenium nanoparticles containing banana extract were. Antibacterial activities of the same were proven to be excellent against oral microorganisms in previous studies.

Banana extract has been proved in studies to be an excellent antibacterial, and as a result, Selenium, which is the main contributor to this feature, was employed in this investigation, with encouraging findings.

When certain bacteria come into touch with an unprotected selenium surface, the release of ions from the copper surface causes intracellular oxidative stress in the bacterial cell wall, resulting in bacterial cell lysis. This phenomenon has been known since

ancient times, but experts have recently revived their interest in it. For the aforementioned phenomenon, the term "contact killing" was coined. In the year 2008, the United States

Environmental Protection Agency (US EPA) designated copper as the first antimicrobial metal.

Low levels of resistance in bacteria are one of the most prominent advantages of selenium as an antibacterial agent. Because of their large surface area and high charge density, NPs can interact extensively with the negatively charged surface of bacterial cells, resulting in increased antibacterial action. The Surface Plasmon Method of green synthesis was chosen for the nanoparticle production because it is cost-effective and does not require the use of harmful chemicals.

Numerous plant extracts have been accounted for in numerous studies, to synthesize selenium nanoparticles. Also, as seen in the results of the current study nano

selenium showed promising antimicrobial properties. Further cytotoxicity tests have to be performed to move the nanoparticle into the clinical trial phase and be incorporated in mouthwash and other dental materials to increase the beneficial effects of the materials [1-18].

CONCLUSION

Within the limits of the study it can be concluded that selenium nanoparticles extracted from banana stem demonstrated promising anticancer properties.

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CONFLICT OF INTEREST

The authors have nothing to disclose or any conflicts of interest.

REFERENCES

1. Alpaslan E, Geilich BM, Yazici H, et al. pH-controlled cerium oxide nanoparticle inhibition of both gram-positive and gram-negative bacteria growth. Scientific Reports 2017; 7:1-2.
2. Aronoff BL. Advantages and disadvantages of the laser. In Lasers in Medicine and Surgery 198; 357:86-88.
3. Asiri A, Mohammad A. Applications of nanocomposite materials in dentistry. Woodhead Publishing 2018.
4. Beyth N, Houri-Haddad Y, Domb A, et al. Alternative antimicrobial approach: nano-antimicrobial materials. Evidence-based Complementary Alternative Med 2015; 2015.
5. Bitiren M, Karakilcik AZ, Zerin M, et al. Protective effects of selenium and vitamin E combination on experimental colitis in blood plasma and colon of rats. Biological Trace Element Res 2010; 136:87-95.
6. Cao W, Zhang Y, Wang X, et al. Novel resin-based dental material with anti-biofilm activity and improved mechanical property by incorporating hydrophilic cationic copolymer functionalized nanodiamond. J Materials Sci 2018; 29:1-3.
7. Gholami A, Ebrahiminezhad A, Abootalebi N, et al. Synergistic evaluation of functionalized magnetic nanoparticles and antibiotics against Staphylococcus aureus and Escherichia coli. Pharm Nanotechnol 2018; 6:276-286.
8. Haris Z, Khan AU. Selenium nanoparticle enhanced photodynamic therapy against biofilm forming streptococcus mutans. Int J Life Sci Scientific Res 2017; 3:1287-94.
9. Ketkar GN, Malaiappan S, Muralidharan N. Comparative evaluation of inherent antimicrobial properties and bacterial surface adherence between copper and stainless steel suction tube. J Pharm Res Int 2020; 149-56.
10. Keystone JS. Advantages and disadvantages of antimalarials for chemoprophylaxis. In Travel medicine 1989; 102-112.
11. Mao L, Wang L, Zhang M, et al. In Situ synthesized selenium nanoparticles-decorated bacterial cellulose/gelatin hydrogel with enhanced antibacterial, antioxidant, and anti-inflammatory capabilities for facilitating skin wound healing. Adv Healthcare Materials 2021; 2100402.
12. Marcello E, Maqbool M, Nigmatullin R, et al. Antibacterial composite materials based on the combination of polyhydroxyalkanoates with selenium and strontium co-substituted hydroxyapatite for bone regeneration. Frontiers Bioeng Biotechnol 2021; 9.
13. Tamara M. Nanotechnology and drug resistance. Adv Drug Delivery Rev 2013.
14. Moghimi SM, Hunter AC, Murray JC. Nanomedicine: Current status and future prospects. FASEB J 2005; 19:311-30.
15. Morens DM, Folkers GK, Fauci AS. Emerging infections: A perpetual challenge. Lancet Infectious Diseas 2008; 8:710-719.
16. Morones JR, Elechiguerra JL, Camacho A, et al. The bactericidal effect of silver nanoparticles. Nanotechnology. 2005; 16:2346.
17. Tran PA, O'Brien-Simpson N, Reynolds EC, et al. Low cytotoxic trace element selenium nanoparticles and their differential antimicrobial properties against S. aureus and E. coli. Nanotechnology 2015; 27:045101.
18. Vimbela GV, Ngo SM, Fraze C, et al. Antibacterial properties and toxicity from metallic nanomaterials. Int J Nanomed 2017; 12:3941.