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GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES USING EXTRACT OF *Anisomeles malabarica* (L.) AND EVALUATION OF ITS ANTIMICROBIAL ACTIVITIES

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AUTHOR'S CONTRIBUTION

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

The phytochemical analysis carried out on the aqueous leaves extract of *Anisomeles malabarica* showed the presence of a maximum number of phytochemicals. The green synthesis of SNPs was done successfully using aqueous leaves extract of *A.malabarica.* Primary confirmation of color change from pale yellow to brown color was observed at 420nm recorded by UV- Visible spectroscopy and detailed characterization was carried out using UV-Visible spectroscopy, XRD, SEM. Present investigation also suggests that the green synthesized SNPs are exerting *in vitro* toxic effects on human microbial pathogens. Antibacterial studies of SNPs were highly attractive with different inhibition zone capacity when compared with aqueous leaves extract. Similarly Antifungal studies of SNPs also showed significant antifungal activity against the fungus when compared with aqueous leaves extract. The zone of inhibition formed is maximum in *Aspergillus niger* and showed best antifungal activity when compared with *Candida albicans.*

Keywords: *Anisomeles malabarica;* AgNO3 nanoparticles; Antibacterial and Antifungal studies.

1. INTRODUCTION

Irresistible sicknesses report for approximately one-portion of all passing around the world. In present day countries, in spite of the advances made in the thought of microorganisms and their oversight, episodes of epidemic occur because of medication resisting microorganisms and the development unavailingly obscure. Infection causing organisms are responsible for public wellbeing concerns [1].

Plants are also additionally utilized in nanotechnology for creating nanoparticles. Subsequently, the present green blend has indicated the environmental caring and sustainable origin of plants utilized as a compelling reducing specialist for the amalgamation of silver nanoparticles. This organic reduction of metal would be helpful for the advancement of perfect, nontoxic and environmentally satisfactory "green methodology" to deliver metal nanoparticles. The shaped silver nanoparticles are profoundly steady and have huge antimicrobial movement. Though great monodispersed, nanoparticles with very much characterized measurements can be acquired by utilizing plants [2].

Nanoparticles as a result of their little size have distinctive properties contrasted with the mass type of

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a similar material, accordingly offering numerous new advancements in the field of biosensing images, natural medicine, and bio nanotechnology. Nanotechnology is a ground-breaking innovation, which holds massive extension for the plan and improvement of numerous sorts of novel items with likely clinical applications on early sickness identification, therapy, and anticipation. The top-down methodology tries to create nanodevices on silicon (or different semiconductors) chips legitimately utilizing electron pillar or X-beam lithography. In the base up approach, nanostructures are integrated from iotas or atoms.

1.1 Silver Nanoparticles

Silver nanoparticles are one of the promising items in nanotechnology production. Silver alludes to any predefined type of the component silver or to the combination of structures which happen in that specific ecological setting [3]. Silver nanoparticles are normally designed to deliver silver particles, which are the wellspring of antibacterial action. Silver has been broadly known for its numerous properties helpful to people. It is in any case, a component of numerous contends. It has the most noteworthy electrical conductivity, a property valuable in electrical contacts and channels.

Above all, silver has for quite some time been utilized as a disinfectant; for instance, in treating wounds and consumes, on account of its expansive range harmfulness to microscopic organisms and, maybe, to growth and infections, just as its standing of restricted poisonousness to individuals [4].

Anisomeles malabarica are plentiful in therapeutic and aromatic properties. This plant species is predominately utilized in customary medication since very old history [5]. Be that as it may, the biodiversity of therapeutic and sweet-smelling plants is yet to be concentrated altogether.

A. malabarica is a fragrant, thickly pubescent, perpetual spice, 1.2-2.0 meter in stature. Leaves are straightforward, inverse, extremely thick, fragrant, elliptical lanceolate, intense, pale above, white underneath, crenate-serrate, and wooly; blossoms purple, in thick whorls of pretty much intruded on spikes; organic products nut lets, bearing ellipsoid and compacted seeds [6]. The basic vernacular names of the *A. malabarica* are Peimiratti, Malabar catmint, Bhutan kusham and Peyameratti.

Earlier phytochemical studies of *A. malabarica* have shown the presence of anisomelic acid, anisomelolide, 2-acetoxymalabaric acid, anisomelyl acetate anisomelin, betulinic acid, ß-sitosterol, Citral, gerainic acid, malabaric acid, ovatodiolide, and triterpenebetulinic acid [7]. The main aim of this study is to green synthesize silver nanoparticles using the plant *Anisomeles malabarica* and test its effectiveness against the selected bacteria and fungi.

2. MATERIALS AND METHODS

2.1 Extraction and Synthesis of Silver Nanoparticles

2.1.1 Plant collection

Fresh plant materials were collected from Trichy, Tamil Nadu, India. The plant materials were systematically distinguished and verified as *Anisomeles malabarica*.

