

GREEN SYNTHESIS AND ANTIBACTERIAL STUDY OF IRON AND SILVER NANOPARTICLES

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Abstract

Green synthesis of Nano particles is an emerging hopeful trend in Chemistry. We have prepared iron as well as silver nano particles from the leaf extracts of the trees *Syzygium jambos* and *Mangifera indica*. Nanoparticles were characterised by v-visible spectrum.the antibacterial properties of these nanoparticles were studied on a growth medium of *E.coli* bacteria.

Keywords : *Syzygium jambos*, *Mangifera indica*, UV- Visible Spectroscopy, *E.coli* bacteria, Inhibition Zone.

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INTRODUCTION

Green alternatives are powerful synthesis methods in replacing conventional chemical preparation methods. Eco friendly synthesis, reduction in cost, decrease in pollution, no need of extreme conditions are the attractive aspects of green chemistry (El-nour *et al* 2010). Due to the amazing properties compared to bulk matter nanoparticles are very interesting to study. The high aspect ratio of nanoparticles gives them different properties from bulk materials (Anna *et al* 2009). Green method of preparation of iron and silver nanoparticles will be a ray of hope for emerging developments in nanoparticles.

We attempted to prepare iron and silver nanoparticles from leaves of commonly available trees. We selected *Syzygium jambo*, *Mangifera indica* and *Psidium guajava* trees. Leaf extracts were prepared and characterised by UV-Vis spectroscopy. Anti-bacterial properties of synthesized nanoparticles were performed on a growth medium of *E.coli* bacteria (Ponder *et al*, 2000; Nayak & Monalisa, 2013).

PROCEDURE

MATERIALS REQUIRED

Leaf extract of *Syzygium jambos* and *Mangifera indica*
0.001M Silver nitrate and 0.001M Ferric chloride solutions
Uv-visible spectrometer photometer, growth medium and culture of *E.coli* bacteria.

PREPARATION OF PLANT EXTRACT

Leaves of *Syzygium jambos* and *Mangifera indica* were washed, cleaned, dried in absence of the sun. 25 grams of these leaves were chopped into small pieces, grinded in mortar, extract is diluted using 100 ml deionized water, it is boiled to 273K, and filtered.

SYNTHESIS OF IRON NANOPARTICLES

0.001M Ferric chloride solution and plant extracts were mixed in 1:1 ratio with constant stirring at 50°C. heating is continued for 20 minutes with continuous stirring (Nayak & Monalisa, 2013).

SYNTHESIS OF SILVER NANOPARTICLES

0.001M Silver nitrate solution and leaf extract were mixed in the proportion of 9:1 and heated at 50°C to 80°C for an hour (Anna *et al* 2009; Krishnaraj *et al* 2010).

CHARACTERISATION OF NANOPARTICLES

Nanoparticles were characterised using Uv-visible spectrometer equipped with 'vision lite' software. Scanning range chosen for iron nanoparticles was 200-350 nm and that for silver Nanoparticles was 300-400 nm.

RESULT AND DISCUSSION

The Nanoparticles of silver and iron was synthesized from leaf extracts of *Syzygium jambos* and Uv visible spectrum was recorded

