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# GREEN SYNTHESIS OF SILVER NANOPARTICLES USING GALINSOGA PARVIFLORA LEAF EXTRACT AND ITS ANTIBACTERIAL AND ANTIOXIDANT ACTIVITIES

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## A bstract

Nanotechnology is the fastest growing science with broad range of applications in the field of agriculture, pharmacy, plant science, fisheries, environmental science, energy science, microbiology, electrochemical, catalysis, photon energy, space industries, textile industries, marine engineering, food and pharma industries. The synthesis of silver nano particles (AgNPs) has been proposed as a simple, eco- friendly and cost effective alternative to chemical and physical method. The present work is focused on the *Galinsoga parviflora* L. plant leaf mediated synthesis of silver nanoparticles for antimicrobial, antioxidant and photocatalytic applications. The synthesized siver nano particles was characterized by using ultraviolet – visible spectroscopy (UV-Vis) 300-700 nm, Fourier transform infrared spectroscopy(FTIR) in the range of 450–4000 $cm^{-1,}$ X-ray powder diffraction (XRD), Scanning electron microscope (SEM) analysis.

Keyword:- silver nano particles, leaf extract,anti bacterial , anti oxidant

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## 1. Introduction

Nanotechnology is emerging as a rapidly growing field with its application in science and technology for the purpose of manufacturing new materials at the nanoscale level. There are various pathways existing for synthesis of nonmaterial's such as microbial enzymes mediated synthesis, plant extracts mediated synthesis, bacteria mediated synthesis, fungi mediated synthesis and etc. The plant mediated synthesis of nanoparticles is a common worldwide approach due to biocompatible, simple and they having number of photochemical like alkaloids, flavanoids, saponins, steroids, tannins and terpenoids which enhance synthesis of nanoparticles (Nandagoapalan *et al*., 2016). Nowadays, researchers have been interest to develop different types of nanoparticles like gold, silver, copper, tungsten, zinc and titanium by green approaches. Out of the nanoparticles, silver nanoparticles are having number of uses in the physical, chemical and biological sciences like photo catalytic, catalysis, antimicrobial, antifungal and anticancer properties (Allafchian *et al*., 2016; Chiguvare *et al*., 2016). Silver nanoparticles are nanoparticles of silver which are in the range of 1 and 100 nm in size. Silver nanoparticles have unique properties which help in molecular diagnostics, in therapies, as well as in devices that are used in several medical procedures. The major applications of silver nanoparticles in the medical field include diagnostic applications and therapeutic applications. The present work is focused on the *Galinsoga parviflora* L. plant leaf mediated synthesis of silver nanoparticles for antimicrobial, antioxidant and photocatalytic applications. *Galinsoga parviflora* L. belongs to the family of Asteracea and native to South America,

however it is widely naturalized in other countries of Asia, Europe, North America, and Africa.

**Taxonomy of *Galinsoga parviflora L.***

**Domain:** *Eukaryota*
**Kingdom:** *Plantae*
**Phylum:** *Spermatophyta*
**Class:** *Dicotyledonae*
**Order:** *Asterales*
**Family:** *Asteracea*
**Genus:** *Galinsoga*
**Species:** *Galinsoga parviflora* L.
**Other names:** Chickweed, French soldier, Mookuthi Poo in Tamil and Potato weed.

The plant extracts are having antimicrobial, antioxidant, astringent, blood purifier and nutritive value. It is also called *tridax parviflora* (Gallant soldier) and widely used in traditional medicine for curing diabetes, skin diseases, rheumatism, fever, diarrhea, vomiting, wound healing and conjunctivitis. There are many other bioactive components identified mainly β-sitosterol-3-O-β-D-glucoside, 3,4-dimethoxycinnamic acid, protocatechuic acid, fumaric acid, and uracil (Ranjitha and Suganthi, 2017). The aspiration of the current study was to assess the biosynthetic potential of the plant, *Galinsoga parviflora* L. for silver nanoparticles production.

## 2. MATERIAL AND METHODS

### 2.1 Chemicals:

Silver nitrate ($AgNO_3$), DPPH reagent, double distilled (DD) water and pathogens were commercially purchased and which were used as received. The *Galinsoga parviflora* leaves were collected and dried.