Fig. 1. *Anisomele malabarica*

2.1.2 Processing of the leaves

The fresh leaves were repeatedly washed appropriately with sterile water and shade dried for 20 days. At that point the dried leaves were powdered utilizing an electrical motor. The powder was put away in an impenetrable holder until needed for study.

2.1.2.1 Preparation of leaf extraction

The plant leaves were extracted with Soxhlet extraction technique. About 20gm of powdered plant

material was consistently pressed into a thimble and removed with 250ml of refined water. The Process of extraction proceeds for 24 hours or till the dissolvable in the Siphon container of an extractor becomes boring.

2.1.3 Synthesis of silver nanoparticles

The fluid arrangement of silver nitrate (AgNO3) at a grouping of 1mM was set up to incorporate biomimetic silver nanoparticles from the watery concentrate of *Anisomeles malabarica* leaf. In detail, 500ml of the watery arrangement at the centralization of 1mM silver nitrate arrangement was added to 25 ml of fluid leaf removal while mixing for decrease into silver particles and the response combination was kept at room temperature for 24-48h. The arrangement of dull earthy colored tone was seen after reasonable hatching time at room temperature and lambda max was taken utilizing UV-Visible spectroscopy (JASCO V-670).

At that point, the biomimetic silver nanoparticles arrangement was refined by rehashed centrifugation at 6,000 rpm for 20 min to detach unadulterated biomimetic silver nanoparticles liberated from other bioorganic exacerbates that present in the response blend. After centrifugation, the acquired particles were washed a few times with refined water for 10 to 20 min and kept in a Hot air stove for drying at 50˚C for 3h to get powder type of silver nanoparticles.

2.2 Characterization of Silver Nanoparticles

2.2.1 UV-Visible spectroscopy

Development of greatest creation of biomimetic silver particles after 48h hatching at room temperature the response combination was affirmed by the shading change of the arrangement and the surface plasmon reverberation band was gotten by UV-Visible ghastly investigation which was finished by utilizing UV-Visible spectrophotometer (JASCO, V-670) from 300-800 nm at a goal of 1 nm. The arrangement of dull earthy colored tone was seen after reasonable hatching time at room temperature and lambda max was taken utilizing UV-Visible spectroscopy (JASCO V-670).

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2.2.2 X-ray Diffraction spectrum

X-ray diffraction (XRD) estimation of the biomimetic blended silver nanoparticles which were completed utilizing X'Pert Pro X-beam diffractometer (PAN investigative BV, The Netherlands) furnished with Cu/Kα radiation source utilizing Ni as channel at a setting of 30kV/30mA. All X-beam diffraction information was gathered under the standard test conditions in the customary precise reach. The translucent silver nanoparticles were determined from the width of the XRD tops, utilizing a Debye-Scherer equation, where D is the average crystallite domain size perpendicular to the reflecting planes, λ is the X ray wavelength, β is the full width at half maximum and θ is the diffraction angle.

2.2.3 Scanning electron microscopy

The response arrangement containing silver nanoparticles combination utilizing fluid leaf concentrate of *Anisomeles malabarica* was centrifuged at 6,000 rpm for 20 min. The supernatants were disposed of and the last pellets were disintegrated in 1ml of deionized water. The pellet was blended appropriately and painstakingly positioned on a glass spread slip followed via air-drying. The spread slip itself was utilized during checking electron microscopy (SEM) investigation. The pictures of biomimetic silver nanoparticles were acquired in a SEM (Fb-Quanta 200 SEM machine) at various amplification levels.

2.2.4 Energy-dispersive X-ray (EDX) analysis

The synthesized silver nanoparticles using *Anisomeles malabarica* aqueous leaf extract subject to the Energy dispersive spectrum using SEM attached Fb-Quanta-200 resolution to confirm the presence of silver in the particles as well as to detect other elementary compositions of the particle.

2.3 Antimicrobial Activity

Four bacterial strains and two fungal strains were selected for this study. Bacterial stains include 2 Gram- positive bacteria *Bacillus subtilis, Staphylococus aureus* and 2 Gram-negative bacteria *Salmonella typhi, Shigella flexneri and 2* fungal culture includes *Aspergillus niger* and *Candida albicans.* The watery plant extract and blended SNPs of *A. malabarica* were screened for antibacterial movement utilizing standard Disk Diffusion Assay

(Bauer, 1996). Sterile paper circles (6mm measurement) containing (10, 20, 40 and 80µg/ml) of fluid plant extricate and orchestrated SNPs of *A. malabarica* were put over the petri plates utilizing sterile forceps. The petri plates which had the bacteria were hatched for 24 hours at 37ºC and those had fungi incubated at 35ºC for 3 days. Amoxicillin (10µg/ml) and Ciprofloxacin (10µg/ml) were utilized as control against gram positive and gram-negative bacteria respectively and Fluconazole (5µg/ml) used as control for fungal strains. After that the zone of hindrance (distance across mm) was estimated.

