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Development & Evaluation of Plant-Bases Silver Nanoparticle with Specific Reference to Antimicrobial Activity

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Abstract:

Nanotechnology is a fast emerging field with several biomedical research applications as a result of recent breakthroughs. Silver has also gained popularity as a disinfectant and antibacterial agent with little negative effects. Silver nanoparticles have a wide range of antibacterial, antifungal, and antiviral properties. Silver nanoparticles can penetrate the walls of bacterial cells, changing the structure of cell membranes and perhaps leading to cell death. Their small size (nanoscale) and high surface area to volume ratio both contribute to their effectiveness. They can form reactive oxygen species by releasing silver ions, which can increase the permeability of cell membranes and prevent the replication of deoxyribonucleic acid. The use of silver nanoparticles as antibacterial agents in dentistry has been studied by researchers. For example, silver nanoparticles can be added to composite resin for restorative treatment, acrylic resin for fabrication of removable dentures in prosthetic treatment, irrigating solution and obscuration material for endodontic treatment, adhesive materials for orthodontic treatment, membrane for guided tissue regeneration in periodontal treatment, and titanium coating for dental implant treatment. No systemic toxicity of ingested silver nanoparticles has been reported, despite the fact that not all authorities have recognized their safety. Their potential danger if discharged into the environment is a major worry. However, the toxicity of nanoparticles can change depending on how they interact with harmful substances and chemical molecules. The antibacterial mechanism, possible uses, and review of silver nanoparticles' antibacterial use in dentistry are highlighted in this research.

Keywords: antibacterial, dentistry, nanoparticles, nanotechnology, silver

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Introduction:

Silver nano particle

have attracted increasing attention for the wide range of application in biomedicine.

It is generally smaller than 100nm and contain 20-15,000 silver atoms, have distinct physical, chemical, and biological properties compared to their bulk parent materials. The optical, the optical, thermal, and catalytic properties of silver nanoparticles are strongly influenced by their size and shape. Additionally, owning to their broad-spectrum antimicrobial ability, silver nanoparticles have also become the most widely used sterilizing nanomaterials in consuming and medical products, for instance, textiles, food storage bags, refrigerator surfaces, and personal care products. The application of nanoscale materials and structure, usually ranging from 1 to 100 nanometers (nm), is an emerging area of nanoscience and nanotechnology.

Nanomaterial.

Nanomaterial may provide solutions to technological and environmental challenges in the areas of solar energy conversion, catalists, medicine, and water treatment. This increasing demand must be accompanied by "green "synthesis method.

Silver nanoparticles

Silver is widely known as a catalyst for the oxidation of methanol to formaldehyde and ethylene oxide. In the United States, more than 4×106 tons of silver were consumed in 2000.

Colloidal silver is of particular interest because of its distinctive nature.

For example, silver colloids are usefull substrates for surface - enhanced spectroscopy (SERS), since it partly requires an electrically conducting surface.

Also, the exposure of silver ions to light reduce them into 3-5 atoms cluster of silver, which catalyzes a gain of ~108 atoms in the latent image to be visible. Chemical reducing is the most frequently applied method for the preparation of silver nanoparticle (Ag NPs) as stable, colloidal dispersions in water or organic solvent. Commonly used reductants are borohydride, citrate, ascorbate, and elemental hydrogen. The reduction of silver ion (Ag+) in an aqueous solution generally yields colloidal silver with particle diameters of several nanometers.

Methods for Synthesis of silver NPs

- Physical
- Chemical
- Micro Emulsion
- Photo induced Reduction
- Electro-Chemical Synthetic Method
- Irradiation Method
- Irradiation Methods
- Polymers & Polysaccharides
- Tollens Method
- Bio-based Method (Fungi Algae Plants)

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Bio-based methods

A number of reports prevailed in the literatures indicate that synthesis of nanoparticles by chemical approaches are eco- unfriendly and expensive, Thus, there is a growing need to develop environmentally and economically friendly processes, which do not use toxic chemicals in the synthesis protocols. This has conducted research's to look at the organisms. The potential of organisms in nanoparticle synthesis ranges from simple bacteria prokaryotic bacterial cells to eukaryotic fungi and plants. Bio-based protocols could be used for synthesis of highly stable and well-characterized NPs.