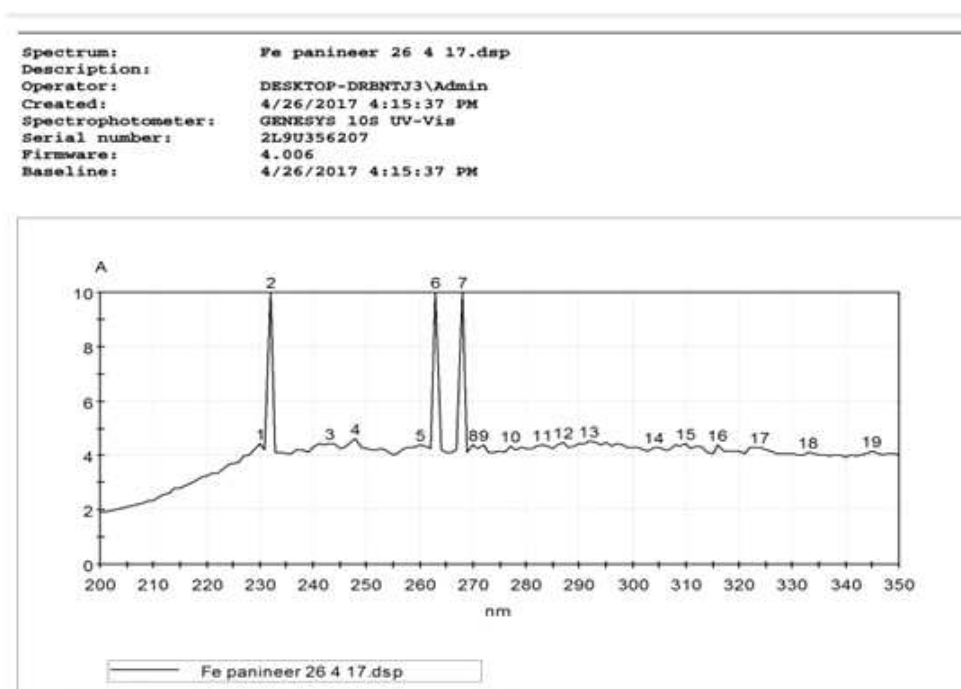


Fig.1.1 Uv visible spectrum of Fe nanoparticles prepared from leaf extract of *Syzygium jambos*

Iron nanoparticles show characteristic peak in UV-Vis spectrum in 216 nm and 267 nm. The peaks observed (Fig 1.1) in the range of 230 nm and 270 nm are noticeable. Further formation of Iron nanoparticles can be confirmed by change in color of solution after the addition of leaf extract. The color change is rapid and on heating color further changes. There is noticeable pH change after the addition of plant extract (Nayak & Monalisa, 2013). Before addition of plant extract pH was 5.6 and after addition it was 2.8

Spectrum: Ag Panineer 25 4.dsp
 Description:
 Operator: DESKTOP-DRBNTJ3\Admin
 Created: 4/26/2017 4:38:09 PM
 Spectrophotometer: GENESYS 10S UV-Vis
 Serial number: 2L90356207
 Firmware: 4.006
 Baseline: 4/26/2017 4:38:09 PM

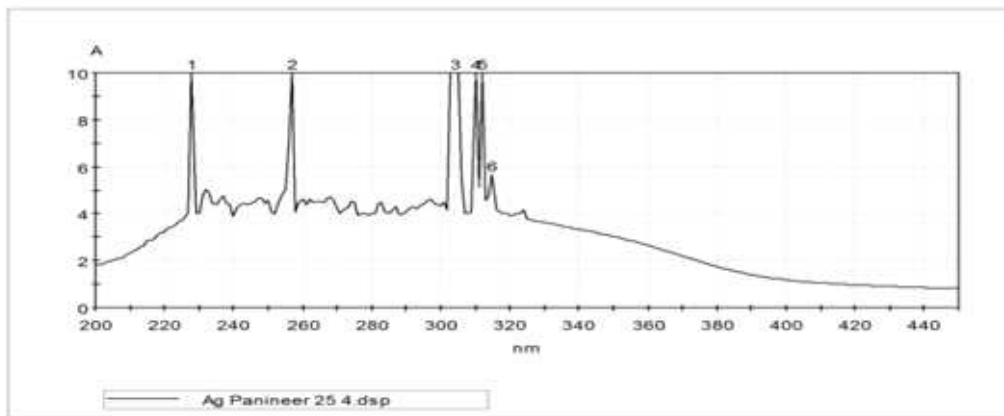


Fig 1.2 Uv visible spectrum of Ag nanoparticles prepared from leaf extract of *Syzygium jambos*

Silver nanoparticles show peaks in the range of 300-400 nm in UV-Vis Spectrum. This is the characteristic peak of ionic silver nanoparticles. From the obtained spectrum we can observe a peak at 315 nm (Fig 1.2). This is a noticeable peak. The change in color of millimolar solution of silver nitrate solution after addition of leaf extract was noticeable. The colorless silver nitrate solution turned slightly yellow in color. During course of heating for an hour, sample was withdrawn during 15, 30, 45 minutes and 1 hour and analysed.

