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SYNTHESIS, CHARACTERIZATION AND ITS *IN VITRO* ANTIOXIDANT, ANTIBACTERIAL AND ANTIDIABETIC ACTIVITIES OF SILVER NANOPARTICLES OF *CURCUMA LONGA* LEAVES

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ABSTRACT

Turmeric, a medicinal plant known by the scientific name *Curcuma longa* has various medicinal properties. India being the largest producer of turmeric exports a large quantity of turmeric all over the world because of its usefulness in medicine, cooking, and even in beauty products. The rhizome is considered as the useful part of the turmeric plant and the stem and leaves of the plant are always considered as waste and are disposed. The waste disposed from the plant is higher than the amount of turmeric rhizome produced. As the rhizome has useful medicinal properties like antioxidant, antimicrobial , anti-inflammatory, antidiabetic activities it is more in demand than its production. Hence, the *Curcuma longa* leaves which is considered as the waste product were selected to experimentally test its useful medicinal properties by synthesizing silver nanoparticles from the extract obtained from the plant leaves. Silver, an ancient metal used for its significant antibacterial property can be synthesized from plant extract as silver nanoparticles by using biological method. The properties like antioxidant, antibacterial and antidiabetic activities of the silver nanoparticles synthesized from turmeric leaf extract were tested and discussed from the result obtained.

Keywords: Turmeric leaves, silver nanoparticles, antioxidant, antibacterial, antidiabetic.

1. INTRODUCTION:

Since the ancient the times the plants are used as a medicine to cure various diseases. These plants in common are known as medicinal plants. In the field of drug development, the compounds obtained from the plants are the main source of the developed drugs present in the market [1]. Medicinal plants play a major role in the drug development field as they naturally possess properties like antimicrobial, antiviral, anti-inflammatory, antidiabetic, antioxidant and various other properties. Diabetics being one of the major health problem in the world, the medicinal plants are used to develop drugs against the disease because of their antidiabetic properties. There are various types of diabetics among which diabetics mellitus is the most common type of diabetics that affect the people [2]. Plants like *Curcuma longa* have antidiabetic property and mostly the rhizome of the plant called as the turmeric is under research for developing the drug against diabetics because the compound curcumin present in the plant has good antidiabetic property. *Curcuma longa* belongs to the family of *Zingiberaceae*, it is a perennial herb which has several therapeutic properties. The *C.longa* from India has high concentration of curcumin compared to other countries. The rhizome part has high concentration of curcumin compared to other parts of the plant [3]. Research shows that the turmeric can be used to treat respiratory disorder, gastrointestinal problems, cardiovascular disorders, diabetics and many other disorders. Turmeric has good anticancer activity[4]. Arthritis is a disease caused due to inflammation and also it is one of the most common disease like diabetics because it affects millions of people worldwide. *C.longa* can be used to treat arthritis as well. Because the curcumin content in the plant helps reduce pain and can act as a pain relief drug [5]. So the turmeric is used to treat arthritis and is under study to develop it as a drug to treat the disease. The turmeric, as a whole has received attention throughout the world because of its health benefits. These health benefits are due to its significant antioxidant and anti-inflammatory properties. Taking turmeric in a low dose regularly can reduce the risk of future health problems in a healthy person. It can be used in food as a flavour

enhancer and colour agent as well. Rather than its use in medical and culinary field it is also used in the field of cosmetics. Because it can help reduce skin problems and treat various skin infections caused to bacterial and fungal infections [6]. The leaves of the plant also has curcumin content but in a quantity less than the rhizome. The leaves of the *C.longa* plant can be used in the green synthesis of silver nanoparticles. The method of green synthesis also known as the biological synthesis is a cost effective, eco-friendly method and does not use chemicals. Among the metal nanoparticles the silver nanoparticles has been used more often because of its good antibacterial activity. Since ancient times silver is known for its significant antimicrobial activity [7]. In our present study, the turmeric plant leaves are collected and used for the green synthesis of silver nanoparticles and then the study of its *in vitro* antibacterial, antioxidant and antidiabetic activities are done.

2. MATERIALS AND METHODS:

2.1 PLANT COLLECTION

The plant leaves were collected from the outskirts of Erode and washed in water to remove dust. The leaves are then prepared for extraction process.

2.2 SOLVENT EXTRACTION

The fresh leaves were grinded using an electric mixer and then subjected to extraction using Soxhlet apparatus. The extract was then stored and used later.

2.3 PHYTOCHEMICAL ANALYSIS:

The qualitative phytochemical study was performed on the extract by using standard tests.

2.3.1 Test for Alkaloids (Wagner's test)

Few ml of plant extract was taken and treated with 4-5 drops of Wagner's reagent. The formation of reddish brown precipitate confirms the presence of Alkaloids.

2.3.2 Test for Phenol (Ferric chloride test)

About 2ml of the extract was treated with 10% ferric chloride solution and observed for the formation of deep blue / black colour.

2.3.3 Test for reducing sugars (Fehling's Test)

To 1 ml of the extract added few drops of Fehling's reagent and the mixture was boiled in a boiling water bath for 10 minutes and observed for the appearance of blue colour.

2.3.4 Test for Saponins (Foam test)

To 2 ml of the plant extract added to 6ml of water in a test tube. The mixture was shaken vigorously and observed for the formation ,of persistent foam for few seconds. The presence of foam confirms the presence of saponins.

2.3.5 Test for Flavonoids

To about 2ml of plant extract, few drops of dilute NaOH solution was added. The formation of intense yellow colour indicates the presence of flavonoids.

2.3.6 Test for Phytosterols (Salkowski's Test)

1 ml of the plant extract was treated with 2 ml of chloroform and few drops of acetic anhydride was added. To that mixture added equal amount of concentrated sulphuric acid was added. The formation of brown colour ring indicates the presence of phytosterols.

