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Synthesis of silver nanoparticles from *Garcinia Cambogia* extract and its antimicrobial efficacy

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ABSTRACT

The microbial infections have become an important clinical threat that leads to high morbidity and mortality which is mainly due to the development of microbial resistance drugs. The aim of the research was to synthesis silver nanoparticles using *Garcinia cambogia* extract and to analyse its antimicrobial activity. Silver nanoparticles have a wide role in different fields of technology. The silver nanoparticles act as antibacterial and antifungal agents in biotechnology, bioengineering, textile engineering, water treatment and silver-based consumer products. The silver nanoparticles were synthesised from the plant *Garcinia Cambogia* using green synthesis technology. The synthesis of silver nanoparticles from *Garcinia cambogia* plant extract, were characterised by UV spectroscopy and its antibacterial activity checked by disc diffusion method. Silver nanoparticles showed higher zone of inhibition compared to erythromycin and vancomycin that was analysed using disc diffusion method. The results that we obtained proved that silver nanoparticles from *Garcinia cambogia* exhibited significant antimicrobial activity than natural plant extract.

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INTRODUCTION

Silver nanoparticles have more applications in many areas including biomedical, material sciences and catalysis. Nanoparticles have many different effects on human health relative to bulk materials from which they are produced (Abou El-Nour *et al.,* 2010). The silver nanoparticles which is very small in size can enter in to skin, lungs, and brain cells very easily and showed its bioactivity. Exposure of metal containing nanoparticle to human lung epithelial cells generated reactive oxygen species, which lead to oxidative stress and damage of the cells (Khanna *et al.,* 2015). They need been used for many applications such as in industrial, household, healthcare-related product, medical device coatings, optical sensors and cosmetics. In pharmacology field the nanoparticles are very much used in diagnostics, medical science, drug delivery, antitumour agents and drug testing. The utilization are very much high in several textiles, keyboards, wound dressing, and medical specialty devices. Nanosized particles due to its unique physical, chemical and biological properties because of their surface-to-volume ratio; so, these nanoparticles are exploited for numerous functions. In order to satisfy the need of nanoparticles, numerous ways are followed for synthesis. The physical and chemical ways of synthesis appear to be costly and dangerous. So, biologically-prepared silver nanoparticles show high yield, solubility and high stability. Among

many artificial nanoparticles synthesis, biological ways appear to be easy, rapid, non-toxic, dependable and inexperienced approaches that may turn out well-defined size and morphology below optimized conditions for change of location analysis. In the end, an inexperienced chemistry approach for the synthesis of AgNPs shows abundant promise. The particle characterization is very important to study the chemical science properties of a particle which might have a major impact on their biological properties. So as to handle the protection issue to use the total potential of any nano material within the purpose of human welfare, in nanomedicines, or within the health care trade, etc., it's necessary to characterize the prepared nanoparticles before application (Zhang, 2016).

Hydroxy citric acid (HCA), the important phytoconstituent of *Garcinia cambogia* (Hypericaceae), is a competitive inhibitor of adenosine 59-triphosphate (ATP) citrate lyase, the enzyme that catalyzes the extra mitochondrial cleavage of citrate to oxaloacetate and acetyl Co A (Watson *et al*., 2000, Rasha T *et al*., 2015). D-leucine from leaves hydroxyl citrus extract from leaves and natural product skin, unsaturated fats and glycerides from seeds (Badami and Razdan, 1972) anthocyanin glycosides from organic products, garcinol, isogarcinol and cambaginol from natural product skins, phenolic mixes like xanthones, biflavanoids from heartwood (Jayaprakasha and Sakariah, 2002) and stem bark and unsaturated fats from seed oil were so far included from this plant (Kantha, 1964). RCOO (peroxyl radicals) which are shaped amid extreme digestion prompting early maturing of the cells. ROS are exceedingly receptive and have short life expectancy, known to make harm cell parts including lipid, DNA, protein, sugar, and other organic atoms, prompting numerous neurotic procedures, for example, maturing, tumor, cardiovascular sickness, diabetes, aggravation and neurodegenerative infections (Krishnamurthy *et al.,* 1981, Shahidi, 1997, Barla *et al.,* 2007, Bektas *et al.,* 2007, Nayak *et al.* 2010). Organic framework has its own particular safeguard system against these free radicals by delivering cell reinforcements. Cancer prevention agents are of restorative intrigue since they ensure the life form against the harm caused by the free radicals (Cos *et al.,* 2003). Cancer prevention agent hinders age of (ROS) responsive oxygen species and (RNS) receptive nitrogen species, or it straight forwardly searches free radicals, yet the insufficiency or abundance oxidative worry in the body requires an outer source. Nanoparticles are used as a tool for the detection of pathological biomarkers in clinical diagnostic applications, resulting in associate advancement of genetics and genetics technologies. The streptadivin-coated fluorescent phenylethylene nanospheres showed bigger sensitivity towards epithelial growth factor receptor (EGFR) in human malignant neoplastic disease cells, that provides a sensitive tool for biomarker discovery (Sies, 1993). The associate ultrasensitive nanoparticle-based assay for the detection of prostate-specific matter (PSA) within the tumor was developed, which may be more sensitive than the standard assay. Therefore, nanoparticles have gained importance in the field of molecular imaging, owing to their chemical properties, flexibility of surface coating and increased stability.

