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Synthesis And Checking The Stability, Biosensing Ability, Anti-Oxidant Power And Anti-Microbial Property Of Silver Nanoparticles (Green Synthesis)

Kadhirmathiyan.V

Dr. N. G. P. Arts and Science Collège (Autonomous),
Coimbatore, Tamilnadu

Abstract: ***Partheniumhysterophorus is a species of flowering plant in the aster family, Asteraceae. The aqueous extraction of the parthenium leaves were prepared. Then the silver nanoparticles were synthesized from the aqueous extraction of the parthenium leaves. This process of synthesis of silver nanoparticles from plants is called as green synthesis. The peak absorbance value of the silver nanoparticles with & without capping agent was noted. Capping agents are frequently used in colloidal synthesis to inhibit nanoparticles overgrowth and aggregation as well as to control the structural characteristics of the resulted nanoparticles in a precise manner. Here Dextrose, the dextrorotatory form of glucose was used as an capping agent. Then the stability of the silver nanoparticles (with & without capping agent) was checked. The biosensing ability of the silver nanoparticles (with & without capping agent) was also checked. The biosensing ability is defined as the ability of the silver nanoparticles to identify the presence of heavy metals in a solution. E.g.: Drinking water. We can observe the biosensing ability of the silver nanoparticles either by a color change or by the formation of a precipitate. The anti-oxidant power of the silver nanoparticles was checked by the Ferrous Reducing Anti-oxidant Power (FRAP) assay. The pathogen E. coli was used here to check the anti-microbial property of the silver nanoparticles synthesized from Parthenium leaf extract. In overall observation, the silver nanoparticles with capping agent Dextrose is more stable and have high biosensing ability than the silver nanoparticles without capping agent. Also the silver nanoparticles synthesized from the parthenium leaves have good anti-oxidant capacity, where the absorbance is 1.240 at 700nm and average anti-microbial property, where the zone of inhibition is 13 mm.***

Keywords: ***Silver nanoparticles, Dextrose, Peak absorbance value, stability, Anti-microbial property, Anti-oxidant power, Biosensing ability, Bio-nanotechnology.***

I. INTRODUCTION

Nanotechnology is an important field of modern research dealing with synthesis, strategy and manipulation of particles structure ranging from approximately 1 to 100 nm in size. Silver nanoparticles (AgNPs) are increasingly used in various fields, including medical, food, health care, consumer and industrial purposes due to their unique physical and chemical properties. Also includes optical, electrical, thermal and biological properties. Recently silver nanoparticles have been used in many textiles, keyboards, wound dressing and biomedical devices. Nanosized metallic particles are unique and can considerably change physical, chemical and biological properties due to their surface-to-volume ratio. Therefore these nanoparticles have been exploited for various purposes. In order to fulfill the requirement of silver nanoparticles various methods have been adopted for synthesis. Generally, conventional physical and chemical methods seem to be very expensive and hazardous. Interestingly, biologically prepared silver nanoparticles show high yield, solubility andhigh stability. Among several synthetic methods for silver nanoparticles, biological methods seem to be simple, rapid, non-toxic, dependable, and green approaches that can produce well defined size and morphology under optimized conditions for translational research. In the end, a green chemistry

approach for the synthesis of silver nanoparticles show much promise.

II. MATERIALS AND METHODS

AQUEOUSEXTRACTION OF PARTHENIUM LEAVES

About 5g of plant sample was taken andwashedin distilled water. Then the plant sample was taken in a beaker and 50ml of distilled was added. The sample was heated at 45°C for 15 – 20 minutes. The extract was filtered and kept for future use.

SYNTHESIS OF SILVER NANOPARTICLES USING PARTHENIUM LEAVES (WITHOUT CAPPING AGENT)

0.01M of $AgNO_3$ stock solution was prepared. Prepare working standard solution from stock solution. Working standard was prepared by taking 10ml of stock solution and made upto 100ml using distilled water. 20ml of working standard solution was taken in a beaker and kept in a magnetic stirrer for 5 minutes. The temperature was maintained at 45-50°C. Added 20µl to 100µl of plant extract drop wise to the $AgNO_3$ solution.