In the same way, Fe and Ag nanoparticles prepared from *Mangifera indica* were characterised by uv-visible spectroscopy and the spectrum is shown below

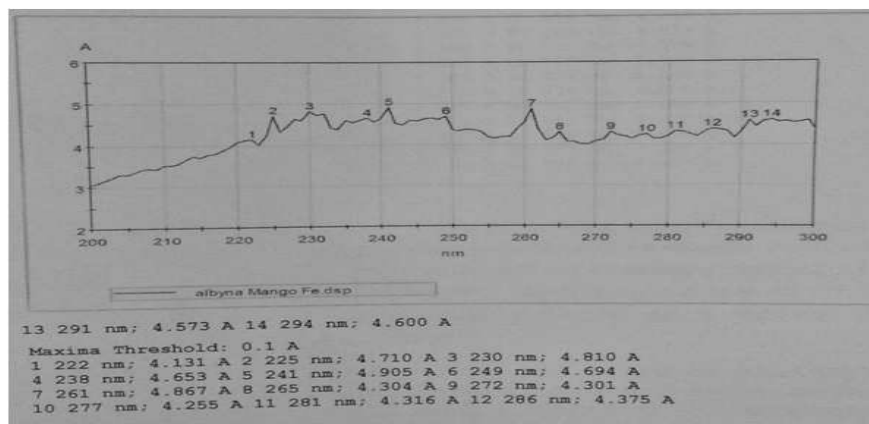


Fig 1.3 UV-Visible spectrum of Fe nanoparticles prepared from leaf extract of *Mangifera indica*

In the UV Visible spectrum, Fe nanoparticles shows peaks at 216 nm and 267 nm. From the above spectrum, formation of Fe nanoparticles was confirmed by peaks observed at 222 nm and 261 nm with reliable absorbance. Nanoparticle formation was further identified by change in color during mixing of leaf extract and FeCl_3 solution. The change in pH of the solution after addition of leaf extract was noticeable. Peaks observed for silver nanoparticles is in the range of 300-400 nm in Uv visible spectrum. There are number of peaks observed in the spectrum due to the interference of other components in the leaf. Large number of inorganic compounds and organic compounds are present in the leaf. Isolation of these components was not carried out so it is difficult to point out a particular peak for the formation of Ag nanoparticles. There are a lot of reliable peaks. Formation of Ag nanoparticles was confirmed by color change of the solution.

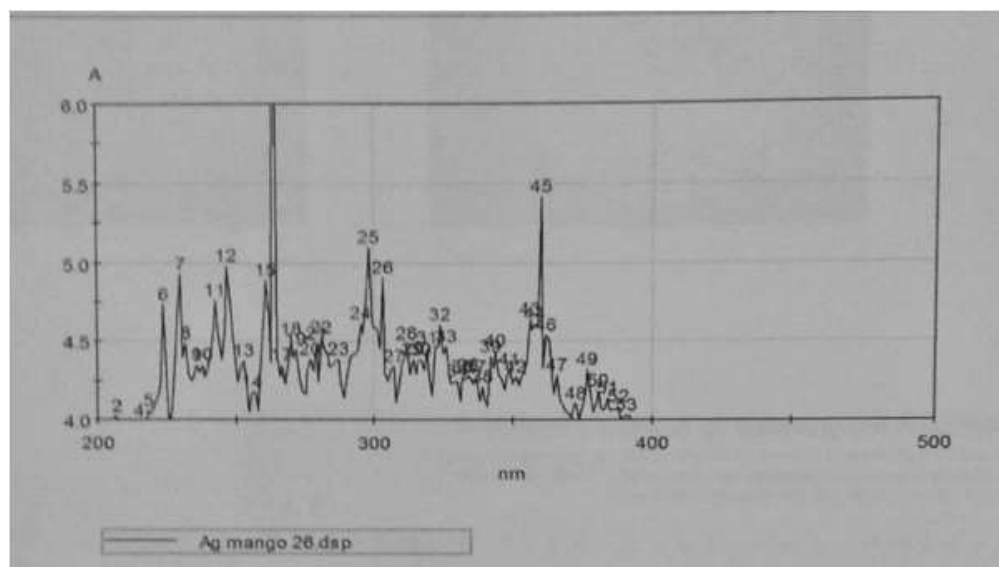


Fig 1.4 UV-Visible spectrum of Ag nanoparticles prepared from leaf extract of *Mangifera indica*

Antibacterial properties of iron and silver nanoparticles prepared from *Syzygium jambos* was conducted on *E. Coli* bacteria by agar well diffusion method. Zone of inhibition can be seen in the picture.