### 2.2 Preparation of *Galinsoga parviflora* Plant Leaf Extracts:

The *Galinsoga parviflora* leaves were collected from the nursery, which is dried in the shadow for one month. The dried plant leaf materials were milled into fine powder using mixer grinder. In order to prepare the extracts, 10 g of plant leafs fine powder were added into the 100 ml of DD water and boiled at 60 ℃ for 1 h. The aqueous mixture was kept in an orbital shaker for 2 h for proper extraction, then the prepared extract were filtered through Whatman No.1 filter paper and stored the filtrate in a refrigerator for further experiment.

### 2.3 Preparation of *G. parviflora* Leaf extracts using Methanol:

The dried leaf of *Galinsoga parviflora* was powdered by grinder. Then 10 g each powder was extracted with 100 ml of methanol for 48 h under orbital shaker at 120 rpm. After 48 h of extraction, methanol was allowed for evaporation and then collects the crude powder. The crude powder was stored at 4 ℃ for further phytochemical studies and to determine the secondary metabolites present in the *G .parviflora* by using various methods.

### 2.4 Green synthesis of silver nanoparticles

1 mM concentrated 1 ml of $AgNO_3$ solution was treated with 10 ml of *Galinsoga parviflora* leaf extract. There are two controls were used in this synthesis; first one is only $AgNO_3$ was used and the second one is plant extracts mediated synthesis. The reaction mixture was heated at 85 ℃ for 30 min and kept in orbital shaker with constant stirring for 1 h. The reaction mixture showed periodically changing the coloration. The formation of pale reddish brown color indicates the presence of silver nanoparticles. The synthesized nanoparticles of *G.parviflora* leaf extract were centrifuged at 6000 rpm for 15 min to concentrate the $AgNO_3$ particles. The above said similar reactions procedure was followed with various concentrations of $AgNO_3$ and plant extracts.

### 2.5. Preliminary phytochemical analysis:

**2. 5.1 Plant extracts preparation:**

The dried leaf of *G. parviflora* was powdered by grinder. Then 10 g each powder was extracted with 100 ml of methanol for 48 h under orbital shaker at 120 rpm. After 48 h of extraction, methanol allowed for evaporation and collects the crude powder . The crude powder was stored at 4 C for further phytochemical studies. To determine the secondary metabolites present in the *Galinsoga parviflora* by using various methods.

**2. 5.2. Determination of alkaloids:**

Karthishwaran *et al.*, (2010) reported protocol has been followed for determined to alkaloids The 5 ml of each plant extract

were mixed with 2 ml concentrated HCl. Then, 1 ml of Dragondroffs reagents were added in the reaction mixture, the formation of orange to red colour indicates the presence of alkaloids.

**2.5.3 Determination of flavanoids:**

1 ml of each methanolic leaf extract was mixed with 8-9 drops of concentrated HCl. Then, add a piece of magnesium ribbon in to the reaction mixture and boiled for 10 min. The appearance of red colour shows the presence of flavanoids (Nandagoapalan *et al*., 2016)**.**

**2.5.4 Determination of saponins:**

2 ml of each plant extract was diluted with 5ml of distilled water and kept under orbital shaker at 120 rpm for 15 min (Hossain *et al*., 2013). The foam formation indicates the presence of saponins.

**2.5.5 Determination of tannins:**

For tannins determination, Arya *et al*., (2012) reported method has been followed. The crude extract (5 ml) was mixed with few drops of 5% $FeCl_3$. The appearance of deep blue black colour indicates the presence of tannins.

**2.5.6 Determination of Vitamin C (Ascorbic acid):**

The vitamin C was estimated by Babitha and Ramanathan (2017) method, which is dinitrophenyl hydrazine method. Vitamin C was oxidized to diketogluconic acid which reacts with 2, 4-dinitrophenyl hydrazine to form diphenylhydrazone. The hydrazone dissolves in strong acid solution to form orange-red colored complex at 520 nm which indicates the presence of Vitamin C.