Nanotechnology has been used in molecular imaging, magnetic resonance imaging (MRI), light imaging, CT imaging and ultrasound techniques. Gadolinium-based magnet nanoparticles targeting protein in arterial sclerosis plaques allowed for more diagnostic imaging as compared to the usually used detecting agents; successively promoting early detection of arterial plaques (Geho *et al.,* 2004, Pulido *et al.,* 2000, Wang *et al.,* 2015). Moreover, nanoparticles are shown to not only solely increase specificity however it also increase solubility, stability and absorption of the drug. The cytotoxic effects of the drug was increased by nanoparticle combined formulation with paclitaxel, 5-fluorouracil and antibiotic which showed a greater impact on anticancer medication drug delivery system (Wang *et al.,* 2015).

MATERIALS AND METHODS

Synthesis of silver nanoparticles from *Garcinia cambogia* extract

Preparation of the extract

12.5 g of *Garcinia cambogia* was dried, powdered and dissolved in 50 ml sterile distilled water and filtered through Whatman No.1 filter paper (pore size 0.45 µm) and was further filtered through 0.22 µm sized filters. The extract was stored at 4°C for further experiments.

Figure 1: Silver nanoparticles formed after incubation

Synthesis of Silver nanoparticles from *Garcinia cambogia* extract

The aqueous solution of 1mM silver nitrate ($AgNO_3$) was prepared for the synthesis of silver nanoparticles. 10 ml of *Garcinia cambogia* extract and 10mg of collagen was added to 90 ml of 1mM silver nitrate solution for reduction into Ag^+ ions and kept for incubation period of 15 h at room temperature. Here the filtrate act as reducing and stabilizing agent for 1mM $AgNo_3$.

Characterization techniques

UV-Vis Spectroscopy

The kinetic behaviour of silver nanoparticles were characterized using UV-VIS spectrophotometer using a blank reference. The scanning range for the samples was 300-600 nm at a scan speed of 480 nm/min. The spectrophotometer was equipped with "UVWinlab" software to record and analyse data. The absorption spectra of all the samples were recorded and data's were analysed in the Origin 6.5 (Figure 2).

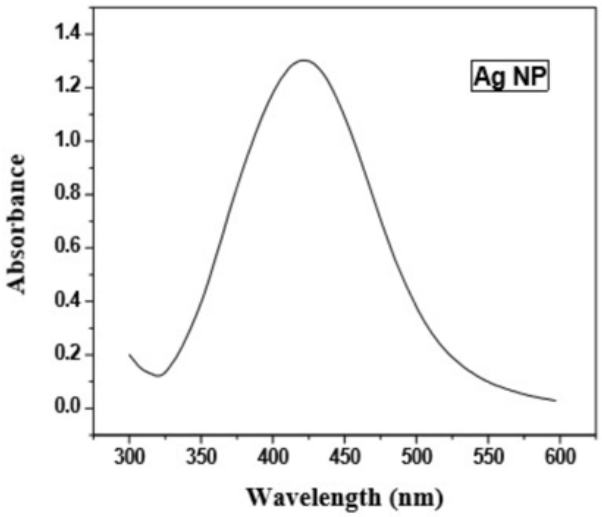

Figure 2: Graph shows the UV spectroscopy of silver nanoparticles

Disc diffusion method

The antibacterial assays was performed by standard disc diffusion method. The nutrient agar (1g beef extract, 1g peptone, 0.5 g NaCl dissolved in 100 ml of double distilled water) plates was used to culture the bacteria. The fresh overnight cultures of inoculum (100 µl) of *Escherichia Coli* were spread on solidified nutrient agar plates. The sterile paper discs made of Whatmann filter paper, 5 mm diameter dipped in different concentration (5, 10,15 µg/ml) of silver nanoparticles along with two standard antibiotic containing discs were placed in each plate. The agar plates were incubated at 37°C for 24 h. After 24 h of incubation the zone of inhibition was measured.