2.3.7 Test for Amino acids and Proteins (Ninhydrin test)

Few ml of plant extract was added to small amount of Ninhydrin reagent. The formation of purple or violet colour indicates the presence of amino acids and proteins

2.3.8 Test for Steroids

About 2 ml of chloroform and 0.2 ml of concentrated sulphuric acid was added to 1ml of leaves extract. The formation of red colour precipitate indicates the presence of steroids.

2.3.9 Test for Tannin

1ml of plant extract is mixed with few drops of dilute ferric chloride solution. The presence of tannin is confirmed by the formation of dark green or blue color.

2.3.10 Test for glycosides

To 1ml of plant extract added few ml of concentrated sulphuric acid. The presence of glycoside is indicated by formation of red colour.

2.4 PREPARATION OF SILVER :

A 0.169 gm of silver nitrate (Agno3) is taken and dissolved with 100ml of distilled water.

2.5 SYNTHESIS OF SILVER NANOPARTICLES:

Add 10ml of silver nitrate solution and 90ml of plant water extract in conical flask cover tightly keep it dark place . after 1 hour in measuring uv- spectrophotometer in 300- 600nm range. The silver Nanoparticles formation was monitored upto 48hr in uv- spectrophotometer measurements. FTIR measurements were obtained on a Nexus 670 FTIR instrument with the sample and also the SEM analysis was done.

2.6 ANTIOXIDANT ACTIVITY :

2.6.1 DPPH radical scavenging activity

The free radical scavenging activity of aqueous extract of plant extract was measured by using 2, 2-diphenyl-1-picrylhydrazyl (DPPH). An aliquot of 3 ml of 0.004% DPPH solution in methanol and 0.5 to 2.5 µl of plant extract/ascorbic acid at various concentrations were mixed. The mixture was shaken vigorously and allowed to reach a steady state at room temperature for 30 min. Decolorization of DPPH was determined by measuring the absorbance at 518 nm. A control was prepared using 0.1 ml of respective vehicle in the place of plant extract/ascorbic acid. The percentage inhibition of DPPH radicals by the taken plant extract AgNps (silver nanoparticles) was determined by comparing the absorbance values of the control and the experimental tubes.

$$\text{Scavenging activity \%} = \frac{\text{A (control) - A(sample)}}{\text{A (control)}} \times 100$$

2.6.2 Ferric reducing/antioxidant power (FRAP) assay :

The antioxidant capacity of sample were estimated according to the following procedure. FRAP reagent (900 µl), prepared freshly and incubated at 37 ºC, was mixed with 90 µl of distilled water and 30 µl of test sample, or acetone (for the reagent blank). The test samples and reagent blank were incubated at 37 ºC for 30 minutes in a water bath. The FRAP reagent contained 2.5 ml of 20 mmol/l TPTZ solution in 40 mmol/l HCl plus 2.5 ml of 20 mmol/l FeCl3.6H2O and 25 ml of 0.3 mol/l acetate buffer, pH 3.6. At the end of incubation period the

absorbance readings were recorded immediately at 593 nm using a spectrophotometer. Scavenging activity was determined using the corresponding regression equation.

$$\text{Scavenging activity \%} = \frac{\text{A (control) - A (sample)}}{\text{A (control)}} \times 100$$

2.6.3 Nitric oxide (NO) scavenging activity :

Nitric oxide scavenging activity of sample was determined by adding 400 µL of 100 mm sodium nitroprusside, 100 µL of PBS (pH - 7.4) and 100 µL of different concentration of plant extract AgNps. This reaction mixture was kept for incubation at 25°C for 150 minutes. To 0.5 ml of above solution, 0.5 ml of Griess reagent was added (0.1 ml of sulfanilic acid and 200 µL naphthylethylenediamine dichloride (0.1%) w/v)). This was kept on incubation at room temperature for 30 minutes, and finally absorbance is observed at 540 nm. The percentage inhibition was calculated by the following formula:

$$\text{Scavenging activity \%} = \frac{\text{A (control) - A (sample)}}{\text{A (control)}} \times 100$$

2.6.4 Hydrogen peroxide scavenging activity (H_2O_2)

This activity of the sample was evaluated by the following procedure. 850 µL of the aqueous sample was added to 150 µL of 4 mm hydrogen peroxide solution prepared in phosphate buffer (0.1 M, pH-7.4). This was incubated for 10 minutes, and absorbance was read at 230 nm. Percent inhibition of the assay was calculated by,

$$\text{Scavenging activity \%} = \frac{\text{A (control) - A (sample)}}{\text{A (control)}} \times 100$$

The A in the formula represents the absorbance of control and sample.

2.7 ANTIBACTERIAL ACTIVITY:

2.7.1 Preparation of the Bacterial Inoculum:

Stock cultures were maintained at 4°c on slopes of nutrient agar. Active culture for experiments were prepared by transferring a loop full of cells from stock cultures to test tubes of 50ml nutrient broth bacterial cultures were incubated with agitation for 24hours and at 37°c on shaking incubator. Each suspension of test organism was subsequently stroke out on nutrient agar media. The bacterial cultures are incubated at 37°c for 24 hours. A single colony was transferred to nutrient agar media slants which are then incubated at 37°c for 24 hours. These stock cultures were kept at 4°c. For use in experiments, a loop of each test organism was transferred into 50ml nutrient broth and incubated separately at 37°c for 18-20 hours for bacterial culture.