SYNTHESIS OF SILVER NANOPARTICLES FROM PARTHENIUM LEAVES (WITH CAPPING AGENT)

0.01M of $AgNO_3$ stock solution was prepared. Prepare working standard solution from stock solution. Working standard was prepared by taking 10ml of stock solution and made upto 100ml using distilled water. 20ml of working standard solution was taken in a beaker and kept in a magnetic stirrer for 5 minutes. The temperature was maintained at 45-50°C. Added 20µl to 100µl of plant extract drop wise to the $AgNO_3$ solution. After the development of yellow color 0.02g of dextrose was added in to the solution.

IDENTIFICATION OF PEAK ABSORBANCE VALUE

The silver nanoparticles with and without capping agent dextrose was transferred to the cuvette and the optical density (OD) reading was taken from 360nm to 500nm.

STABILITY CHECKING

The silver nanoparticles without capping agent was checked for stabilityat different wavelength from 440nm to 480nm. The silver nanoparticles with capping agent dextrose was checked for stability at different wavelength from 410nm to 450nm.

BIOSENSING ABILITIES OF SILVER NANOPARTICLES

0.01M of heavy metals of different salts was prepared separately. 1ml of silver nanoparticles (with and without capping agent separately) were taken andadded 100µl of heavy metal solution. Then it was Incubated in the room temperature and observed for the precipitate or color change.

FERROUS REDUCING ANTI-OXIDANT POWER (FRAP) ASSAY

A simple, automated test measuring the ferric reducing ability of plasma, the FRAP assay, is presented as a novel method for assessing "antioxidant power." Ferric to ferrous ion reduction at low pH causes a colored ferrous-tripyridyltriazine complex to form. The absorbance was viewed under UV spectrometer.

ANTI-MICROBIAL PROPERTY OF SILVER NANOPARTICLES

The ability to kills the micro-organisms or stops it's growth is called as anti-microbial property. It is important to use a growth medium that is as close as possible to a natural environment. Nutrient broth with agar is called nutrient agar. The overall purpose of the agar is to customize the media for specific bacteria. Nutrient agar continues to be a widely used general purpose medium for growing nonfastidious microorganism. The nitrogen, carbon vitamin, aminoacid in the nutrient agar are provided by enzymatic digest of gelatine and beef extract. Agar is a solidifying agent.

III. GRAPHS AND TABULATION

WAVELENGTH (nm)	OPTICAL DENSITY READING
360nm	0.542
370nm	0.599
380nm	0.668
390nm	0.701
400nm	0.722
410nm	0.737
420nm	0.753
430nm	0.783
440nm	0.793
450nm	0.803
460nm	**0.812**
470nm	0.802
480nm	0.788
490nm	0.777
500nm	0.758

Table 1

*The peak absorbance value of the silver nanoparticles without capping agent is observed at 460nm.

WAVELENGTH (nm)	OPTICAL DENSITY READING
360nm	0.542
370nm	0.576
380nm	0.694
390nm	0.776
400nm	0.809
410nm	0.824
420nm	0.936
430nm	**1.045**
440nm	1.008
450nm	0.934

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460nm	0.845
470nm	0.817
480nm	0.795
490nm	0.773
500nm	0.740

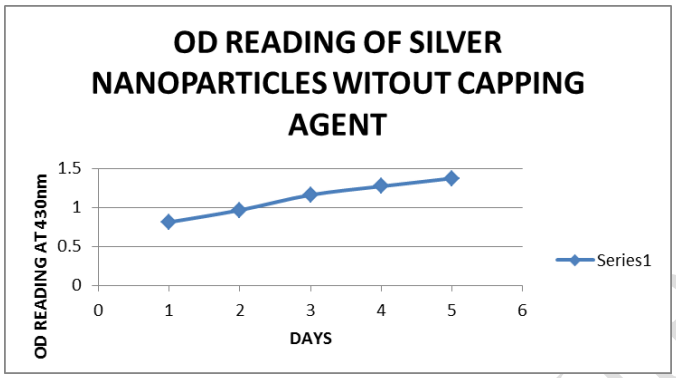
Table 2

* The peak absorbance value of the silver nanoparticles with capping agent is observed at 430nm.