RESULT AND DISCUSSION

Plants deliver numerous phytochemicals to shield themselves from the microbial contaminations and other organic toxicities. Thus, plant materials can fill in as the great wellsprings of home grown pharmaceuticals (Bhalgat *et al.,* 1998, Tharachand *et al.,* 2005). Many infectious diseases are spreading in this new era which is the cause of morbidity and mortality worldwide. Many multidrug resistant microbial strains are increasing day by day which kills many people (Kim *et al.,* 2013). The use of traditional plant extracts which exhibit antimicrobial properties can be of great significance for therapeutic treatment against these dreadful microorganisms. The table 1 showed that through disc diffusion method, the silver nano particles of 5 µg/ml has a zone of Inhibition of 13.6 mm for E. coli, 10 µg/ml of AgNp particle has zone of inhibition of 15.3 mm for an E. coli, 15 µg/ml of AgNp particle has zone of inhibition of 17.6 mm for an E. coli, comparing this with vancomycin of 10 mcg/disc has a zone of inhibition of 19.6 mm diameter and that of erythromycin has no zone of inhibition for *E. coli* (Figure 3).

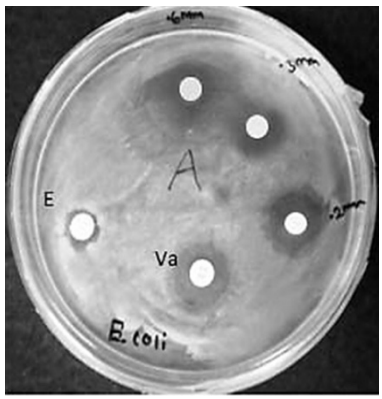

Figure 3: Images of antibacterial activities of discs of different particles were formed at the concentration of Ag nanoparticles (5, 10 and 15 µg/ml) and other antibiotics on E.coli (N=nanoparticles, VA= Vancomycin, E= Eryth-romycin).

Silver nitrate is utilized as diminishing operator as silver has particular properties such as great conductivity, synergist and concoction soundness. The fluid silver particles when presented to home grown concentrates were decreased in arrangement, there by prompting the development of silver hydrosol. Silver has more microbial adequacy and more viable within the sight of proteinaceous material (Iwu *et al.,* 1999). The zones of inhibition formed were mainly due to the destabilization of the outer membrane of microorganisms, plasma membrane damage and intracellular ATP depletion by the silver nanoparticles. The combination of antibiotics with

AgNPs against Gram-positive and Gram-negative bacteria would exhibit a valuable contribution to nanomedicine. The antibiotic action of bacitracin, streptomycin, gentamycin, kanamycin, ampicillin has been increased in the combination of AgNPs against the organisms causing serious illness. The previous evidence which supports our current results (Manojkanna *et al.,* 2017, Gandhi *et al.,* 2016). To understand the antibacterial drug mechanism of silver nanoparticles to gram-negative bacterium, we tend to chosen *E. coli* as model to check the result of silver nanoparticles on the permeableness and also the membrane structure of *E. coli* cells. It's documented that gram-negative bacterium possess associate outer membrane outside the peptidoglycan layer lacking in gram-positive organisms. The essential work of the outer membrane is to function as a selective permeableness barrier, protective bacterium from harmful agents, like detergents, drugs, toxins, and degradative enzymes, and penetrating nutrients to sustain microorganism growth (Li *et al.,* 2010). The silver nanoparticles synthesized from *Garcinia Cambogia* aqueous extract have shown dose-dependent inhibitory effect on the growth of the bacteria *E.Coli* at various different concentration. It was therefore recommended that the nature and the number of the active antibacterial silver nanoparticles size and characterisation can be studied in detail.

CONCLUSION

The significant morbidity and mortality caused by many diseases is mainly associated with the development of microbial resistance. These results provide evidence for the antimicrobial activity of silver nanoparticle synthesized from natural herbal extracts against microorganisms.

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