2.7.2 Well Diffusion method

The antibacterial activity of crude extract was determined by Well Diffusion method. MHA plates were prepared by pouring 20ml of molten media into sterile Petri plates. After solidification of media, 20- 25µl suspension of bacterial inoculums was swabbed uniformly. The sterile paper discs were dipped into required solvents then placed in agar plates. Then 10-50 µl of plant extract was poured into the wells. After that, the plates were incubated at 37°C for 24 hours. Assay was carried into triplicates and control plates were also maintained. Zone of inhibition was measured from the edge of the well to the zone in mm. The tested cell suspension was spread on mullerhinton agar plate. Well were put into the agar medium using sterile forceps. plant extract were poured

on to wells. Then plates were incubated at 37°c for about 24 hours and control was also maintained. Zone of inhibition was measured for each zone in cm.

2.8 ANTIDIABETIC ACTIVITY

2.8.1 Alpha-amylase Inhibition Assay

Alpha-amylase activity was carried out by starch-iodine method. 10 µL of α-amylase solution (0.025 mg/mL) was added to with 390 µL of phosphate buffer (0.02 M containing 0.006 M NaCl, pH 7.0) with different concentration of the extract in a test tube. After incubation at 37° C for 10 min, 100 µL of starch solution (1%) was added, and the mixture was re-incubated for 1 h. Then after incubation, 0.1 mL of 1% iodine solution was added to the test tube, then 5 mL distilled water is added, the absorbance was taken at 565 nm. Sample, substrate and α-amylase blank determinations were carried out under the same reaction conditions. Inhibition of enzyme activity was calculated by,

$$\% \text{ Inhibition} = \frac{\text{Absorbance of Control- Absorbance of Sample}}{\text{Absorbance of Control}} \times 100$$

2.8.2 Alpha- glucosidase Inhibition Assay

At first 225 ml of 80mM Phosphate buffer (pH 7.0) is added to different concentration of test samples and 75 ml of alpha-glucosidase is added to test tubes and pre-incubated at 37^0 C for 30 mins. It is then kept in boiling water bath for 2 mins, cooled and then 250 ml of glucose reagent is added. It is then incubated at room temperature for 10 mins. The OD value is measured at 510 nm. The materials used are alpha-glucosidase and the substrate is Sucrose- Himedia, India (RM 3063)- Stored at room temperature. The standard used is Acarbose- Stored at RT-Glucobay (Bayer Pharma, India). The instrument used to measure OD value is UV- Visible Spectrometer. The percentage inhibition can be calculated by using the following equation:

$$\% \text{ Inhibition} = \frac{\text{Absorbance of Control- Absorbance of Sample}}{\text{Absorbance of Control}} \times 100$$

3. RESULTS AND DISCUSSION:

3.1 Plant Collection

The plant leaves were collected from the outskirts of Erode and washed with water to remove dust. Then the leaves are prepared for extraction process. Figure 3.1 shows the *C.longa* leaves.

Fig 3.1 Collection *C.longa* leaves

3.2 Extract Preparation

The fresh leaves of *C.longa* were grinded using an electric mixer and then subjected to extraction using Soxhlet apparatus. The extract was then stored and used later. Figure 3.2 shows the extract of *C.longa* leaves.

Fig 3.2 Extract of *C.longa* leaves

3.3 Phytochemical Analysis :

The qualitative phytochemical study was performed on the extracts by using standard tests. The formation of reddish brown precipitate confirms the presence of alkaloids. Presence of reducing sugars observed by the appearance of blue colour. Saponins presence is indicated by formation of persistent foam for few seconds. The presence of flavonoids is indicated by formation of intense yellow colour. The formation of brown ring indicates the presence of phytosterols. A violet colour formed indicates the presence of amino acids and proteins. The absence of red colour precipitate indicates the absence of steroids. The presence of tannin is confirmed by the formation of dark green. The lack of formation of red colour indicates the absence of glycoside. The figure 3.3 shows the result of phytochemical analysis of *C.longa* extract.

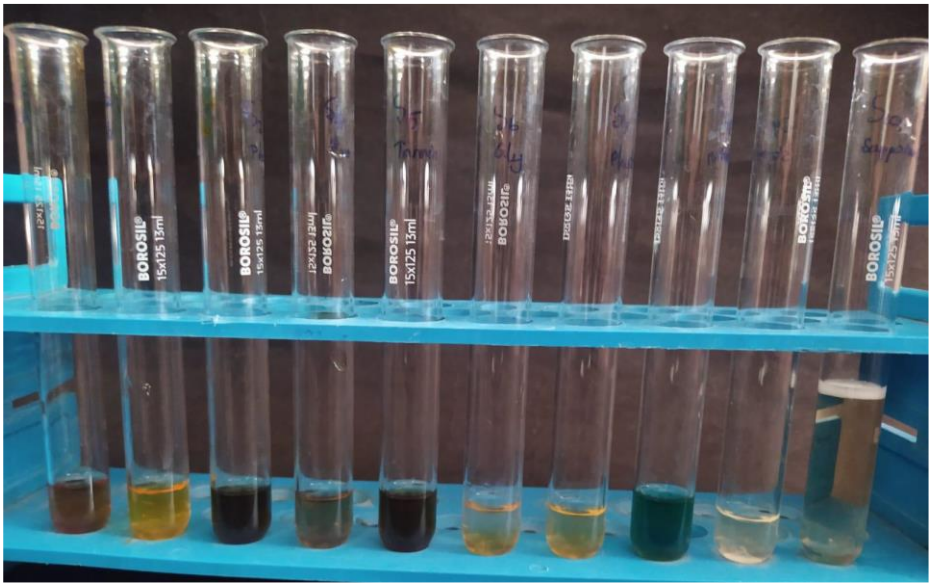


Fig 3.3 Phytochemical Analysis

PHYTOCHEMICAL TEST	APPERANCE	RESULTS
Alkaloids	Reddish brown colour(+++)	Positive
Flavonoids	Intense yellow colour (+++)	Positive
Phenol	Deep blue colour (+++)	Positive
Amino acids & proteins	Violet colour (++)	Positive
Tannin	Dark green colour (+++)	Positive
Glycosides	Absence of red colour (-)	Negative
Phytosterol	Brown ring (+)	Positive
Reducing Sugar	Blue colour (+++)	Positive
Steroids	Absence of red colour (-)	Negative
Saponins	Presence of foam (+++)	Positive

The tabulation shows the presence and absence of various phytochemicals in the *C.longa* extract.