Synthesis of SNPs using plants is very cost effective, and thus can be used as an economic and valuable alternative for the large-scale production of SNPs. Camellia sinensis (green tea) extract has been used as a reducing and stabilizing agent for the biosynthesis of silver NPs. Phenolic acid - type biomolecule (e.g. Caffeine) and theophylline) present in the C. Sinensis extract seemed to be responsible for the formation and stabilization of silver NPs.

Biological synthesis of silver NPs.

Black tea leaf. extracts were also used in the production of silver NPs.The NPs were stable and had flavonoids seemed to be responsible for the biosynthesis of these NPs.

Properties of silvernano particle: -

1) optical properties
2) Antibacterial effects
3) Anticancer
4) Antifungal

Application of SilverNPs: -

1) sensors
2) Optical probes
3) Antibacterial agents
4) Catalyst

Side Effects of Silver NPs :-

1) lethal doses of AgNPs increase larval lethality and affect development.
2) Lethal doses of AgNPs increase larval lethality and affect development.
3) Lethal doses of AgNPs protract pupal development & reduce exclusion success.
4) Silver deposition occurs in response to both lethal & sublethal level of AgNPs.
5) Sublethal AgNP exposure shortens the adult life span and compromises the stress tolerance capacity.
6) Lethal AgNPs exposure leads to profound apoptosis and double stranded DNA breaks.
7) Lethal AgNP exposure leads to profound activation of autophagy.

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PLANT PROFILE

Cassia occidentalis L. is an annual perennial Ayurvedic plant which is roused in several traditional medicine to cure various disease. This weed has been known to possess antibacterial, antifungal, antidiabetic, anti- inflammatory, ant cancerous, antimutagenic and hepatoprotective activity. A wide range of chemical compounds including achrosin, aloe emodin, emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, . It has been isolated from this plant. The presented review summarizes the information concerning the botany, ethanol pharmacology query, Phytochemistry, biological activity and toxicity of the Occidentalis plant.

Cassia occidentalis L. is an Ayurvedic plant with important medicine values. It is known by various name, e. g. Coffee Senna,
Fetid cassia, and Negro Coffee(English) . In India IN it is known by its various vernacular name, the most commonly used ones are kasamarda, kaasaari(Ayurveda), Kasondi, Bari Kasondi (Hindi) Kasondi (Unani)

Pharmacological Activities

- Antimicrobial Activity.
- Antioxidant /hepatoprotective activity & Larvicidal Activity.
- Antimalarial activity.
- Immunosuppression.
- Anti -inflammatory activity
- Toxicity
- Antianxiety & Antidepressant activity
- Analgesic & Antipyretic Activity
- Antidiabetic Activity.

Keeping in view the importance of the herbal medicinal plants and Ag-NPs the present work was designed. Ag-NPs were developed, characterized and evaluated for antimicrobial and cytotoxic activities.

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RESEARCH ENVISAGED

Aim and Objective: - To develop plant -based Silver Nano particles and Evaluation of its Antimicrobial activity.

Objectives: -

- Collection, procurement and authentication of plant material.
- **To** prepare leaf extract from the selected medicinal plant.
- To synthesis leaf extract mediated silver nanoparticle assisted by different Techniques.
- To characterize the silver nanoparticles made by various methods, like UV absorption, particle size analyzer, SEM / TEM & FTIR.
- To determine the toxicity of synthesized SNPs.
- To determine the toxicity of the synthesized silver nanoparticles.
- To evaluate antimicrobial activity of the prepared silver nanoparticles.

Plan of work: -

- Procurement and Authentication of plant material
- Preparation of Leaf Extract
- Synthesis of silver NPs by biological Method
- Characterization of Silver NPs.

Biological work

- Antimicrobial activity of synthesis silver NPs.
- Toxicity and safety profile of synthesis silver NPs.

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Rational of the Study :-

- Our research focused on the production, characterization and application of silver nanoparticles (AgNPs) , which can be utilized in biomedical research and environmental cleaning applications.

  We used an environmentally friendly extracellular biosynthetic technique for the production of the AgNPs. The main objective of synthesizing nanoparticle using plant extract is to get the eco-friendly method of synthesis of nanoparticle which are not cytotoxic as well as they showed good result against microbws as microbes are developing resistance against many drugs.