STABILITY OF THE SILVER NANOPARTICLES WITHOUT CAPPING AGENT

WAVELENGTH (nm)	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
440nm	0.793	0.961	1.159	1.116	1.374
450nm	0.803	0.965	1.162	1.220	1.378
460nm	**0.812**	**0.966**	**1.163**	**1.222**	**1.387**
470nm	0.802	0.962	1.161	1.217	1.374
480nm	0.788	0.960	1.154	1.216	1.361

Table 3

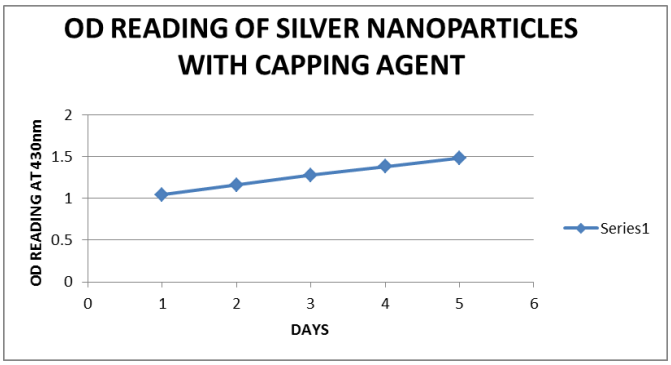


Graph 1

STABILITY OF THE SILVER NANOPARTICLES WITH CAPPING AGENT

WAVELENGTH (nm)	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
410nm	0.824	1.101	1.218	1.345	1.370
420nm	0.936	1.108	1.229	1.361	1.431
430nm	**1.045**	**1.162**	**1.279**	**1.379**	**1.483**
440nm	1.008	1.161	1.277	1.370	1.465
450nm	0.934	1.152	1.276	1.365	1.374

Table 4



Graph 2

BIOSENSING ABILITY OF SILVER NANOPARTICLES WITHOUT CAPPING AGENT

SAMPLE	COLOUR DEVELOPED	PRECIPITATION
Lead Acetate	Light brown	Present
Zinc Chloride	Colorless	Present
Zinc Acetate	Dark brown	Present
Copper Sulphate	Colorless	Present
Ferrous Sulphate	Colorless	Present
Cadmium Nitrate	Light blue	Absent

Table 5

BIOSENSING ABILITY OF SILVER NANOPARTICLES WITH CAPPING AGENT

SAMPLE	COLOUR DEVELOPED	PRECIPITATION
Lead Acetate	Light brown	Present
Zinc Chloride	Colorless	Present
Zinc Acetate	Dark brown	Present
Copper Sulphate	Colorless	Present
Ferrous Sulphate	Light yellow	Present
Cadmium Nitrate	Light brown	Present

Table 6

IV. RESULT

Figure 1: PARTHENIUM LEAVES

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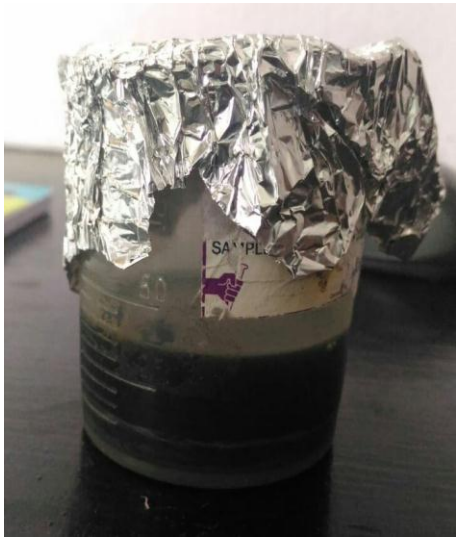


