EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 4
Issue: 12
348-351
Year: 2017

GREEN SYNTHESIS OF *ACHYRANTHES ASPERA* SILVER NANO PARTICLES AND CONFIRMATION OF THEM THROUGH MICROSCOPY AND SPECTROPHOTOMETRIC TECHNIQUES

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Article Received on 25/09/2017 **Article Revised on 13/10/2017** **Article Accepted on 07/11/2017**

Nanotechnology is the creation of functional materials, devices and systems through control of matter on the nanometer length scale (1-100 nanometers), and exploitation of novel phenomena and properties (physical, chemical, biological, mechanical, electrical...) at that length scale." *Achyranthes aspera commonly* called as Prickly Chaff Flower, Chaff-flower, Crocus stuff, Crokars staff, and Devil's horsewhip. This plant is popularly supposed to act as a safeguard against scorpions and snakes by paralyzing them. It is described as purgative, pungent, and digestive, a remedy for phlegm, and inflammation of the internal organs, piles, itch, abdominal enlargements, and rheumatism and for enlarged cervical glands.

MATERIALS AND METHOD

Achyranthes aspera seed were collected from Lalgudi Taluk,Tiruchirappalli district, Tamilnadu., authenticated and deposited in RAPINET HERBARIUM, St.Joseph College, Trichirappalli, Tamilnadu. Homogenate was prepared by weighing 20grams of fresh flower of Nerium oleander Washed thoroughly (thrice) in distilled water and homogenized using a mortar and pestle. The homogenate was then filtered using a sterile gauze cloth. This homogenate extract prepared was then transferred to a sterile container and used for the study.

Qualitative Phytochemical Analysis

Qualitative Phytochemical Analysis for sugar, alkaloid, saponins, tannins, terpenoids, flavonoids, steroids, quinone, coumarin and phenol were carried out for the extract as per the standard protocols (Harborne, 1984).

Preparation of Silver Nanoparticles

To 750ml of each millimolar concentration of silver nitrate, 7.5ml of the plant homogenate was added, respectively into a clean conical flask. The conical flasks were then exposed to the sunlight (while being continuously shaken) for the synthesis of the nanoparticles to begin. The colours of the mixture turns from green to brown when exposed to sunlight and once it turns to colourless the particles were settled at the bottom of the flasks (Amanullah *et al* 2005).

Charecterization of Nanoparticles

UV -VIS Spectral Analysis

The bioreduction of Ag+ions in solutions was monitored by measuring the UV-VIS spectrum of the reaction medium. The UV-VIS spectral analysis of the sample was done by using U-3200 Hitachi spectrophotometer at room temperature operated at a resolution of 1 nm between 200 and 800 nm ranges.

FT-IR Analysis

For FT-IR measurements, the Ag nanoparticles solution was centrifuged at 10,000 rpm for 30min.The pellet was washed three times with 20ml of de-ionized water to get rid of the free proteins/ enzymes that are not capping the silver nanoparticles. The samples were dried and grinded with KBr pellets and analyzed on a Shimadzu IR-IR Affinity1 model in the diffuse reflectance mode operating at a resolution of 4 cm−1.

Table 2: Preliminary Phytochemical investigation in the seed extract of *Achyranthes aspera.*

TEST	WATER	ALCOHOL
TERPINOIDS	-	-
Flavanoid	+	+
Steroid	++	++
Glycoside	-	-
Alkaloid	-	+
Quinone	++	+
Phenol	-	-
Saponine	-	-
Cumarin	++	+

Table 3: Indication of Color Change in Synthesis of Silver Nano Particle.

S.No	Plant seeds extract+AgNo3	Color change		pH change		Color intensity	Time	Result
	Scientific name	Before	After	Before	After			
1	*Achyranthes aspera*	Light Yellow	Brown	4.0	4.70	+++	30min	Positive