3.4 Silver Nanoparticle Synthesis :

Add 10ml of silver nitrate solution and 90ml of plant water extract in conical flask and it is mixed well with magnetic stirrer and then cover tightly and keep it in dark place for 24 hours. After 1 hour in measuring uv-spectrophotometer in 200- 800nm range the silver nanoparticles formation was monitored upto 48hr in uv-

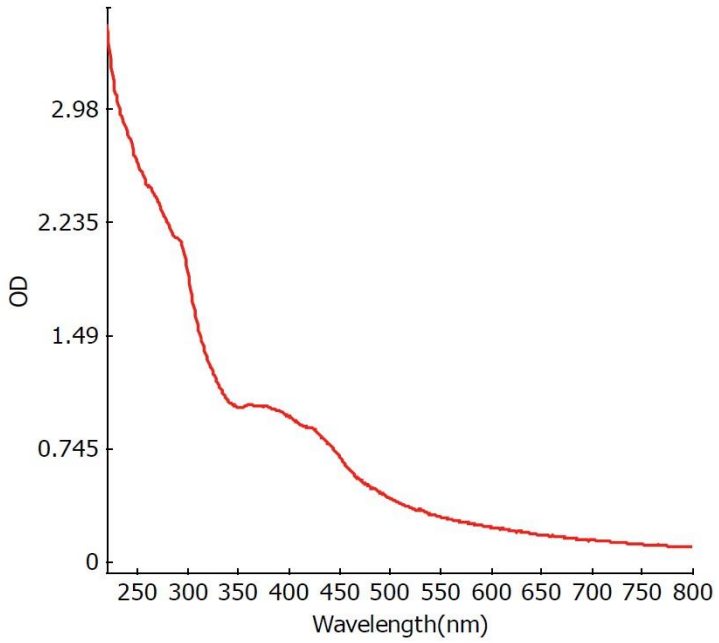
spectrophotometer measurements. FTIR measurements were obtained on a Nexus 670 FTIR instrument with the sample and SEM analysis was also done. Fig 3.4.1 and Fig 3.4.2 shows the silver nanoparticle synthesis.

Fig 3.4.1 Synthesis of silver nanoparticles

Fig 3.4.2 Silver nanoparticle synthesized

3.5 UV-Vis Spectroscopy:

Ultraviolet-Visible spectra of as-prepared sample in range between 200-800 nm. The plant sample AgNps was deposited on clean glass substrate using screen printing technique. The Figure 3.5 shows optical absorbance



spectrum of as prepared film at 100◦C. UV-Vis results shows the presence totally 4 peaks of are 400 nm shows 0.956 absorbance and 350 nm shows 1.015 absorbance, 300 nm and 1.913 absorbance and shows 220 nm weave length shows high degree of 3.538 absorbance. From this UV results finds the confirmation of functional group are present in the plant extract AgNps.

Fig 3.5. UV-Vis Spectroscopy Graph

3.6 FTIR Spectra Acquisition :

The results of FTIR (Fourier transform infra-red spectroscopy) analysis confirm the presence of functional groups which shows the major peak values that are 3309.85(O-H), 1635.64(=C-H), 686.66, 601.79 and 563.21 gives halogen compound(C-Cl), 470.63(Phosphate group). The functional groups such as nonbonded, O-H stretch, carboxylic group, acidic, H bonded, C-H stretch, asymmetric stretching of –CH (CH2) vibration, C=N (stretch), carbon-carbon triple bond, multiple bonding, carbonyl compound frequency, C=O stretch, C=C stretch, O-H bend, alcoholic group, C-N stretch, C-O stretch, PO stretching, =C-H bending and C-Cl respectively. Figure 3.6 shows the FTIR graph of *C.longa* AgNps.