**2.5.7 Determination of Vitamin E (Tocopherol):**

For Vitamin E determination, Baker and Frank (1968) method has been followed. The vitamin E reduces ferric ion to ferrous ion, which forms a red colored complex with α, α'-bipyridyl. That indicates the presence of Vitamin E.

**2.6 Characterization methods:**

**2.6.1 UV–vis spectroscopy:**

The formation of AgNPs was primarily observed by monitoring the change in color of the extract after treated with AgNO3 (1 mM). The bio-reduction of Ag ions in aqueous extract was monitored with the UV–visible spectra of the solutions after diluted a small aliquot (0.1 ml) of the sample to 10 times with $ddH_2O$. UV–visible spectra were recorded with Hitachi double beam spectrophotometer (Hitachi, Japan) from 300 to 700 nm wavelength at room temperature. Double distilled water was used as reaction blank (Premasudha *et al*., 2015).

**2.6.2 FTIR:**

Crude AgNP's were purified and washed with $ddH_2O$ three times and dried. After drying AgNP's were grinded with KBr pellets and were subjected to FTIR spectroscopy in the range of 450–4000 $cm^{-1}$ at a resolution of 4 $cm^{-1}$ (Premasudha *et al*., 2015; Rajkuberan *et al.,* 2016)

**2.6.3 XRD analysis:**

The biologically synthesized AgNP's cast onto glass slides was done as per the previous report of Singhal *et al*., (2011). Briefly, PAN ANALYTICAL X-ray diffractometer machine operating at a voltage of 40 kV and current of 20 mA with Cu K(α) radiation of 1.54187 nm wavelength. The scanning as carried out with 2θ angle from 20◦ to 80◦ at 0.02 deg min−1, with 2θ time constant (Premasudha *et al*., 2015).

**2.6.4 SEM:**

SEM experiments were performed to characterize size and shape of bio-reduced AgNP's. Purified AgNP's were sonicated for 15 min to make it uniform distribution and a drop of this solution was loaded on carbon-coated copper grids and solvent was allowed to evaporate under infrared light for 30 min. SEM measurements were performed on Icon Analytical, FEI Quanta 200.

**2.7 Antimicrobial activity in ATCC bacterial strains:**

The prepared silver nanoparticles using *Galinsoga parviflora* was tested for antimicrobial activity against *Escherichia coli* (ATCC 10536), *Bacillus subtilis* (ATCC 11774), *Pseudomonas aeroginosa* (ATCC 49132), and *Klebsiella pneumoniae* (ATCC 132). The microbial strains were cultured in LB (Luria Bertani) broth at pH 7.5. The disc diffusion method was used in this study, to identify the microbial susceptibility on MHA media (Muller Hinton Agar).The strains are raised in overnight and were subcultured in LB broth until culture density was reached to 0.5 MCF ($10^8$ CFU/ml). The sterile cotton swab, were dipped in the microbial culture and spread over the MHA plate evenly for antimicrobial assay. Using well puncher, the well was created on the MHA plate and pored the AgNP's at different concentrations (50, 100, 150 and 200 µg). The antibiotic streptomycin (10 µg/disc) (Himedia) were used as positive control, the plates were maintained at room temperature for 24 h for observing the zone of inhibition. The zone of inhibition was measure and represented as Mean ± SD.

### 2.8 Antioxidant activity in DPPH assay:

In order to assess the antioxidant potential using *Galinsoga parviflora* silver nanoparticles, the DPPH (2, 2-Diphenyl-1-picrylhydrazyl) assay were performed by using Abdelli *et al*., (2016) method. The 1 ml of each plant derived AgNP's at various concentrations (100, 150, 200 and 250 µg/ml) were added with 1 ml DPPH (150 µM) solutions which dissolved in methanol and kept in the dark incubation at 37℃ for 30 min. The reaction mixture was observed at 517 nm in UV spectrometer and results were expressed in the percentage of antioxidant activity using this following equation: % of antioxidant activity = Control OD – Experimental OD / Control OD × 100 Where, Control OD = Absorbance of sample without AgNP's; Experimental OD = Absorbance of sample with AgNP's. Ascorbic acid used as positive control. The results were plotted in the graph as percentage of radical scavenging vs. concentrations of AgNP's. The plant extracts are able to inhibit 50% of free radicals DPPH as called $IC_{50}$ and the $IC_{50}$ values were represented as Mean ±SD.