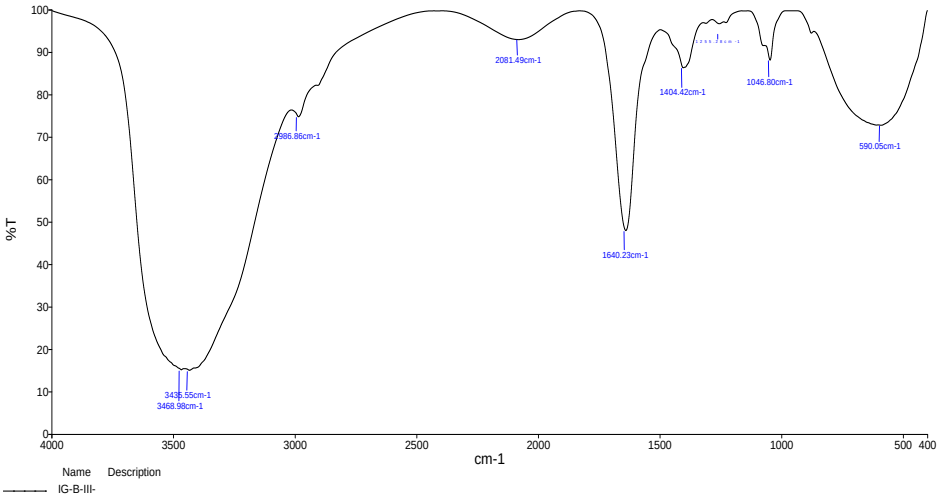

Fig 1: FT-IR analysis of seeds extract of *Achyranthes aspera.*

Table 4: FT-IR analysis of seeds extract of Achyranthes *aspera.*

S.NO	FREQUENCY RANGE	TYPE OF BOND	TYPE AND GROUP
1	3435	O–H stretch, H–bonded	alcohols, phenols
2	3468	O–H stretch	carboxylic acids
3	2081	–C(triple bond)C– stretch	Alkynes
4	1640	N–H bend	primary amines
5	1404	N–H bend	primary amines
6	1046	C–C stretch (in–ring)	Aromatics
7	590	C–H wag (–CH2X)	alkyl halides

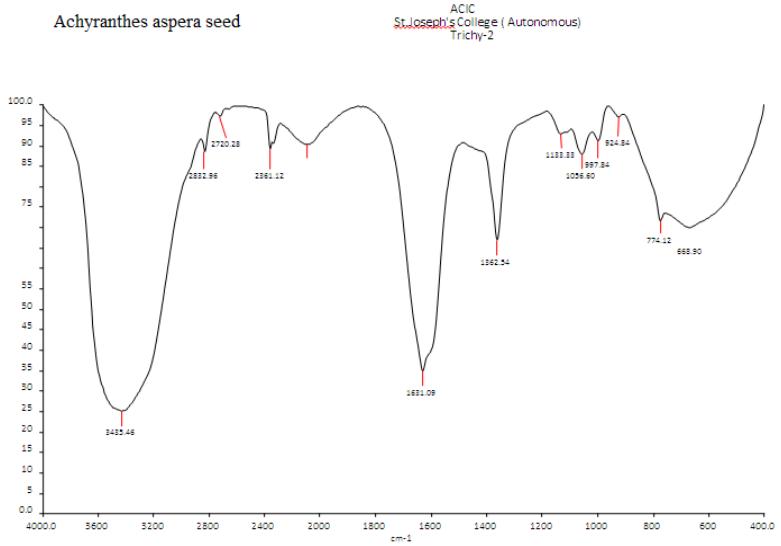

Fig 2: FT-IR Analysis of silver Nano particles.

Table 5: FT-IR Analysis of silver Nano particles.

S.NO	FREQUENCY RANGE	TYPE OF BOND	TYPE AND GROUP
1	3435.46	O–H stretch, H–bonded	alcohols, phenols
2	2832.16	C–H stretch	Alkanes
3	2719.36	C-H-O, C–H stretch	Aldehydes
4	2361.12	C-H-O, C–H stretch	Aldehydes
5	2092.40	C≡ bond N stretch	Carboxyl
6	1631.09	N-H bend	Primaryamine
7	1133.33	C–H wag (–CH2X)	alkyl halides
8	1362.54	C-H rock	Alkanes
9	997.84	C-H bond	Alkens
10	924.84	o-H bend	Carboxylic acid

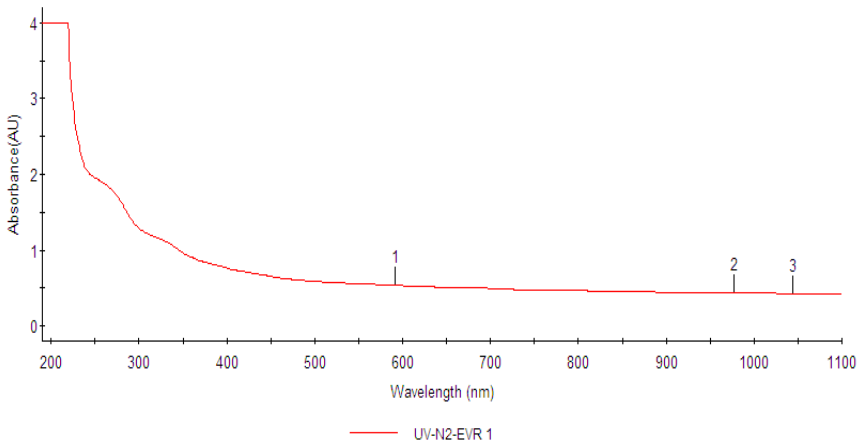

Fig 1: UV-VIS analysis of *Achyranthes aspera* seed extract.

The preliminary phytochemical analysis was carried out in the seed extracts of *Achyranthes aspera*. The phytochemical analysis was carried out for two different extracts (Table 2). The qualitative analysis of the ethanolic and water extracts of *Achyranthes aspera* seeds revealed the presence of flavanoid, terpenoid, saponin, quinine, steroids and cumarin.