3. RESULTS AND DISCUSSION

3.1 Visual Appearances of Flask Containing the Aqueous Extract of *A. malabarica* Leaf and AgNO3 Solution

Extraction acquired from *Anisomeles malabarica* leaves in Soxhlet mechanical assembly gave a dim green shading separate in great amount. The nanoparticle perception was the shade of the response combination changed from gleam yellow to dull ruddy earthy colored after 48h brooding at room temperature which demonstrates the development of silver nanoparticles utilizing *A. malabarica* leaf fluid concentrate. It is notable that silver nanoparticles show a dim earthy colored tone in water because of excitation of surface Plasmon vibration in metal nanoparticles.

Control (without silver nitrate) shows no shading change, when the *A. malabarica* leaf fluid concentrate with watery silver nitrate arrangement when hatched at 24-48h demonstrated ruddy earthy colored shading this showed the combination of silver nanoparticles (Fig. 2) because of present of bioactive mixes in fluid concentrate of *A. malabarica* leaf liable for the decrease of silver nitrate to silver nanoparticles.

The diverse variety of compounds and phytochemicals are available in *A. malabarica* plant separately, these phytochemicals might be answerable for the decrease of silver particles.

3.2 Characterization of Synthesized Silver Nanoparticles

3.2.1 UV-visible spectroscopy analysis

Development of silver nanoparticles (AgNPs) by decrease with silver nitrate (AgNO3) by fluid concentrate of *Anisomeles malabarica* leaf after 48h hatching tests were portrayed by utilizing UV-Visible spectroscopy (JASCO-V/670) and this method has end up being exceptionally helpful for the investigation of biomimetric silver nanoparticles arrangement in the response combination. In the UV-Vis retention range, a solid, expansive pinnacle situated between 420 to 471 nm was watched (Fig. 3). UV- Visible spectra likewise uncovered that arrangement of AgNPs happened quickly inside the 48 hours just and the AgNPs in arrangement stayed stable even following 48h of fulfillment of response. The comparable sort of the silver nanoparticles tops was accounted for in Geranium leaf separate, fluid concentrate of areca nut and pomegranate strip extricate. In this current investigation, the incorporated silver nanoparticles (AgNPs) were demonstrated at 461 in noticeable light districts.

Fig. 2. Visual appearances of flask containing the aqueous extract of *A. malabarica* leaf and AgNO3 solution after 48h reaction time
a) Aqueous extract of *Anisomeles malabarica* leaves. b)1mM AgNO3. c) Reaction mixture 0 min incubation. d) Reaction mixture after 48h incubation at room temperature.

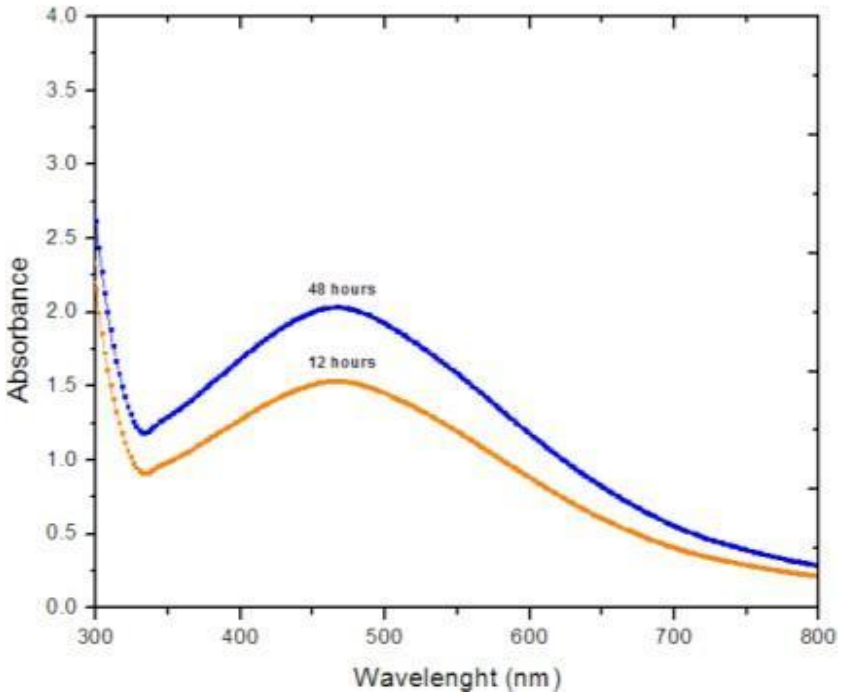


Fig. 3. Absorption spectrum of AgNPs synthesized by aqueous extract of *A. malabarica*