### 2.9 Statistical analysis:

All the Data are expressed as Mean ± SD of a minimum of four replicates and all the experiments were repeated twice. Statistical differences between control and target groups for all experiments were determined using Duncan multiple range test (DMLT) with one way ANOVA was set at $p \leq 0.$

## 3. RESULTS AND DISCUSSION:-

### 3.1 Synthesis of silver nano particle:

The formation of silver nano particles was initially confirmed visually, the change in color of the reaction miindicates the formation of silver nano particles(fig.1)


**Fig.1 synthesis of silver nano particles**

### 3.2 Optimization of various concentrations of plant extracts and silver nitrate for green synthesis of silver nanoparticles (AgNP's):

The *Galinsoga parviflora* leaf explant was tested for green synthesis of AgNP's, the leaf explant was responded well and convert the silver ions into nanoparticles with short span of time (Fig. 6). The UV spectrum of silver nanoparticles was recorded from the reaction medium as a function of a reaction time (10, 15, 30, 60 min) using 10% *Galinsoga parviflora* leaf with 1 mM $AgNO_3$ (Fig. 2).

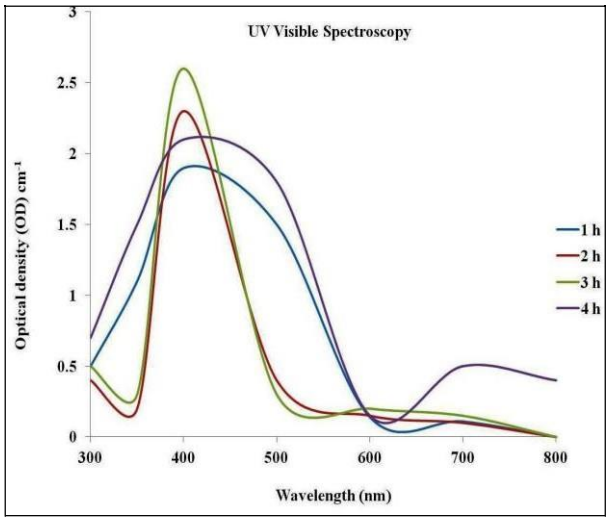



**Fig.2 UV-Vis spectra of *Galinsoga parviflora* AgNP's**

The samples showed similar behavior with maximum absorption peak ranging between 390–410 nm. The maximum absorption peaks for *Galinsoga parviflora* silver nanoparticles was 410 nm. The silver nanoparticles were produced from leaf explant was shown in figure (Fig. 2). The reduction of silver ion into silver particles during exposure to the plant extracts could be followed by color change. Silver nanoparticles exhibit dark yellowish-brown color in aqueous solution due to the surface plasmon resonance phenomenon. The nanoparticles were primarily characterized by UV-Vis spectroscopy, which was proved to be a very useful technique for the analysis of nanoparticles. Reduction of Ag+ ions in the aqueous solution of silver complex during the reaction with the ingredients present in the plant leaf extracts observed by the UV-Vis spectroscopy revealed that silver nanoparticles in the solution may be correlated with the UV-Vis spectra. As the plant extracts were mixed with the aqueous solution of the silver ion complex, it was changed into dark yellowish-brown color due to excitation of surface plasmon vibrations, which indicated that the formation of silver

nanoparticles. UV-Vis spectrograph of the colloid of silver nanoparticles has been recorded as a function of time by using a quartz cuvette with silver nitrate as the reference.

### 3.3 XRD analysis:

The XRD analysis proved the appearance of the nanoparticles in the crystalline structure (Fig. 7). The green synthesized nanoparticles were converted through various functional groups present in the plant sample which is described by FTIR spectra (Fig. 8). The SEM image was proved that our nanoparticles are in globular shape with 20 nm to 200 nm in size (Fig. ). The leaf extracts produced various sizes of nanoparticles with same structure. The Figure 7, showed the XRD confirming the existence of silver colloids in the sample. The Braggs reflections were observed in the XRD pattern for leaves = 23.9598, 29.6946, 34.0265, 38.2520, 41.4289 and 46.8065 respectively (Fig. 3).