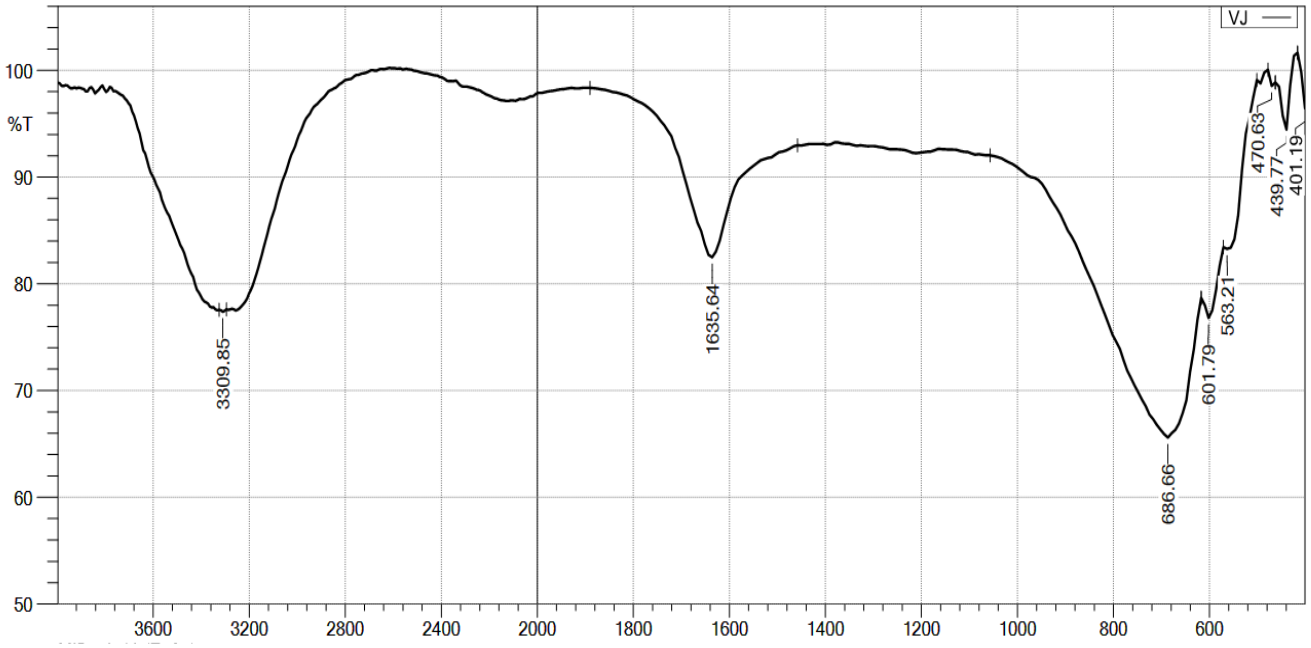


Fig 3.6

FTIR Spectra Acquistion Graph of *C.longa* AgNps

3.7 SEM Analysis :

SEM is used to characterize and visualize surface morphology, particle size distribution, particle/crystal shape, agglomeration of nanoparticles and surface functionalization and in single-particle analysis. Thus, the majority of studies apply this technique to characterize the morphological properties of nanoparticles.

The formation of spherical shaped silver nanoparticle extracted, whose size ranging in between 20 nm to 149 nm was confirmed by scanning electron microscopy. Scanning Electron Microscopic (SEM) analysis was done using Hitachi S-4500 SEM machine. Silver nanoparticle synthesized within 10 minutes has an absorbance at 430 nm and the broadening of the peak indicates the polydispersion of the particle. The SEM shows that spherical shape nanoparticle formed with different diameter range. Fig 3.7 shows the SEM results of *C.longa* AgNps.

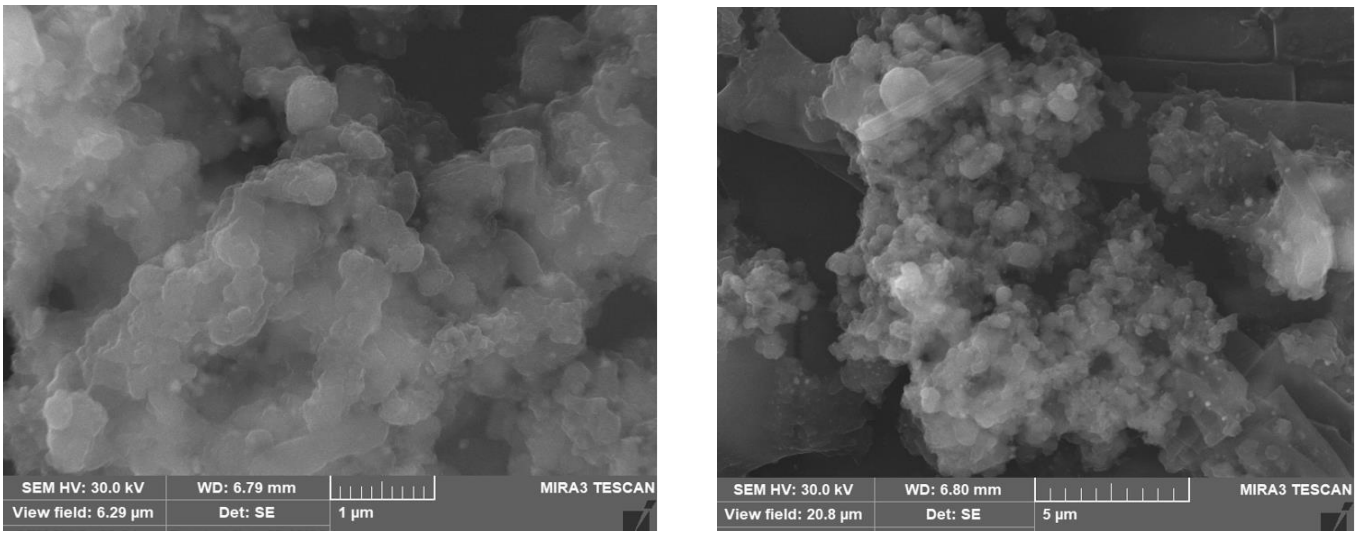


Fig 3.7. SEM images of synthesized AgNps with different magnification

3.8 Antioxidant Activity:

DPPH Assay:

Decolorization of DPPH was determined by measuring the absorbance at 517 nm. A control was prepared using 0.1 ml of respective vehicle in the place of plant extract AgNps/ascorbic acid. The percentage inhibition of DPPH radicals by the extract/compound was determined by comparing the absorbance values of the control and the experimental tubes.

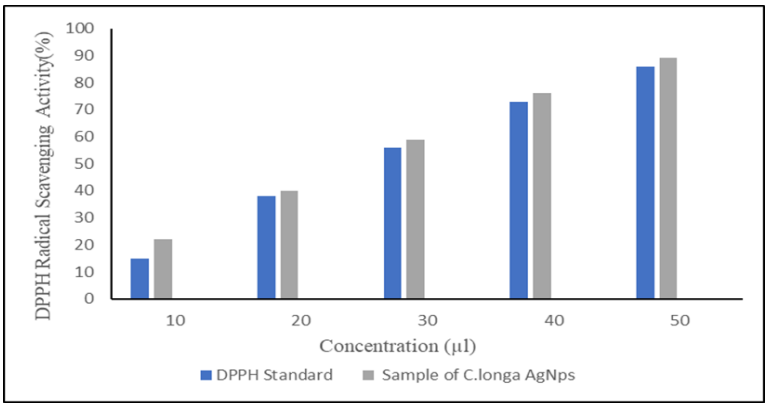


Fig 3.8.1 Graphical Representation of DPPH Assay

The graph is drawn by comparing the standard (Ascorbic acid) and the sample (*C.longa* AgNps). The graph (Fig 3.8.1) is drawn between inhibition percentage and concentration(µl) of standard and sample. The sample shows maximum inhibition at all the concentrations compared to the standard.