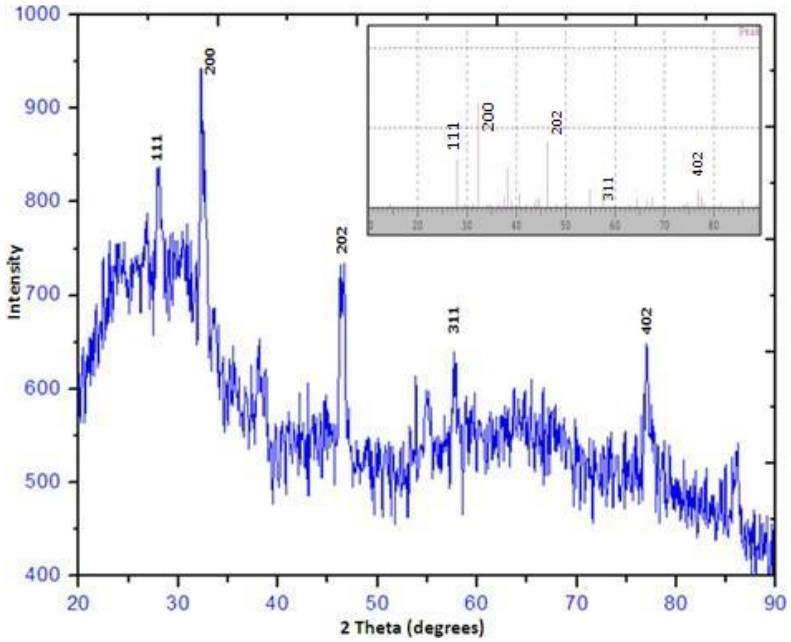


Fig. 4. X-ray diffraction spectrum of synthesized silver nanoparticles

3.2.2 XRD analysis

Fig. 4 shows the X-beam diffraction range of biomimetric integrated AgNPs. The Braggs reflections were seen in the XRD design at 2θ =32.27, 46.25, 59.60 and 78.69 These Braggs reflections unmistakably demonstrated the presence of (200), (202), (311) and (402) arrangements of cross section planes and further on the premise that they can be listed as face focused cubic (FCC) structure of silver. Revealed that the XRD design green incorporated silver nanoparticles and demonstrated a number of Braggs reflections that might be listed based on the face focused cubic structure of silver. Since, the

current investigation unmistakably showed the x-beam diffraction example of biomimetic integrated silver nanoparticles framed glasslike in nature. Extra so far unassigned pinnacles were likewise watched and proposing that the crystallization of the bioorganic stage happened on the outside of the nanoparticles.

3.2.3 SEM image

The morphology of nanoparticles was determined by SEM. The image of scanning electron microscopy of aqueous extract *A. malabarica* plant leaf medicated biomimetric synthesized AgNPs shows high aggregation of silver particles on the surface of the cell. The XRD and SEM analysis revealed that the green synthesized silver nanoparticles were shown spherical in shape with particles size below 40-80 nm in diameter. The larger silver nanoparticles may be due to the high aggregation of the smaller ones. This may be due to availability of different quantities and nature of bioorganic compounds present in the aqueous extract of *A. malabarica* leaves. Fig. 5 showed different magnification scanning electron microscopic images of biomimetric synthesized silver nanoparticles using *A. malabarica* leaf extract. Previous observations indicated that the plant phytochemicals may be responsible for bio reduction of Ag+ to Ag0 and subsequent formation of silver nanoparticles, the obtained AgNPs shown spherical in shape with high aggregation.

3.2.4 EDX analysis

Energy-dispersive X-beam spectroscopy (EDX) is an explanatory procedure utilized for the natural examination or compound portrayal of an example. In this current investigation, the component examination of the biomimetic orchestrated AgNPs was performed utilizing EDX range (Fig. 6). The EDX range of round fit as a fiddle with high total of silver nanoparticles on the outside of the cell arranged with this bioreduction technique utilizing *Anisomeles malabarica* demonstrated most extreme tops around 3.28 keV relate to the coupling energies of silver particles. All through the filtering scope of restricting energies, some expansion tops having a place with bioorganic compound present in the response blend. The EDX investigation uncovered solid signs in the silver area and affirms the development of silver nanoparticles by utilizing organic source. There were other EDX range tops for Cl, Si, O and Ca proposing that they are blended accelerates present in the plant separate.