Material method:-

List of Chemicals: -

S. No.	Name	Manufacture
1	Ethanol	Hindon chemsynth Pvt. Ltd
2	Chloroform	Hindon chemsynth Pvt. Ltd
3	Methanol	Hindon chemsynth Pvt. Ltd
4	Nutrient agar	CDH Laboratory Chemicals
5	Nutrient broth	CDH Laboratory chemicals
6	Silver nitrate	Central Drug House (P) Ltd., India IN

Collection of leaves:

Leaves from the plant C. occidentalis were collected from Herbal Garden , Jamia Hamdard, New Delhi, India IN and authenticated by Taxonomist, Department of Botany, Jamia Hamdard. The collected leaves were washed were washed twice with distilled water to remove all the dust particulates and air dried at room temperature all the dust particulates and air dried at room temperature. Once the leaves were air dried at room temperature kept in oven at 60 °C for further drying and removal of moisture. The dried leaves .were the crushed in grinder and stored in air tight plastic containers until further use.

Preparation of leaf extract :

10 % solution was prepared for each leaf extract by weighing 10 gram of dried leaves in 100 ml of distilled water and the boiling the composite mixture at 100 °C for 20-30 minutes. The mixture was then allowed to cool down at room temperature and then filtered first by blotting paper, followed by filtration through whatman filter paper No. 1 so as to remove all the particulates and get a clear solution.

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Preparation of 1 mm AgNO3

1 NM AgNO3 was prepared by weighing 0.08gm of AgNO3 and dissolving it in double distilled water and then making up final volume to 500 ml. The prepared solution was then kept in flask covered with foil so as to avoid photometric induced reaction.

Biosynthesis of silver Nanoparticle

Once leaf extract and AgNO3 was prepared, the green route synthesis of nanoparticles was carried out. 5ml of prepared leaf was mixed in 45 ml of AgNO3, the composite mixture thus prepared was incubated at different parameter so as to determine the best method for synthesis of nanoparticles.

Biosynthesis of AgNPs by incubation at room temperature: -

The prepared mixture was incubated in dark for 24hr-72hrs.The change in the color of mixture was noted after 24 hrs as well as 72 hrs of incubation. For further confirmation of synthesis of the synthesis process, the optical density of the mixture was noted by U. V. Spectrophotometer in the range of 200-800nm.

Biosynthesis of AgNPs by incubation on magnetic stirrer with heating plate

The prepared mixture was incubated at magnetic stirrer with heating plate for 15-20 minutes at 100 °C with medium rotating speed. The mixture was then allowed to cool down & then optical density was measured in the range of 200-800nm.

Characterization of AgNPs by incubation in microwave

The prepared mixture was incubated in microwave for 120 seconds and the optical density was then measured.

CHARACTERIZATION OF THE SYNTHESIS NANOPARTICLES

UV SPECTROSCOPY

Sample **(1mL) of** the suspension were collected after every incubation to monitor the completion of bio reduction of Ag+ in aqueous solution, followed by dilution of the samples with 2 ml of deionized water and subsequent scan in U. V- visible.

ZETA SIZER

The size of the synthesis nanoparticle was determined by Malever Zeta sizer.

FTIR

FTIR spectra were measured with a Nicolet Nexus 6700 FTIR spectrometer using a multi - Bounce ATR accessory with a ZnSe crystal. All spectra were measured using 2 °cm-1 resolution.

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Experimentally a few drops of a given sample were layer on top of the ATR crystal and were left to dry. The remaining residue yielded a film which was then analyzed.

TEM (Transmission Electron Microscopy)

The morphological features of synthesized silver nanoparticles from plant extract were studied by Scanning Electron Microscope.