Figure 2: AQUEOUS EXTRACTION OF PARTHENIUM LEAVES

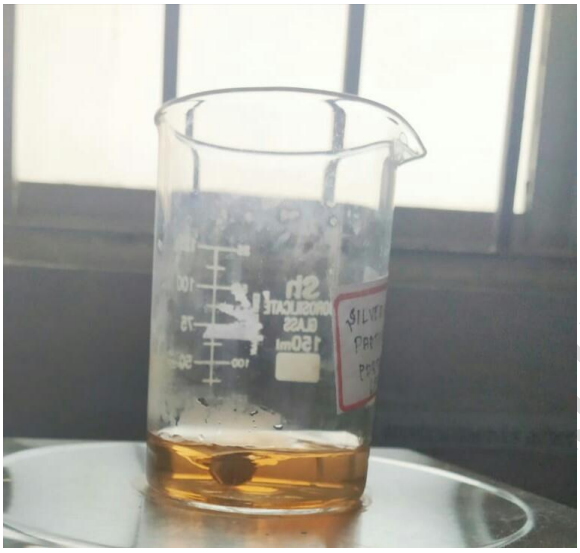
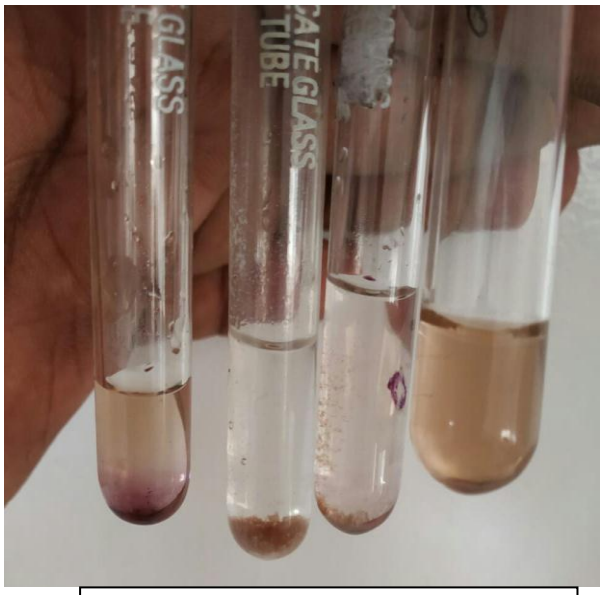


Figure 3: SILVER NANOPARTICLES WITHOUT CAPPING AGENT

Figure 4: SILVER NANOPARTICLES WITH CAPPING AGENT

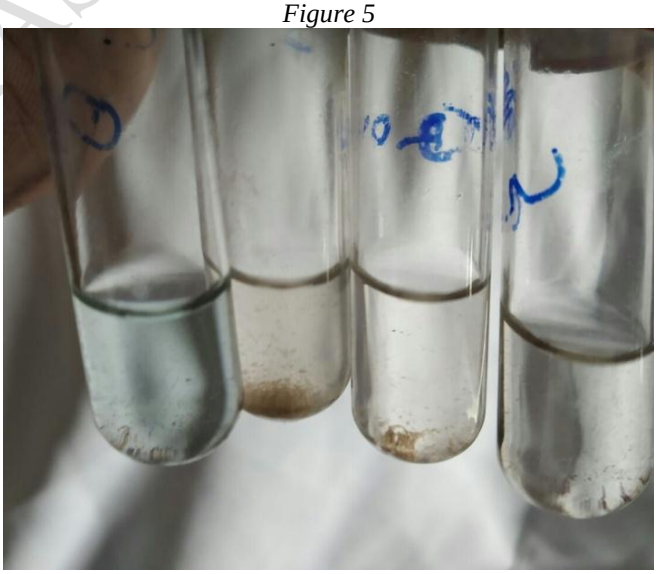
BIOSENSING ABILITY OF SILVER NANOPARTICLES WITHOUT CAPPING AGENT



1 2 3 4

1. Zinc acetate
2. Zinc chloride
3. Lead acetate
4. Control

Figure 5



1 2 3 4

1. Cadmium nitrate
2. Ferrous sulphate
3. Copper sulphate
4. Control

Figure 6

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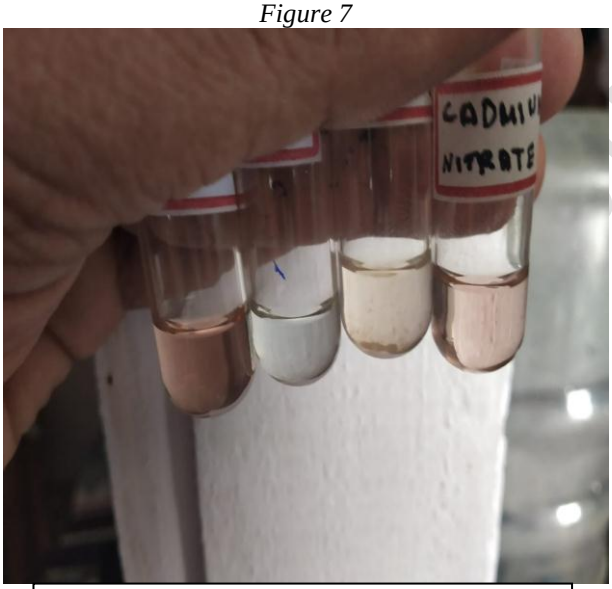
BIOSENSING ABILITY OF SILVER NANOPARTICLES WITH CAPPNG AGENT