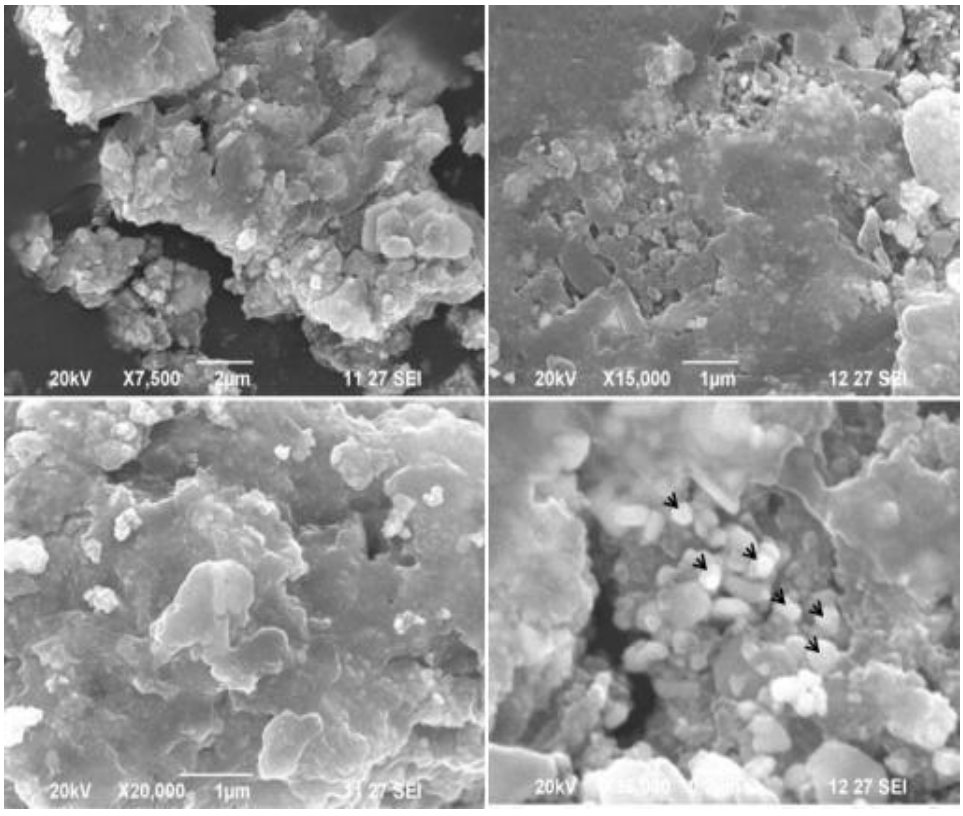


Fig. 5. SEM image of biomimetic synthesized AgNPs

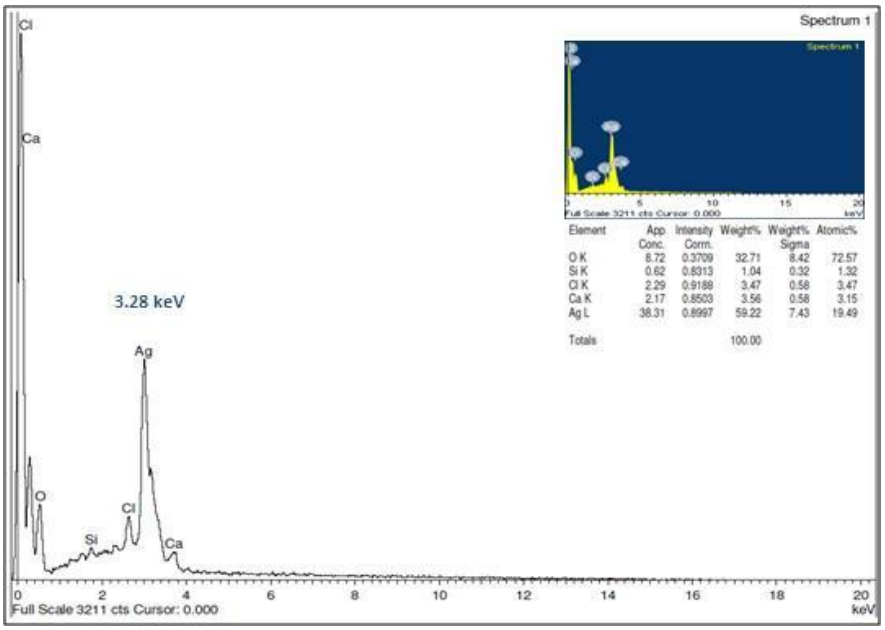


Fig. 6. EDX spectrum of prepared AgNPs using *A.malabarica* at room temperature

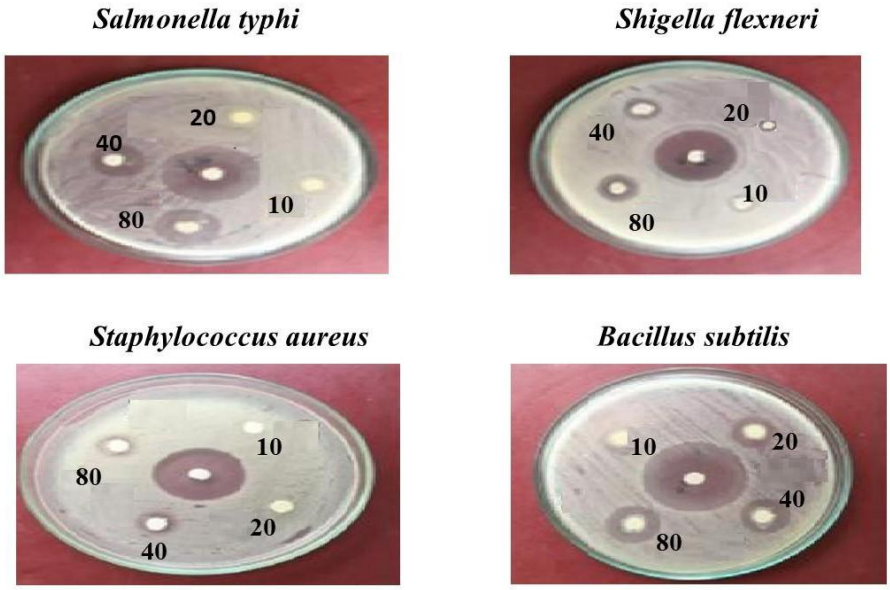


Fig. 7. Photograph showing the discs of antibacterial activity of aqueous extract of *A.malabarica* at different concentrations (10, 20, 40 and 80 µg/ml)

Table 1. Antibacterial activity of aqueous extract of *A.malabarica* against various test pathogens

Test organisms	Zone of inhibition (mm)				
	Control	Concentration (µg/ml)			
	10µg/ml	10	20	40	80
S.typhi	22±0.16	5±1.03	7±0.28	11±0.66	15 ±0.86
S.flexneri	23±0.33	5 ±0.33	6 ±0.44	8 ±0.44	10 ±0.57
S.aureus	22± 0.88	4 ±1.8	5±1.03	6 ±0.86	7±0.28
B. subtilis	24±1.15	4± 0.33	7±0.28	8±0.44	14±1.16

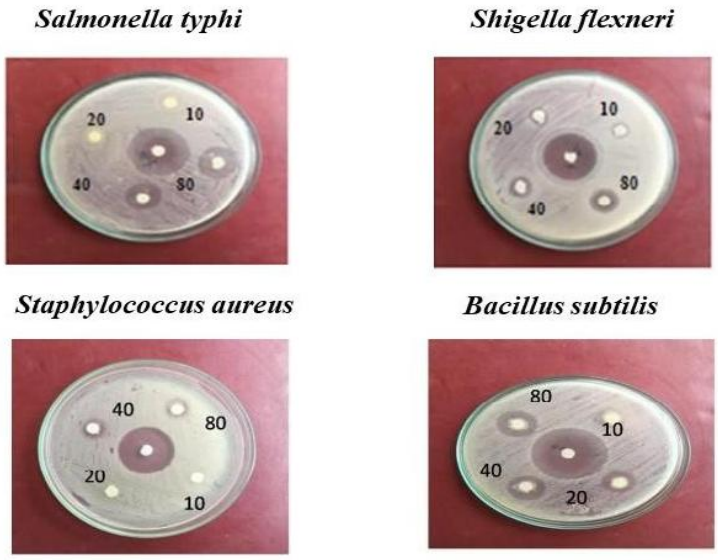


Fig. 8. Photograph showing the discs of antibacterial activity of green synthesized SNPs of *A.malabarica* at different concentrations (10, 20, 40 and 80 µg/ml)

Table 2. Antibacterial activity of green synthesized SNPs of *A.malabarica* against various test pathogens

Test organisms	Zone of inhibition (mm				
	Control	Concentration (µg/ml)			
	10µg/ml	10	20	40	80