TOXICITY STUDY

Seed germination method

Four different concentration of (25%,50 %,75%,100%) of Ag NP dispersion were prepared in distilled water. The germination test was carried out in sterile petri dishes of 12 cm diameter by placing a Whatman no. 1 filter paper on them. Ten seeds of each receptor crop, Moong Bean (V. radiate) and Chickpea (C. arietinum), we're placed in the respected petri dishes. The seed were surface sterilized with 0.1 % HgCl2 solution and rinsed three times with distilled water. The solution of each concentration was added to each petri dish of respected treated daily in such an amount just enough to wet the seeds. The petri dish was then placed in dark room temp. Seeds with root tip 1 mm and higher were considered as germination. Percent germination and length of root and root and shoot (in mm) obtained following each 24h up to 72 after the germination of seeds was observed were calculated thereafter.

ANTIBACTERIAL ACTIVITY

The comparative antibacterial activities of the plant extract and of the AgNPs synthesized from the Salvia Egyptiac extract was effectively accessed again 1 gram (+) ve (Bacillus) bacteria and one Gram (-) ve (Escherichia coli) (E. coli) bacteria as test microorganism procured from Hilleman lapidaries. Bacillus and E. Coli culture were first enriched by enrichment technique in nutrient broth so as to get all the cells in the vegetable state

Components	g/l
Peptone	05.0
Beef extract	03.0
Nacl	08.0
Ph.	07+-0.2

Table 1 Composition of the nutrient broth: -

Preparation of nutrient broth:

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28 gm of nutrient was weight and dissolved in distil water. The pH was adjusted and final volume was made to 1 liter.

Loop full of culture was taken and inoculated in 50 ml of nutrient broth. The inoculated flask was then kept in incubated shaker at 37 degree Celsius, at 200 rpm for 24 hours ⧖Nutrient agar plates were also prepared.

Component	g/l
Peptone	5.0
Beef extract	3.0
Nacl	8.0
Agar-Agar	20
PH	07+- 0.2

Table 2 :- Composition of the nutrient agar media.

Preparation of nutrient agar was weight and dissolve in distil water. pH was adjusted to 7.0 using 1 N HCL or HCL or NaOH and final volume was made to 1 litre. The media was then autoclaved at 15 PSI and 121 degree Celsius. After autoclaving, the sterilized media was poured into the petri plates inside the laminar air flow bench and left for overnight to observe the contamination. Disc diffusion method was followed for the testing of plant Leaf extract and their respective.

Component	g/l
Peptone	5.0
Beef extract	3.0
Nacl	8.0
Agar -Agar	20
pH	07 +- 0.2

Table 3: -Composition of the nutrient agar media.

PREPARATION OF THE MEDIA: -

28 gm of nutrient agar was weight and dissolved water. pH was adjusted to 7.0 using 1NHCL or 1 N NaOH and final volume was made to 1 liters. The media was then autoclaved at 15 PSI and

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121 degree Celsius. After autoclaved at 15 PSI and 121 degrees Celsius. After autoclaving, the sterilized media was in starboard into petri plates inside the laminar airflow bench and left for overnight to observe for contamination.

Disc diffusion method was followed for testing of plant leaf extract and their respective AgNPs containing solution. The disc were soaked with doubled distilled water, drug, plant leaf extract, silver nitrate solution and solution containing silver nanoparticle of each type separately. Then the disc was air dried sterile condition. The plate containing the nutrient agar media were prepared by the swabbing them with the microbial cultures. Plant containing media as well as culture were dried into 5 equal parts and previously prepared discs were placed on part of the plate. The disc were placed in the following order :disc soaked with double distilled water as negative control, disc soaked with drug as positive control, disc soaked with plant leaves extract disc soaked plant leaves , disc soaked with 1nM silver nitrate solution and disc soaked with solution containing plant leaves mediated synthesized silver nanoparticles. The plants were incubated at 37°C for 24 to 48 h. Then, the maximum zone of inhibition were observed and measured for analysis against each type of test microorganism.

RESULT AND DISCUSSION:-

COLLECTION OF LEAVES :-Leaves were collection from herbal garden, Jamia Hamdard, New Delhi. Leaves were dried crushed and stored in the air tight container for study.

PREPARATION OF LEAF EXTRACT: -

10 % leaf expert was prepared by boiling the leaf the extract in heating mantle, followed by filtration by blotting sheet and whatman filter paper no. 1 so as to remove all the particulates and then stored at 4 °C.