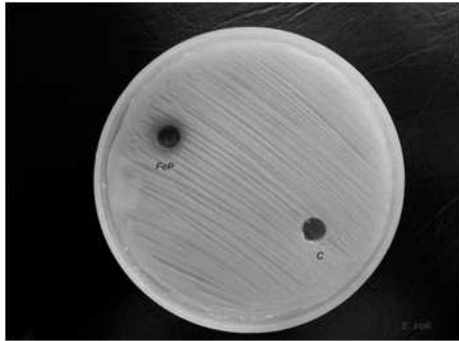


Fig.1.5 Inhibition zone of iron nanoparticles is shown above

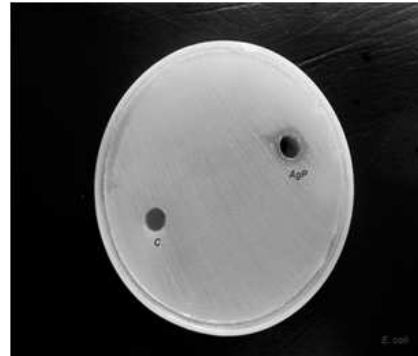


Fig 1.6 Anti bacterial property of Ag nanoparticles was carried out. Inhibition zone is shown above

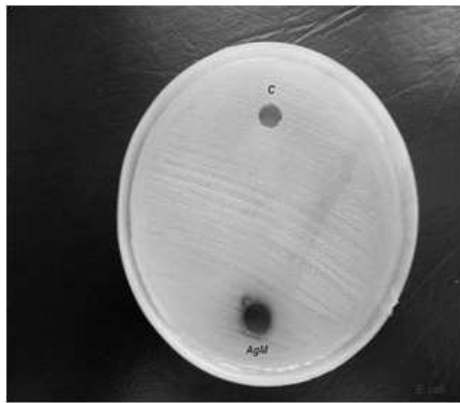


Fig 1.7 Inhibition zone produced by Fe nanoparticles

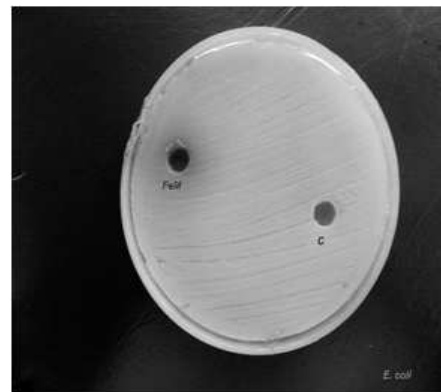


Fig 1.8 inhibition zone produced by Ag nanoparticles



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T I E S - t i e s M i n d a n d N a t u r e

TEST REPORT

Name: Mr. Nithin Mathew, St. Stephen's College, Uzhavoor.

We have tested the extracts for the antibacterial activity through agar well diffusion method, handed over us on 02.06.17 and following are the test results. Zone size measured in cm.

Samples	<i>E. coli</i>	
	T	C
Plant extract I	2.0	0
	2.0	0
	1.9	0
	1.9	0
	1.9	0
	1.9	0
Fe P	1.2	0
	1.2	0
	1.1	0
	1.1	0
	1.2	0
	1.2	0
AgP	1.2	0
	1.2	0
	1.3	0
	1.2	0
	1.3	0
	1.2	0
Fe M	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
AgM	1.0	0
	0.9	0
	0.9	0
	0.8	0
	0.8	0
	0.8	0
Sample	<i>S. canis</i>	

The result of anti bacterial studies and diameter of inhibition zone is given in the certificate

CONCLUSION

We were able to prepare iron and silver nanoparticles from the leaf extracts of *Syzygium jambos* and *Mangifera indica* by green synthesis. The nanoparticles were obtained in colloidal form and characterised by UV -Visible spectroscopy and physical changes including color change and changes were noticed during nanoparticle formation. Antibacterial properties of the samples were studied on *E.coli* bacteria by agar well diffusion method. When we compare antibacterial properties, Fe nanoparticles prepared from *Mangifera indica* leaf extracts had poor antibacterial property. All other nanoparticles possess antibacterial property.

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