S.typhi	26±1.45	7±0.28	9±0.44	12±0.5	17 ±1.10
S.flexneri	23±0.33	6 ±0.44	8 ±0.44	10 ±0.44	12 ±0.28
S.aureus	23± 1.0	7 ±0.33	8±1.03	9 ±0.57	10±0.44
B. subtilis	26±0.57	8± 0.33	10±0.57	11±0.66	18±1.09

3.3 Antibacterial Analysis

Zone of inhibition increases with increase in the concentration of aqueous extract and green synthesized SNPs of *A.malabarica*. With increase in concentration at 80µg/ml all the aqueous extract and SNPs exhibited highest antibacterial activities. Highest zone of inhibition was found against gram positive bacteria *B.subtilis* and gram negative bacteria *S.typhi* for aqueous extract (14±1.16mm) (15 ±0.86mm) and SNPs (18.1±1.09mm) (17 ±1.10mm) respectively. Moderate zone of inhibition against gram negative bacteria *S.flexneri* for aqueous extract (10 ±0.57mm) and SNPs (12 ±0.28mm) and lowest zone of inhibition against gram positive bacteria *S.aureus* for aqueous extract (7±0.28mm) and SNPs (10±0.44mm) was noticed Table 1 and 2. Anyhow synthesized SNPs showed the highest zone of inhibition when compared with aqueous extract for all the four bacterial strains. All the organisms when compared with standard control such as Amoxicillin and Ciprofloxacin showed a significant activity.