These Braggs reflections clearly indicated the presence of (111), (200) and (311) sets of lattice planes and further on the basis that they can be indexed as face-centered-cubic (FCC) structure of silver. Hence XRD pattern thus clearly illustrated that the silver nanoparticles formed in this present synthesis are crystalline in nature.

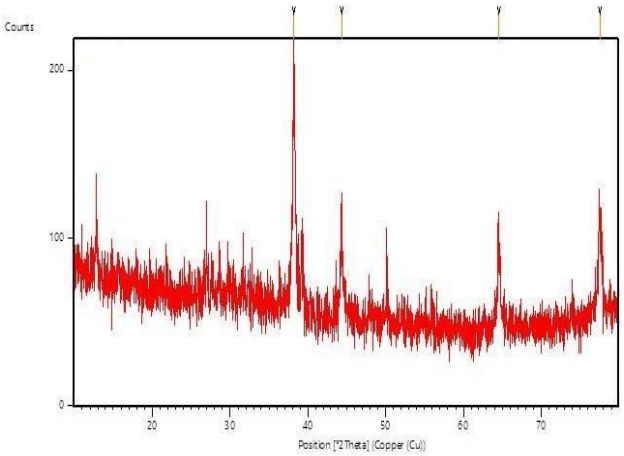



**Fig.3 XRD analysis of *Galinsoga parviflora* AgNP's**

### 3.4 FT-IR analysis:

FTIR measurements were carried out in order to identify the presence of various functional groups in biomolecules responsible for the bioreduction of Ag+ and capping/stabilization of silver nanoparticles. The observed intense bands were compared with standard values to identify the functional groups.

In leaf mediated synthesized silver nanoparticles, the peaks are observed at 3416.31, 2360.61, 233.90, 1632.82, 1384.32, 1193.85, 1103.09, 830.07, 856.03 and 619.11 $cm^{-1}$ respectively (Fig 4).

The immediate reduction and capping of silver ion into silver nanoparticles in the present analysis might be due to flavanoids and proteins. The flavonoids present in the leaf extract are powerful reducing agents which may be suggestive of the formation of AgNPs by reduction of silver nitrate.

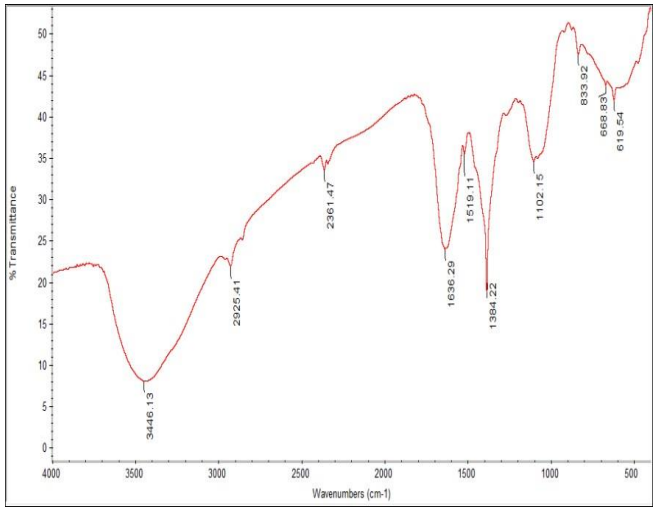



**Fig. 4 FT-IR analysis of *Galinsoga parviflora* AgNP's**

### 3.5. SEM ANALYSIS:

SEM provided further insight into the morphology and size details of the silver nanoparticles. The size of the prepared nanoparticles was more than the size of nanoparticle which should be; i.e.; between 1-100 nm. The size was more than the desired size as a result of the proteins which were bound in the surface of the nanoparticles. The result showed that the particles were of spherical shape (Fig 5).