FRAP Assay:

The concentration of antioxidant has a ferric- TPTZ reducing ability equivalent to that of 1 mmol/l FeSO4.7H2O. Equivalent Concentration was calculated as the concentration of antioxidant giving an absorbance increase in the FRAP assay equivalent to the theoretical absorbance value of a 1 mmol/l concentration of Fe (II) solution determined using the corresponding regression equation.

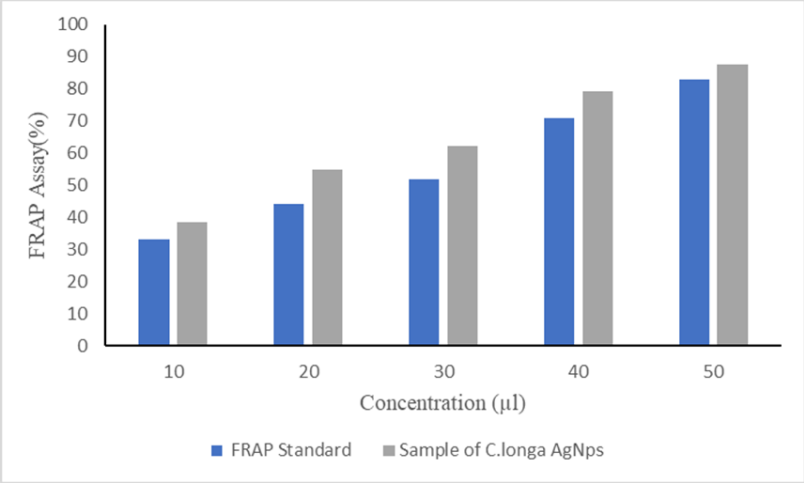


Fig 3.8.2 Graphical representation of FRAP Assay

The graph is drawn by comparing the standard (Ascorbic acid) and the sample (*C.longa* AgNps). The graph (Fig 3.8.2) is drawn between inhibition percentage and concentration(µl) of standard and sample. The sample shows maximum inhibition at all the concentrations compared to the standard.

Nitric oxide (NO) scavenging activity:

The antioxidant activity of plant extract was evaluated by nitric oxide scavenging activity using different concentrations 0.2µl, 0.4µl, 0.6µl, 0.8µl, 1.0µl. Finally absorbance is observed at 540 nm. Their percentage inhibition was calculated by the formula.

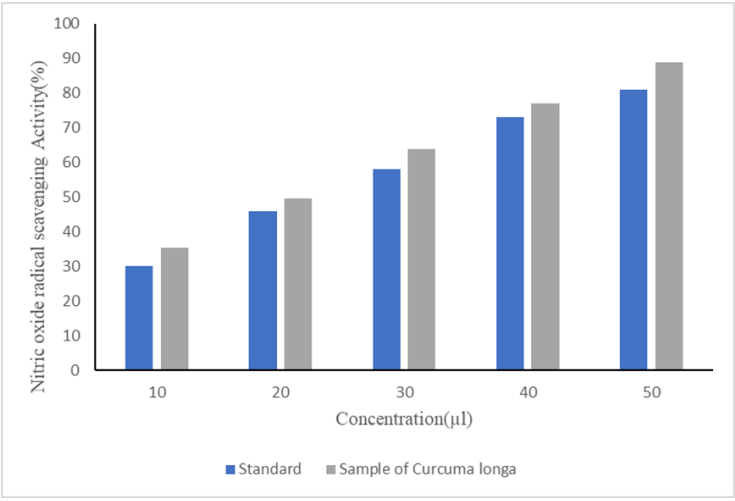


Fig 3.8.3 Graphical representation of NO Assay

The graph is drawn by comparing the standard (Ascorbic acid) and the sample (*C.longa* AgNps). The graph is drawn between inhibition percentage and concentration(µl) of standard and sample. The sample shows maximum inhibition at all the concentrations compared to the standard.

Hydrogen peroxide scavenging activity (H_2O_2):

The hydrogen peroxide scavenging activity measured absorbance was read at 230 nm by using UV-vis spectroscopy. Percent inhibition of the assay was calculated.

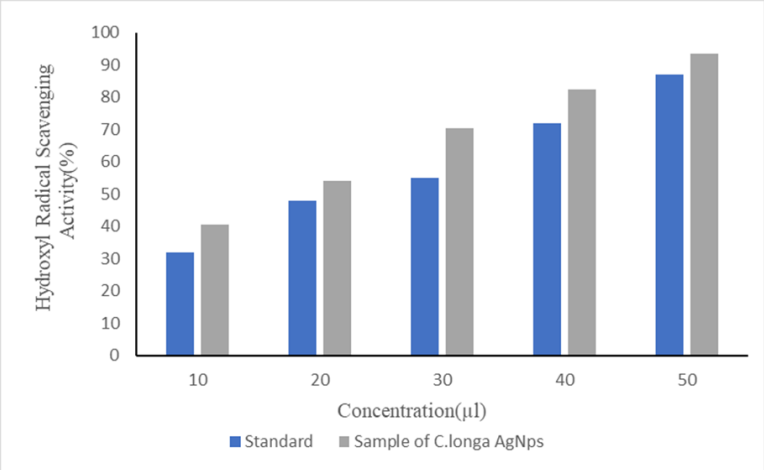


Fig 3.8.4 Graphical representation of H_2O_2 Assay

The graph is drawn by comparing the standard (Ascorbic acid) and the sample (*C.longa*). The graph is drawn between inhibition percentage and concentration(µl) of standard and sample. The sample shows maximum inhibition in all concentrations compared to the standard.