BIOSYNTHESIS OF AgNPS: -

Incubation at room temperature in dark After 24-72 hours ⧖of incubation change in the color was observed from faint yellow to yellowish brown to reddish brown and filially to colloidal brown indicating AgNPs formation. Silver nanoparticle(AgNP) appear yellowish brown in colour in aqueous medium as a result of result of surface plasmon vibration. For further confirmation U. V-vis spectra was recorded after 24 and 72 hrs of incubation. Absorption spectra formed in the reaction media has absorption maxima in the range of 425 to 476nm due to surface plasmon resonance of AgNPs. The U. V-vis spectra of AgNO3 formed in the reaction media has absorption maxima in the range of 425 to 475nm due to surface plasmon resonance of AgNPs. The UV -vis spectra record, implied that most rapid biorediction was achieved using vitex leaf extract is made by adding 10g powdered leaf in 100ml of distilled water boiled at selected plants was successfully made.

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Synthesis of AgNPs:

Incubation at magnetic stirrer with heating plate:-In 30 min of incubation change in the color was observed from faint yellow to yellowish brown to reddish brown and finally to brown in colour in aqueous medium as a result of surface plasmon vibrations.

For further confirmation UV-vis spectra of AgNPs formed in the reaction media has absorption maxima of 425 to 475 nm due to surface plasmon
resonance of AgNPs. The UV-vis spectra recordrecorded. Absorption spectra of AgNPs formed in the reaction media has absorbed has absorption maxima in the range of 400 to 475 nm due to surface Plasmon resonance of AgNPs. The UV- spectra recorded, implied that most rapid bio reduction was achieved using C. occidentalis leaf extracts.

CHARACTERIZARTION OF SYNTHESISED AgNPs

U. V. Vis-spectroscopy

Synthesis of nanoparticle was confirmed by measuring the absorption in the range of 200-800nm. Where peak at 400-500 nm confirm the synthesis as synthesized particle show maximum absorbance at this range due to surface Plasmon resonance.

FTIR -Analysis

FTIR measurements were carried out to identify the possible biomolecule for the reduction of the Ag+ions and the capping of the bio reduced Ag+ was centrifuge at 12000rpm for 20 minutes to isolate the Ag-NPs from protein or other compounds present in the solution. The representative spectra of Ag-NPs obtained shows absorption peaks located at about 3398,2825,1626,1387,1048,818 and 775 cm-1 in the region 500-400cm-1.

The bnad (3498 cm-1) assigned to alcoholic O-H stretching vibration. The band (1058 cm -1) could be contributed to C=C aromatic vibration The band (1058 cm-1) could be contributed to C-N Stretching Vibration of aliphatic amine. The band (823 cm-1) assigned for the presence of alkyl halides. The spectral analysis indicates than OH group present in the extract is involved in the reduction of Ag+to AgO through the oxidation of alcohol to aldehyde group. FTIR analysis confirmed that the carbonyl group of amino acids and protein has the stronger ability to bind with Ag-NPs and could form a layer on the surface of Ag-NPs. Hence, the surface capped biomolecules (protein and amino acids) prevent agglomeration and thereby stabilize the Ag-NPs. This suggests that the biological molecule could act as both reducing & stabilizing agent for Ah-