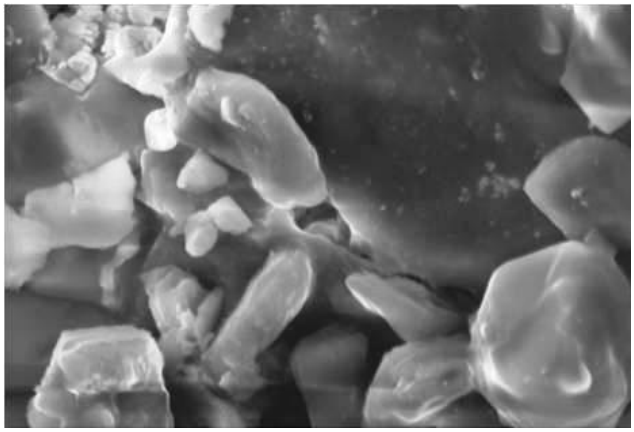


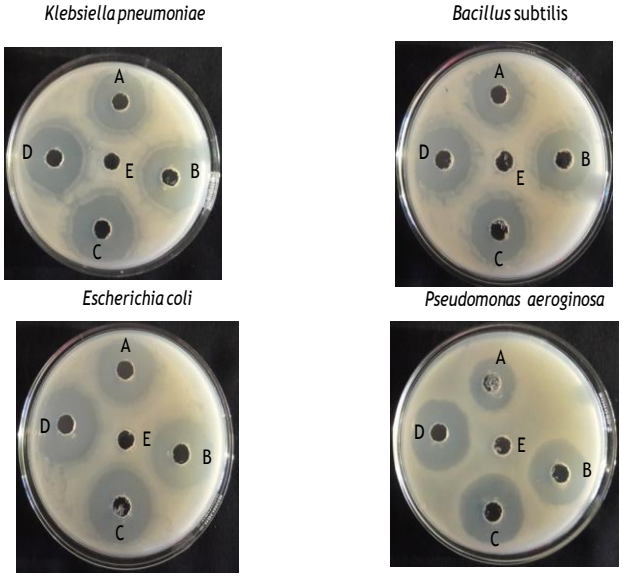
**Fig.5 SEM of *Galinsoga parviflora* AgNP's**

**3.6. Evaluation of antibacterial potential of green synthesized AgNP's against tested pathogens:**

The present study showed that, *Galinsoga parviflora* leaf mediated synthesized AgNP's were having higher antimicrobial activity (Table 1). The AgNP's of *Galinsoga parviflora* showed zone of inhibition (ZOI) was ranged from 11.5 mm to 2.9 mm for bacterial pathogens (Table 1). This result clearly indicated that, *G. parviflora* synthesized nanoparticles were found to be more effective to inhibit the bacterial growths of *E. coli*, *B. subtilis*, *P. aeroginosa* and *K.pneumoniae* (Table 2).

**Table 1.Antimicrobial activity of *Galinsoga parviflora* AgNP's**

| Microbial strains | Strepto mycin (10 µg/disc) | Zone of inhibition in mm | | | |
|---|---|---|---|---|---|
| | | Concentration of AgNP's in (µg/ml) | | | |
| | | 50 | 100 | 150 | 200 |
| **Bacterial species** | | | | | |
| *E. coli* | 45.5 ± 0.8 | – | 07.2 ± 0.3 | 11.2 ± 0.4 | 06.1 ± 0.3 |
| *B. subtilis* | 39.8 ± 0.3 | – | – | 05.6 ± 0.4 | 09.0 ± 0.8 |
| *P.aeroginosa* | 32.8 ± 0.5 | – | – | 07.2 ± 0.7 | 11.5 ± 0.6 |
| *K. pneumoniae* | 32.8 ± 0.2 | – | – | 02.9 ± 0.5 | 05.9 ± 0.2 |




***A.* 50 µg/ml, B. 100 µg/ml, C. 150 µg/ml, D. 200 µg/ml, E. Control**

**Fig.6. Photograph showing the ZOI for *K. pneumoniae, B.Subtilis, E.coli* and P. aeroginosa**

**3.7 Assessment of the antioxidant potential of green synthesized AgNP's against DPPH reagent:**

Among the different concentrations (100, 150, 200 and 250 µg/ml) of *G. parviflora* nanoparticles were tested for antioxidant activity, the leaf synthesized nanoparticles showed the activity from 100–250 µg/ml in DPPH assay (Fig. 6). These AgNP's are capable to scavenge the purple colour 2,2-diphenyl-1-picrylhydrazyl (DPPH) radicals and convert in to colourless 2,2-diphenyl-b-picrylhydrazine . The antioxidant activity shows in the concentration dependant manner to inhibit the free radicals . Interestingly, higher concentration of AgNP's was produced high percentage of antioxidant potential than lower concentration . The *Galinsoga parviflora* AgNP's showed 82.7% antioxidant activity . The antioxidant potential was compared with standard antioxidant (ascorbic acid).