3.9 Antibacterial Activity:

Antibacterial activity was performed by agar diffusion method. The stock culture of bacteria (*Staphylococcus aureus*, *Bacillus subtilis*, *Klebseilla pneumoniae*, *E.coli*) were received by inoculating in nutrient broth media and grown at 37% for 18 hours. The agar plates of the above media were prepared. Each plates was inoculated with 18 hours old cultures the bacteria were swab in the sterile plates. Cut the 5 wells and pour the plant extract in ratio 25µl, 50µl, 75µl, 100µl. All the plates were incubated at 37^{o}C for 24 hours and the diameter of inhibition zone was noted in Cm.

Agar well diffusion method has been used to determine the antimicrobial activities and minimum inhibitory concentrations of plant extracts AgNps against the bacterial species. The extracts exhibited antibacterial activities against the tested microorganisms.

The zone of inhibition(cm) of the antibacterial activity of the sample(*C.Longa* AgNps) at different concentration (µl) of the sample can be seen from the Fig 3.9.1,Fig 3.9.2, Fig 3.9.3, Fig 3.9.4 and the standard used is Chloramphenicol. The 100(µl) of the sample gives maximum zone of inhibition against all the four bacterial species.

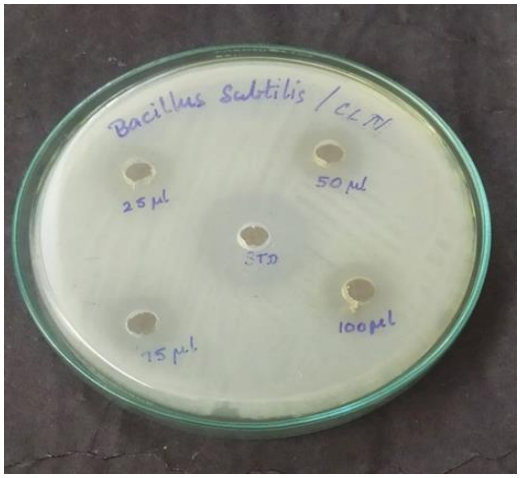


Fig 3.9.1 Zone of inhibition of *Bacillus*

Fig 3.9.2 Zone of inhibition of *Klebsiella*

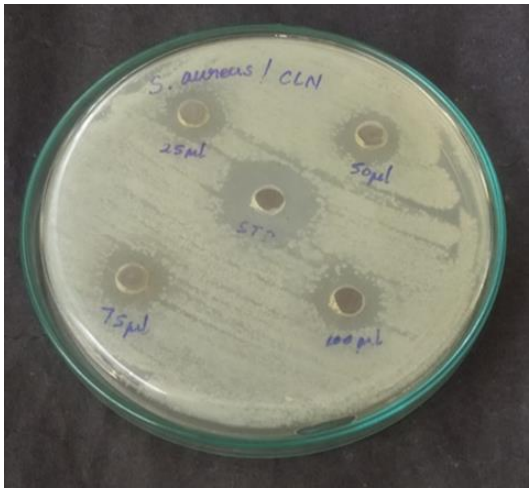


Fig 3.9.3 Zone of inhibition of *S.aureus*

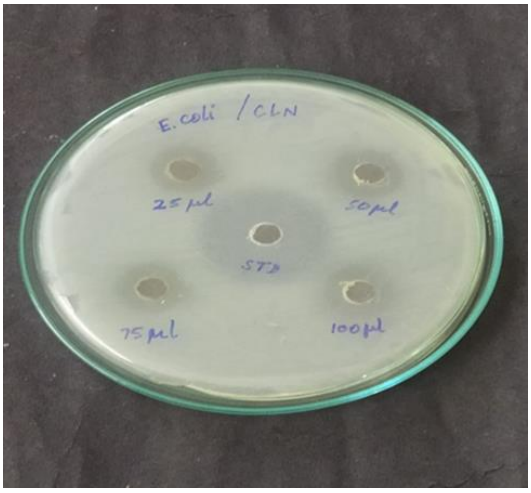


Fig 3.9.4 Zone of inhibition of *E.coli*

3.10 Antidiabetic Activity

Alpha-amylase Inhibition Assay

Alpha-amylase activity was carried out by starch-iodine method. 10 µL of α-amylase solution (0.025 mg/mL) was mixed with 390 µL of phosphate buffer (0.02 M containing 0.006 M NaCl, pH 7.0) containing different concentration of extract AgNps. After incubation at 37° C for 10 min, 100 µL of starch solution (1%) was added, and the mixture was re-incubated for 1 h. Next, 0.1 mL of 1% iodine solution was added, and after adding 5 mL distilled water, the absorbance was taken at 565 nm. Sample, substrate and α-amylase blank determinations were carried out under the same reaction conditions. This assay gives the antidiabetic activity of the sample.

The graph (Fig 3.10.1) is drawn between the percentage inhibition and concentration (µl) of the standard(Acarbose) and the sample. The sample shows maximum inhibition in all concentrations compared to the standard (Acarbose).