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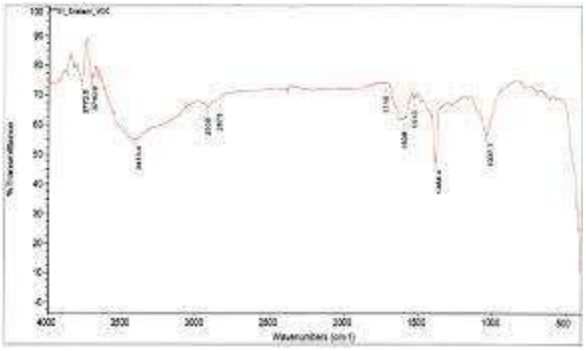
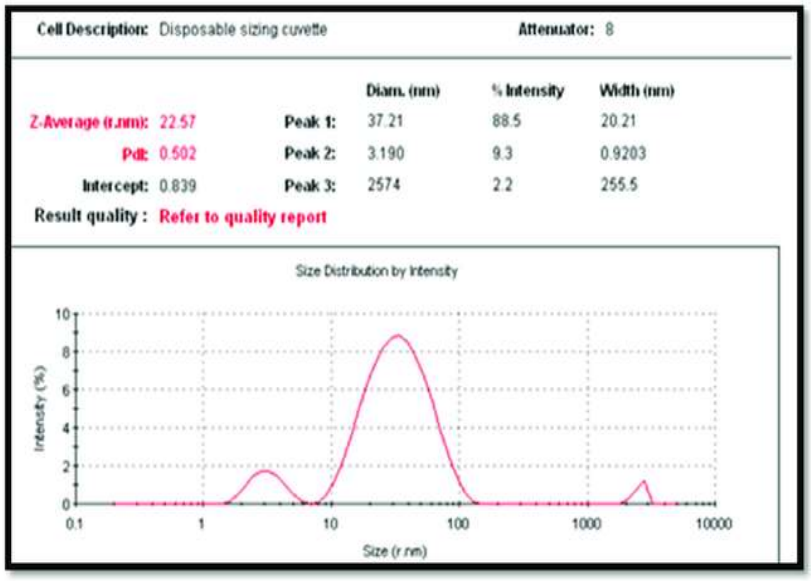


Fig: FT-IR Ag-NPs

ZETA-SIZER ANALYSIS

The zeta sizer was performed to determine the average diameter of the synthesis AgNPs. On performing zeta sizer, it was found that size of the produced nanoparticles is 255.7 nm. .



Results:

Z-Average :107.9
Pdl: 0.292
Intercept :0.893
Result quality: Good

Toxicity Assay of Synthesis AgNPs

Seed germination method

Toxicity analysis of the AgNPs prepared out on Moong bean (radiate) and chickpea (C.arietinum) seeds and their resultant root and shoot lengths were recorded. Seeds were considered to have germination of seeds was obtained after 24 hrs .

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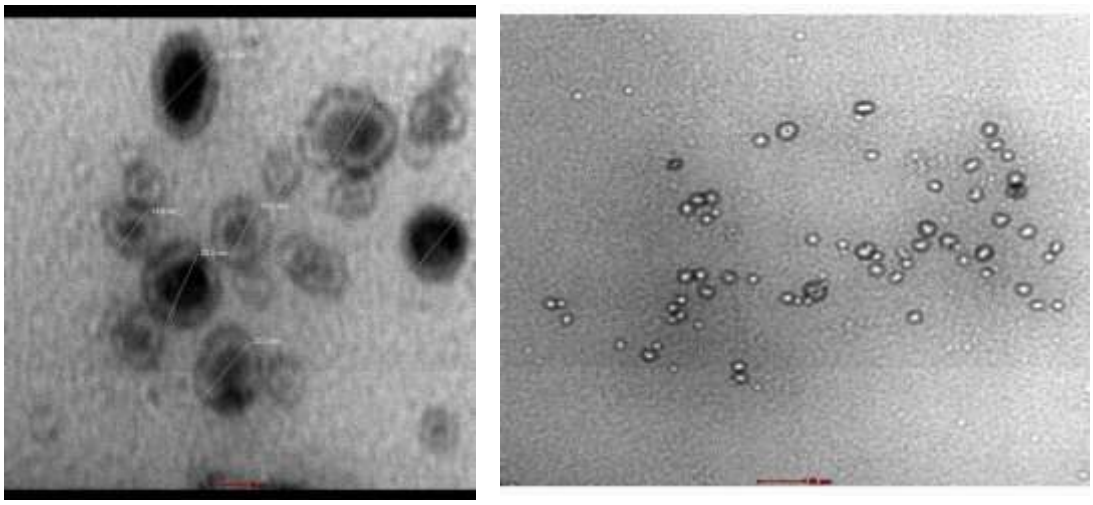

Fig: TEM ANALYSIS OF AgNPs

Table 3: -Number of seed generation

Percentage of AgNPs	Moong Bean	Chickpea
Distilled water	10	10
25%	8	9
50%	6	7
75%	4	5

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100%	2	3

Root and shoot length was measured after 48 hrs. and distilled water-treated controls in seeds treated with solution of AgNPs. On measuring root and shoot was found to be:

Percentage of AgNPs used	Moong bean (Cm)	Chickpea (Cm)
Distilled water	1.56	0.87
25%	1.56	0.53
50%	1.23	0.43
75%	1.10	0.38
100%	1.0	0.31

Table 3: Root length measure after 48 hrs

Antimicrobial Activity

It was tested for gram positive species i.e. Bacillus subtillis and gram negative species i. e. E Coli. On testing it was found that AgNPs show microbial activity towards E. Coli.