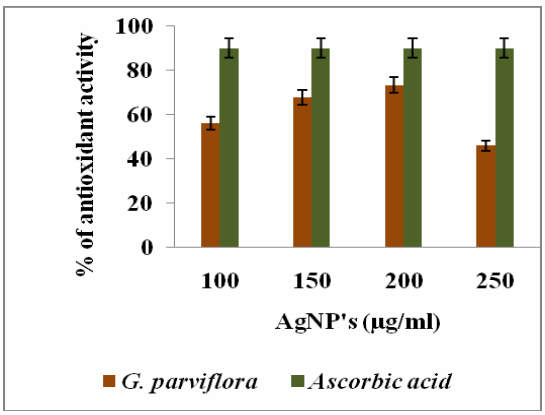



**Fig.7 Antioxidant potential of *Galinsoga parviflora* AgNP's**

In order to find out the phytochemical profile of the *Galinsoga parviflora*, I have assessed leaf of this plant through various standard methods. Out of the phytochemicals tested, all the phytochemicals showed the variations in the level of accumulation some are having rich phytochemical in leaf (Table. 2).

**Table .2. Preliminary phytochemical analysis**

| S. No | Plant constituents | *Galinsoga parviflora* (Leaf) |
|---|---|---|
| 1 | Alkaloids | + |
| 2 | Tannins | + |
| 3 | Vitamin C | + |
| 4 | Saponins | + |
| 5 | Vitamin E | + |
| 6 | Flavanoids | + |

## 4. DISCUSSION:

Nanoscience mainly deals with the production of various size, shape and chemical compositions of the nanoparticles for the human benefits (Kumar and Yadav, 2009). The physical and chemical synthesis of the nanoparticles is effective, well structured and stable with wide range applications. Therefore, biological species like microbes, algae and plants were used to produce nanoparticles as an eco friendly approach (Kumar and Yadav, 2009). Shankar *et al*., (2003) and Sathyavathi *et al*., (2010) were used the leaf extracts of *Pelargonium graveolens* and *Coriandrum sativum* for green synthesis of silver nanoparticles. Some of the researches also reported the polyol components and the water-soluble heterocyclic components to be responsible for the reduction of silver ions and the stabilization of the nanoparticles (Arangasamy and Munusamy 2008). The nanoparticles are holding the property of large surface area to volume ratio, it helps to inhibit the microbial growth (Khalil *et al*., 2013). Out of the novel nanoparticles synthesized, silver nanoparticles (AgNP's) has attracts the scientific community for their various properties such as stability, catalytic, conductivity, antimicrobial, antifungal, antiviral, antioxidant and anticancer activities (Ahmed *et al*., 2016). Numerous plants have been used to produce silver nanoparticles with diverse range in shape and size and All the parts of the plants are having the capacity to convert silver ions into AgNP'ses. For instance, the leaf extract of *Acalypha indica*, *Azadirachta indica*, *Chenopodium album* and rhizome of *Acorous calamus* were produced various size of AgNP's ranging from 10 to 50 nm (Ahmed *et al*., 2016). The numerous plants had been utilized for the preparation of silver nanoparticles. The green rapid syntheses of spherical shaped silver nanoparticles with dimensions of 50–100 nm were observed using *Alternanthera dentate* aqueous extract. These silver nanoparticles exhibit antibacterial activity against *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumonia* and *Enterococcus faecal (Kumar et al., 2014).*