3.4 Antifungal Analysis

The antifungal activity of aqueous leaves extract and green synthesized SNPs of *A. malabarica* were studied against the fungus *Aspergillus niger* and *Candida albicans* at a concentration of (10, 20, 40 & 80 µg/ml) by agar well diffusion technique. The control fluconazole at concentrations of (5 µg/ml) were also tested. The data revealed that both the fungus showed a significant reduction in the growth. The synthesized SNPs showed significant differences in the efficacy and a maximum antifungal activity against *Aspergillus niger* and *Candida albicans* when compared with aqueous extract with increase in concentrations (Fig. 9). The aqueous extract of *A. malabarica* tested against *Candida albicans* showed poor activity when compared with SNPs. Anyhow the zone of inhibition formed is maximum in *Aspergillus niger* and showed best antifungal activity when compared with *Candida albicans*. The zone of inhibition formed is given in the Table. 3 and 4.

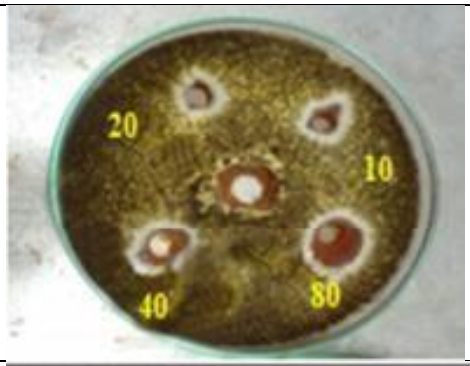
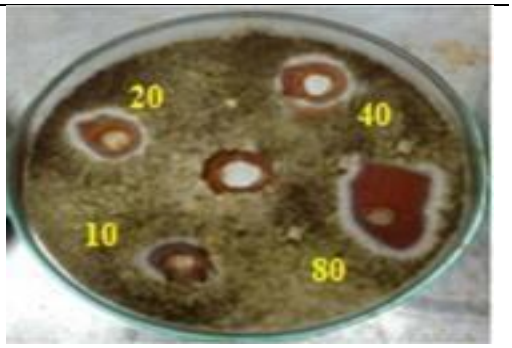
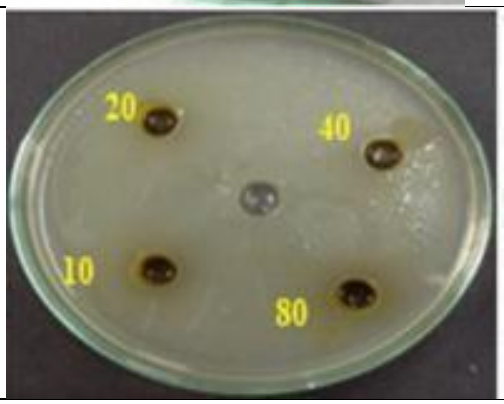
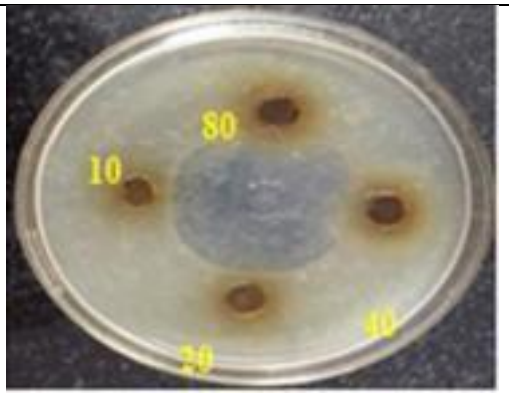
Fungi	*A. malabarica* Extract	Green synthesized SNPs of *A. malabarica*
Aspergillus niger		
Candida albicans		

Fig. 9. Photograph of antifungal activities of aqueous extract, SNPs and Control of *A.niger* and *C. albican*

Table 3. Zone of inhibition of plant extract formed against fungal strains

Test organisms	Zone of inhibition (mm)				
	Control flucanazole 5µg/ml	Concentration (µg/ml)			
		10	20	40	80
Aspergillus niger	7±0.44	-	2±0.33	4±0.33	6±0.66
Candida albicans	6±0.57	-	-	2±0.33	4±0.33

Table 4. Zone of inhibition of silver nanoparticles formed against fungal strains

Test organisms	Zone of inhibition (mm)				
	Control Flucanazole 5µg/ml	Concentration (µg/ml)			
		10	20	40	80
Aspergillus niger	8±1.15	4± 0.44	6±0.28	8±0.33	13±0.28
Candida albicans	7±0.33	3±0.33	4 ±0.44-	6±0.33	8±1.03

In the ongoing years, research is centered around metal nanoparticles because of their exceptional optical, electronic, mechanical, attractive, and synthetic properties that are fundamentally not quite the same as those of mass materials [8]. Silver-impregnated wraps and dressings are the treatment of decision for genuine consumers and are currently accessible over-the-counter for nearby treatment of wounds and disposal of pathogenic microscopic organisms [9]. Based on the results, alkaloids seem to be the most common bioactive phytoconstituents and were present in *A.malabarica* plant extracts. Flavonoids, glycosides, carbohydrates and tannins were also present in the plant extracts. Saponins, phenols and terpenoids had also shown their presence in the plant extracts. Apart from all these bioactive phytochemicals, quinones and phenolics were also present in the plant extracts. These findings correlate well with several earlier publications [10,11]. Hence, plants are known for their ability to produce

secondary metabolites and mankind has used many species for centuries to treat a variety of diseases. As a matter of fact, many have been shown to present exciting biological and pharmacological activities and may have potential to be used as chemotherapeutic agents or serve as the starting point in the development of new medicines. Moreover, plants are rich in a wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which have been found *in vitro* to have antimicrobial properties [11]. Hence, the presence of all these bioactive phytoconstituents in the investigated plants support their substantial antimicrobial activity and warrants further efforts in regard to purification and isolation of bioactive compounds from their extracts for probable development of new therapeutic agents, especially antimicrobials.