On performing cup plate method, the average diameter for zone of inhibition for E. coli was 1.20 cm and for B subtillis was found to be 1,68 cm respectively.

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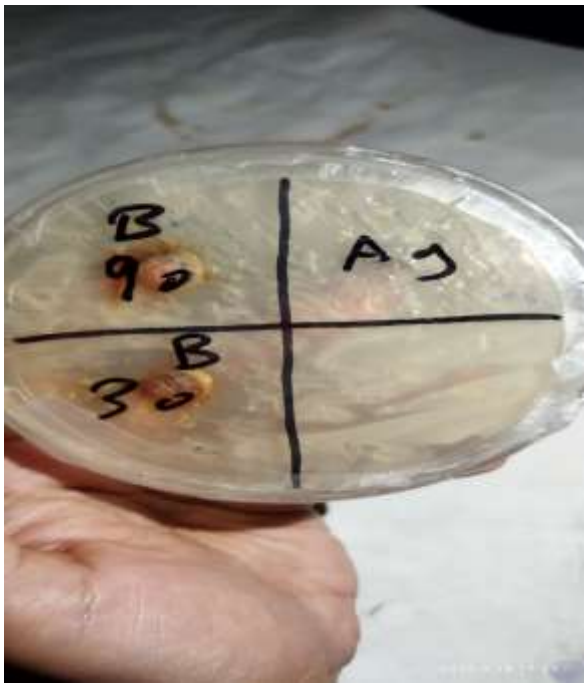

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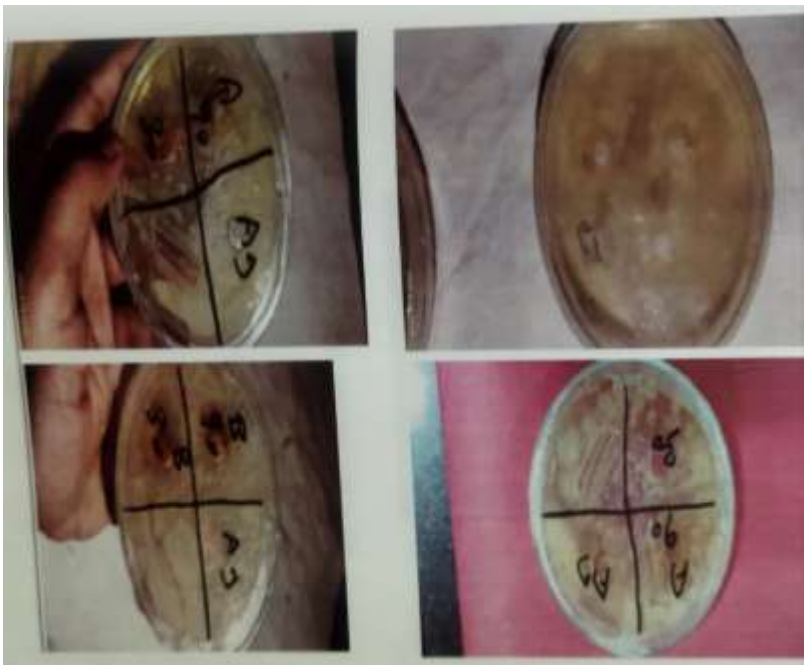

Summary and Conclusion: -

Nanotechnology broadly refer to a field of applied science and technology whose unifying theme is control of matter on the molecule level in scales smaller than 1micro meter, normally 1-100nm, and its fabrication of devices within the range. It is a highly multi-disciplinary drawing from field such as photometrical science, applied science, material science, colloidal science, device physics, supra molecule chemistry and even mechanical and electrical engineering.