### 4.1 Antimicrobial activity of silver nanoparticles

Vijay Kumar *et al*., (2014) showed the green synthesis of silver nanoparticles and its antibacterial activity against *Aeromonas hydrophila, Pseudomonas fluorescens and Flavobacterium branchiophilum* strains using *Boerhaavia diffusa* plant extracts. The *Alternanthera dentate* plant extracts synthesized AgNP's showed antimicrobial activity against *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia* and *Enterococcus faecalis* (Nakkala *et al*., 2014). Similarly in *Tribulus terrestris* and *Cocous nucifera* plants produced silver nanoparticles showed the antibacterial activity against *Streptococcus pyogens*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Salmonella paratyphi* (Mariselvam *et al*., 2014). Velmurugan *et al*., (2015) synthesized silver nanoparticles by using the leaf extracts of *Prunus yedoensis* and showed significant antibacterial activity against skin infection causing, *Propionibacterium acnes* and *Staphylococcus epidermidis*. Sathishkumar *et al*., 2012 used the *Morinda citrifolia* plant extracts for green synthesis of silver nanoparticles and exhibits potential antibacterial activity against tested pathogens. Sankar *et al*., (2013) have used *Origanum vulgare* leaf extracts and produced AgNP's showed higher antimicrobial activity against *Aeromonas hydrophila*, *Escherichia coli*, *Salmonella paratyphi*, *Shigella dysenteriae* and *Shigella sonnei*. In aqua culture, the fish pathogens *Flavobacterium branchiophilum*, *Aeromonas hydrophila* and *Pseudomonas fluorescens* were treated with silver nanoparticles produced by *Ficus benghalensis* leaf extracts for disease free fish culture (Saxena *et al*., 2012). Similarly, the AgNP's of *Shorea tumbuggaia* showed antifungal activity against *Fusarium*, *Aspergillus* and *Rhizopus* sp and the AgNP's of *Svensonia hyderobadensis* plants exhibits the antifungal activity against *Rhizopus*, *Aspergillus*, *Curvularia* and *Fusarium* sp. (Savithramma *et al*., 2011). Many reports are available for antimicrobial activity of plant derived silver nanoparticles (Chung *et al*., 2016) however, there is no reports are available for production AgNP's through *Jatropha multijida* and *Jatropha podagrica* plants.

### 4.2 Antioxidant activity of silver nanoparticles:

Swamy *et al*., (2004) tested the leaf extracts of medicinal plant, *Leptadenia reticulata* for AgNPs production and antioxidant activity studies. He observed that, 500 µg/mL of green synthesized silver nanoparticles showed maximum (64.81 %) radical scavenging activity. The plant phenolic compounds are responsible for conversion of silver nitrate into silver nanoparticles and exhibit antioxidant activity. The Niraimathi *et al*., (2013) produced silver nanoparticles using *Alternanthera sessilis* plants and these particles showed antioxidant activity against DPPH reagent. Similarly, the Mittal *et al*., (2012) used the flower extracts of *Rhododendron dauricum* plants for biosynthesis of silver nanoparticles than applied for radical scavenging activity. The silver nanoparticles were synthesized using aqueous *Piper*

*longum* fruit extract and the aqueous *P. longum* fruit extract and the green synthesized silver nanoparticles showed powerful antioxidant properties *in vitro* antioxidant assays (Haes *et al*., 2002). The toxicity of starch-coated silver nanoparticles was studied using normal human lung fibroblast cells (IMR-90) and human glioblastoma cells (U251). The toxicity was evaluated using changes in cell morphology, cell viability, metabolic activity, and oxidative stress. These nanoparticles produced ATP content of the cell causing damage to mitochondria and increased production of reactive oxygen species (ROS) in a dose-dependent manner. DNA damage, as measured by single cell gel electrophoresis (SCGE) and cytokinesis blocked micronucleus assay (CBMN), was also dose-dependent and more prominent in the cancer cells (Reddy *et al*., 2014). The high frequency electrical behaviour of nanosilver based conductors is up to 220 G*Hz.* (AshaRani *et al*., 2009).The number of reports is available for free radical scavenging and antioxidant studies using plant derived silver nano particles (Chung *et al*., 2016). However, there is no reports are available through *Jatropha multijida* and *Jatropha podagrica* plants derived silver nanoparticles.

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