Recently many research groups have been involved in the synthesis of metal nanoparticles in a green chemistry approach. In this method we can use greener solvent, non-toxic reducing agents and greener methods like microwave or sonochemical methods. In green methodology mostly plant extract, edible items, and nontoxic reducing have been utilized to avoid harsh reaction conditions and environmentally benign medium. In the present work we have demonstrated a simple green chemistry approach for the synthesis of silver nanoparticles using *A.malabarica* leaves extract. The selection of plants was based upon medicinally important plants which cure various types of diseases and they are routinely used in our Indian tradition medicine in a prescribed format. The antimicrobial activity of the plant extract in presence of the metal nanoparticles synthesized by a green chemistry method have been tested.

Silver ion reduced into silver nanoparticles during exposure to plant extracts was observed as a result of the colour change (Fig. 1). The colour change is due to the Surface Plasmon Resonance phenomenon (SPR), i.e. the interaction of electromagnetic radiation and the electrons in the conduction band around the nanoparticles were reported by Park et al. [12]. Combined vibration of free electrons of metal nanoparticles in resonance with light waves give the SPR absorption band. Silver nanoparticles were observed strongly in the range 400- 450 nm in visible regions. In the present work, the UV absorption bands are observed for silver nanoparticles at around 437 nm while *A.malabarica* was at 440 nm. This plant has more potential to reduce Ag ions into Ag nanoparticles. This colour variation is due to the excitation of the SPR in the metal nanoparticles. The results of XRD and SEM also showed the potency of the plant studied for nanoparticle synthesis.

The elemental analysis of the silver nanoparticles shown in the figure reveals the highest proportion of silver followed by aluminium, and oxygen. The oxygen peaks are from the biomolecules bound to the surface of the silver nanoparticles, and aluminium peaks are due to sample grid holders which are made from aluminium alloy. It has been reported that nanoparticles synthesized using plant extracts surrounded by a thin layer of some capping organic material from the plant leaf are stable in solution several months after synthesis [13].

It is reported that synthesized metal nanoparticles attached to the surface of the cell membrane, disturb its function and penetrate directly with the bacterial outer membrane and release metal ions. As positive control Ofloxin 1 mg/mL is used. If the concentration of the synthesized sample increases, the zone of inhibition values also increases. At higher concentration, silver nanoparticles directly damage the cell envelope by penetrating the cell and then binding to the DNA. Thus an Ag-DNA complex is made and it prevents the DNA replication by rupturing the hydrogen bonds between adjacent purines and pyrimidines fractions. Synthesized silver and copper nanoparticles show better antibacterial activity at higher concentration than the standard. The high bactericidal activity of synthesized silver and copper nanoparticles is due to their extremely large surface area, which provides better contact with microorganisms. Combination of silver nanoparticles and antibiotic Ofloxin reveals a synergistic effect, the antibacterial activity against the selected bacterial strains.

Several researches confirming antibacterial activity of silver nanoparticles against the food related bacteria Bacillus subtilis, Escherichia coli, and Staphylococcus aureus have been reported [14]. These nanoparticles are also known to exhibit antibacterial activities against *E. coli* [15]. The formation of hydrogen peroxide from the surface of silver is considered to be mainly responsible for its antibacterial property [16]. Thus from this study it can be concluded that *A.malabarica* extracts can be used for the synthesis of silver nanoparticles. This study also suggests that synthesized silver nanoparticles can be used as an alternative to the existing antibacterial agents.

4. CONCLUSION

In the present scenario the use of complementary and alternative remedies is greater than ever and it offers unique opportunities for the development of natural medicine. Traditional knowledge of the past and present folk is of massive value to the development of

newer drug compounds. Earlier studies are contributing so much in the isolation of the compounds which are responsible for the mechanism of action and therapeutic values in various types of ailments. Many allopathic medicines of daily use have been isolated from natural sources. Now-a-days all the related diseases are increasing due to the changes in the current lifestyle. The present study demonstrates the antimicrobial study in vitro model that can significantly repress the development of activities. Hence it is evidence from the present investigation that green synthesized SNPs and bioactive compounds of aqueous extract of *A.malabarica* exhibit excellent antimicrobial properties would emerge as a natural and alternative replacement for chemical therapeutic drugs.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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