In the present study SNPs were synthesized by using extract of *Achyranthes aspera* seeds rapidly within 15 min of incubation period and brown colour was developed by addition of Silver Nitrate. The time duration of change in colour and thickness of the colour varies from plant to plant. The reason could be that the quantitative variation in the formation of SNPs (or) availability of H+ ions to reduce the silver. It is well known that SNPs exhibit yellowish brown colour in aqueous solution due to excitation of surface plasmon vibrations in silver nanoparticles. Silver nitrate is used as reducing agent as silver has distinctive properties such as good conductivity, catalytic and chemical stability. The aqueous silver ions when exposed to herbal extracts were reduced in solution, there by leading to the formation of silver hydrosol.

FT-IR analysis of Seed extract of *Achyranthes aspera*

FT-IR measurement was carried out to identify the possible biomolecules in seeds of *Achyranthes aspera* .This spectrum shows lot of absorption bands indicates the presence of active functional groups in the seeds of *Achyranthes aspera* . The intensity peaks are slightly increased for the period of 3435,3468,2081 cm-1 as well as some intensity peaks decreased like 1640,1402, 590 cm-1.Fig: 1 shows the band at 3435 correspond to O-H Stretching vibrations of alcohol. The peak at 3468 represents to O-H in plane bend to a carboxylic acids. Peak at 2081 represents alkynes. The peak at1649, 1402, 1046 and 590 corresponds to primary amines, aromatics and alkyl halides stretching vibrations respectively presnt in the seed extract.

FT-IR analysis of SNP of *Achyranthes aspera*

FT-IR measurement was carried out to identify the possible biomolecules responsible for capping and

efficient stabilization of Ag nanoparticle synthesized using *Achyranthes aspera* extract. This spectrum shows lot of absorption bands indicates the presence of active functional groups in the synthesized silver Nanoparticles. The intensity peaks are slightly increased for the period of silver nanoparticle synthesis like 3435,2832, 2720, 1133 cm-1 as well as some intensity peaks decreased like 1631, 2092, and 1362 cm-1. Fig 2 shows the band at 3435 correspond to O-H Stretching vibrations of Silver, amide, alcohol and H–bonded to phenols. The peak at 2832 represents to C-H in plane bend to alkanes. The peak at 2092 corresponds to C≡ bond and N stretching vibrations to carboxyl groups. The band at 1631,1133,1362,and 924 corresponds toprimary amines, akyl halides,alkanes and carboxylic acids in the seed extract. The presence of active functional groups in seed extract results in the swift reduction of silver ions to silver Nanoparticle. To obtain good signal to noise ratio of silver nanoparticle were taken in the range 500–3400 cm−1.

SEM

The SEM image showing the high intensity of silver nanoparticles synthesized by Vitex negundo extract further confirmed the development of silver nanostructures.SEM provided further insight into the morphology and size details of the silver nanoparticles. SEM analysis showed the particle size of about 10 µm as well the crystal structure of the nanoparticles. The silver nanoparticles synthesized via green route are highly toxic to multidrug resistant bacteria hence has a great potential in Biomedical applications. The present study showed a simple, rapid, economical route to synthesized silver nanoparticles. Application of such eco-friendly nanoparticles in bactericidal, wound healing and other medical and electronic applications makes this method potentially exciting for the large scale synthesis of other inorganic materials (nano-materials). Plate 2: shows the SEM analysis of Silver nano particle.

SUMMARY AND CONCLUSION

In the preset investigation silver nanoparticles were synthesized from *Achyranthes aspera* seed extract and the synthesis of nano particles were confirmed by both visually and by spectrophotometrically. In visual observation the colour change of the solution, confirms the synthesis of AgNPs. UV-VIS, FT-IR and SEM analysis confirmed the presence of AgNPs by their respective peaks and images. The present study represents a clean, non-toxic as well as eco-friendly procedure for synthesizing AgNPs of *Achyranthes aspera* seed extract. The capping around each particle provides regular chemical environment formed by the bio-organic compound present in *Achyranthes aspera* seed extract, which may be chiefly responsible for the particles to become stabilized. This technique gives us a simple and efficient way for the synthesis of nanoparticles with tunable optical properties governed by particle size. The phytosynthesis of silver nanoparticles was demonstrated by visual inspection and by performing some spectral techniques (UV-VIS absorption, FT-IR spectroscopy and SEM analysis).

FT-IR results proved that bioactive compounds responsible for silver bioreduction could be proteins and flavonoids present in the aqueous extracts of *Achyranthes aspera* presumed to act as reducing and capping agents for the silver nanoparticles preventing the agglomeration of the particles and thereby stabilizing the nanoparticles. From the nanotechnology point of view, this is a noteworthy development for synthesizing AgNPs economically. In conclusion, this green chemistry approach toward the synthesis of AgNPs possesses several advantages *viz*, easy process by which this may be scaled up, economic viability, etc. Applications of such eco-friendly nanoparticles in bactericidal, wound healing and other medical and electronic applications, makes this method potentially stimulating for the large-scale synthesis of other inorganic materials, like nanomaterials. The present study included the bio-reduction of silver ions through medicinal plants extracts.

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