Nanotechnology is rapidly gaining importance in a number of area such as health care, cosmetics, food & feed environmental health, mechanics, optics, biomedical sciences, chemical industries, electronics, space industries, drug , drug gene delivery, energy science, optoelectronics, catalysis, single emitters, nonlinear optical devices, and photoelectrochemocal application, catalysis, single electron transmitters, light emitters, nonlinear optical devices and photo electrochemical applications.

Nanomaterials are seen as solution to many technological and environmental challenges in the field of solar energy conservation, catalysis, medicine, and water treatment. The nanoparticles have exclusive physical and chemical properties, such as, electronic properties, antibacterial properties, optical properties, catalytic properties and magnetic properties. Silver is widely used as an antimicrobial agent as it has vast inhibitory effects towards microorganisms and bacterial strained which are present in industrial as well as medical process. The proportion of the extract of the plant to that of the metal ion was made fixed and the alternation within the Colour of the solution was observed and noted which indicated and proved the formation of nanoparticles. The chemicals required for the synthesis of nanoparticles are toxic in nature and also release harmful and non-environment friendly byproducts. That is why, a need to identify methods which do not release toxic byproduct was highly needed, and as a result, the interest was transferred toward the biological approaches which do not release any toxic or harmful byproducts. Plant extract

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sources are always preferred as plant extract sources are quite easily available; due to their non-toxic nature; due to the availability of a wide range of choice and options; and most importantly it is a quick way of synthesis which resultantly make the plants sources best option for the production of silver NPs. Silver nanoparticles have an extensive application in many fields, especially biomedical field. Due to the small size of nanoparticles, their energy stability is very low. As a result, the particle assembles themselves to achieve stability. Due to which few potential charges were observed on the surface of nanoparticles which is the reason of this stability. We got this charge potential from analysis of results. Zeta-sizer /zeta-potential (also called surface potential) is also directly relational to the stability of the structures. Fourier transform infrared spectroscopy was done to find out the biomolecule for the efficient stabilization and capping of the metallic nanoparticle that were synthesized. The FTIR result proved that the protein and the amino acids containing carbonyl groups have a greater ability to bind the metals which showed that the protein may be from the nanoparticle of metals which is to save the collaboration action, which as a result stabilize the medium used. Silver ions were reduced to silver nanoparticle when the plant extracts were exposed. This had been observed when the change in Colour took place. Surface Plasmon resonance phenomenon is the phenomenon due to which the Colour change appeared. The nanoparticle of metals contained free electrons due to which SPR band of absorption was observed. This happened due to the combination of vibrations of metallic electrons of nanoparticles in resonance with the wave of light. Sharpest bands were observed around 443nm when silver nanoparticles of C. occidentalis were tested. The nanoparticles were characterized by UV-Visible Spectrophotometer, Zeta- size analyzer, TEM and FTIR techniques. The result was found that the size of the nanoparticle formed by the process were of the size 123-200nm in range. The antimicrobial and cytotoxicity activity of developed Ag-NPs was also carried out. It was found that they are antimicrobial and nontoxic in nature.

Conclusion :- The production of Ag-NPs using the leaves of Cassia occidentalis plant through rapid biological method gives us a very simple, useful and effective were of the wavelength 415-480nm and gave the absorbance in the range 0.51-0.98.The size of these nanoparticle was bigger as compared to the standard size as these particles had a thin layer of protein and various other metabolites like flavonoids containing functional groups of aldehydes, ketones, alcohol, carboxylic acids, amines, etc. This was found when characterization using UV-Vis Spectrophotometer, zeta-size analyzer, TEM and FTIR techniques was performed. Due to this, the major thing that appeared was that the proportion of extract of plant to that of the metal ion has a very crucial role to play for the determination of the shape of nanoparticle have a non-toxic nature. The growth of root and shoot from the seeds of chickpea proved this nature. Silver □from a very long time has been always an outstanding antimicrobial agent and therefore have been used for antimicrobial purposes since then. The synthesis of silver nanoparticle can be also done through other sources such as, fungal and bacterial. However, plant extract sources are always preferred over the latter two as plant extract sources are quite easily available; due to their non-

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toxic nature; due to the availability of a wide range of choice and options; and most importantly it is quick way of synthesis which resultantly make the plant extract sources the best option for the production of Ag-NPs. Ag nanoparticles have an extensive application in many fields, especially biomedical field.

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