1 2 3 4

1. Zinc acetate
2. Zinc chloride
3. Lead acetate
4. Control

Figure 7



1 2 3 4

1. Control
2. Copper sulphate
3. Ferrous sulphate
4. Cadmium nitrate

Figure 8

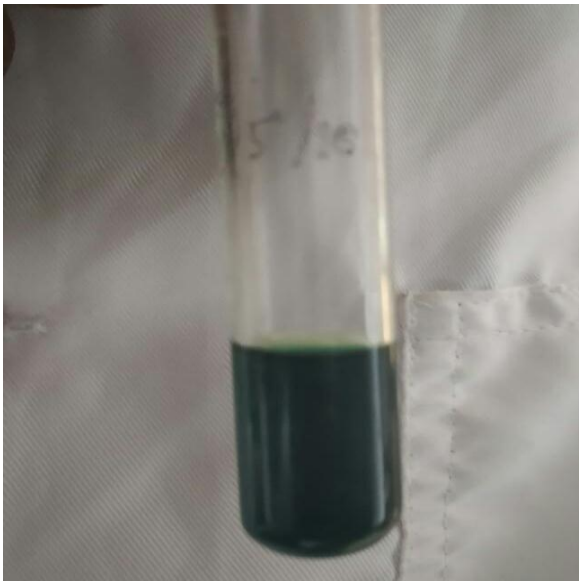


Figure 9: FRAP ASSAY

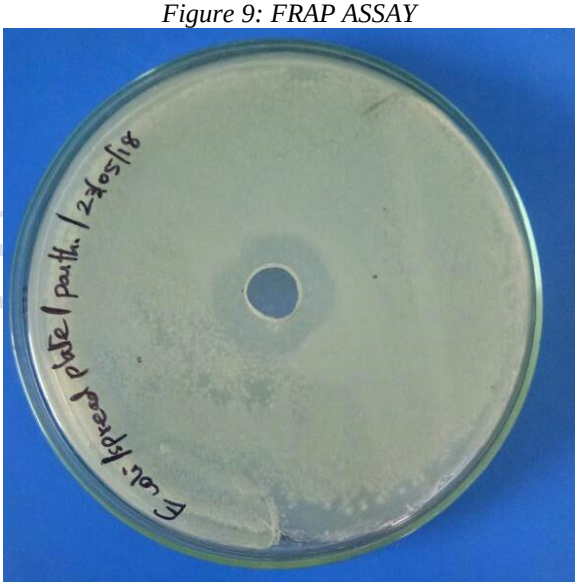


Figure 10: ANTI-MICROBIAL PROPERTY

V. DISCUSSION

PEAK ABSORBANCE VALUE (WITHOUT CAPPING AGENT)

The peak absorbance value of the silver nanoparticles without capping agent was observed at 460nm.TheThe peak absorbance value of the silver nanoparticles with capping agent was observed at 430nm.

STABILITY

The stability of the silver nanoparticles without capping agent (day 1- 0.812, day 2- 0.966, day 3-1.163, day 4- 1.222, day 5- 1.387) is low while comparing to the silver nanoparticles with capping agent (day 1- 1.045, day 2- 1.162, day 3- 1.279, day 4- 1.379, day 5- 1.483).

BIOSENSING ABILITY

The biosensing ability of the silver nanoparticles without capping agent is low while comparing to the biosensing ability of the silver nanoparticles with capping agent.

ANTI-OXIDANT POWER

Due to the development of dark green color and an absorbance of 1.204 at 700nm we can conclude that the silver nanoparticles synthesized from the parthenium leaves have high anti-oxidant power.

ANTI-MICROBIAL PROPERTY

The silver nanoparticles synthesized from the parthenium leaves have average anti-microbial property because the zone of inhibition is only 13mm.

VI. CONCLUSION

The silver nanoparttheicles were successfully synthesized from the parthenium leaves and the stability of the silver nanoparticles with capping agent dextrose is high while comparing to the silver nanoparticles without capping agent. Therefore, dextrose acts as a suitable capping agent for the silver nanoparticles synthesized from parthenium leaves. The biosensing ability of the silver nanoparticles with capping agent is high while comparing with the silver nanoparticles without capping agent. Then it have high anti-oxidant power and average anti-microbial property.

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