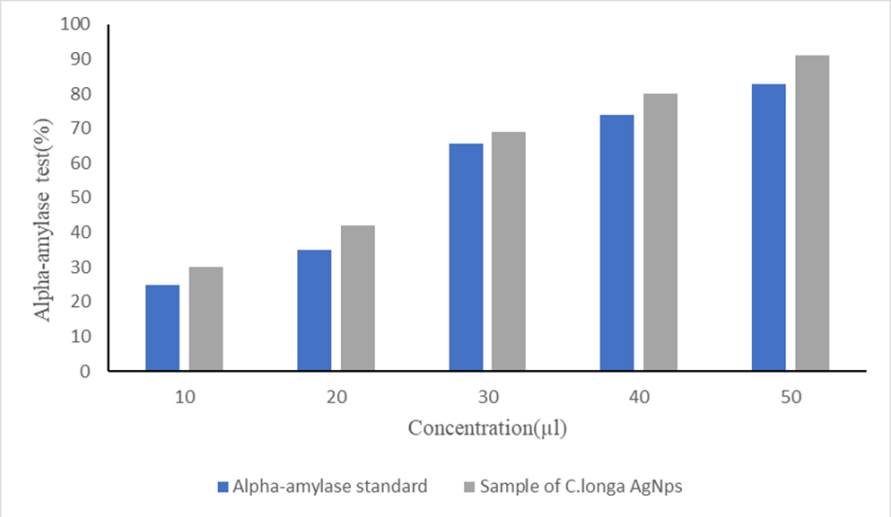


Fig 3.10.1 Graphical representation of Alpha-amylase assay

Alpha- glucosidase Inhibition Assay:

At first 225 ml of 80mM Phosphate buffer (pH 7.0) is added. Different concentration of test samples (*C.longa* AgNps) and 75 ml of alpha-glucosidase is added and pre-incubated at 37^0 C for 30 mins. It is then kept in boiling water bath for 2 mins, cooled and then 250 ml of glucose reagent is added. It is then incubated at room temperature for 10 mins. The OD value is measured at 510 nm. This assay gives the antidiabetic activity of the sample.

The graph (Fig 3.10.2) is drawn between the percentage inhibition and concentration (µl) of the standard(Acarbose) and the sample. The sample shows maximum inhibition in all concentrations compared to the standard.

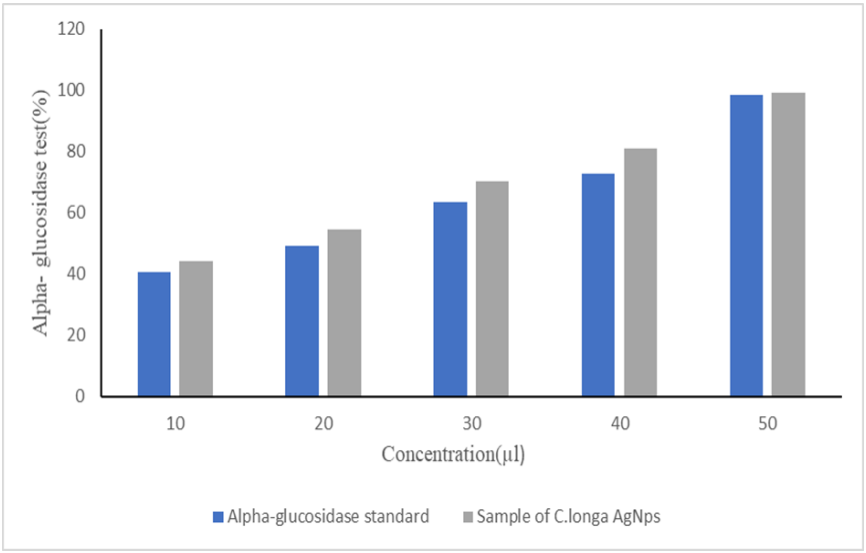


Fig 3.10.2 Graphical representation of Alpha-glucosidase assay

4. CONCLUSION:

The present study reveals that *Curcuma longa* plant shows the presence of phytochemical constituents like alkaloids, flavonoids, carbohydrates, saponins, tannins, in aqueous solvent extract. Antibacterial activity of *Curcuma longa* silver nanoparticles was seen against several bacteria namely *Escherichia Coli, Staphylococcus aureus, Bacillus subtilus* and *Klebsiella pneumoniae*. Alkaloids are natural chemical compounds containing basic nitrogen atoms. They often have pharmacological effects and are used as medications and recreational drugs. Flavonoids enhance the effects of Vitamin C and function as antioxidants. They are also known to be biologically active against liver toxins, tumours, viruses and other microbes. Plant terpenoids are used extensively for their aromatic qualities. They play a role in traditional herbal medicines and are under investigation for Antibacterial, Anti-neoplastic and other Pharmaceutical functions. Tannins have shown potential Antiviral, Antibacterial and Antiparasitic effects. Saponins cause haemolysis of red blood cells. The antibacterial activity was screened because of their great medicinal properties towards the pathogenic organisms.

The medicinal plant *Curcuma longa* showed good antibacterial activity against several organisms like *Staphylococcus aureus, Bacillus, Klebsiella* and *E. coli*. Antibacterial activity of *Curcuma longa* extracts on bacterial isolates showed that Silver nanoparticle had the broadest spectrum of activity on the test bacteria. The result exhibited that *C.longa* silver nanoparticle had antibacterial activity against four bacterial isolates *B.subtilus , S. aureus, E.coli* and *klebsiella*. They also have good antioxidant and antidiabetic activity as well.. Further work can be carry out to discover more pharmacological activities from the extract in order to support antioxidant, antibacterial and antidiabetic activity of the *C.longa* AgNps. Our study demonstrated that *Curcuma longa* can be as effective as modern medicine to combat diabetics and support the use of *Curcuma longa* as a medicinal plant.

Curcuma longa silver nanoparticles were successfully synthesized through vigorous stirring of plant extract and silver nitrate at room temperature by an environment friendly and cost effective method without any additional chemicals and external energy. The green synthesized *C.longa* AgNps were characterized by various spectral analyses and exhibited excellent homogeneity and around 20 nm in size with high stability. The *C.longa* AgNps possessed effective antibacterial, antidiabetic and antioxidant activities. These activities indicate that the synthesized *C.longa* AgNps are possible candidates for use in various biomedical applications.

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