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Comparative analysis of synthesis of silver nanoparticles using different flower extracts (*Hibiscus rosa sinensis, Tabernaemontana sp.Datura metel*) through green synthesis method and determination of their antifungal activity

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Abstract : *This investigation deals with a cost effective and environment friendly technique for green synthesis of silver nanoparticles silver nitrate solution through extracts of Hibiscus rosa sinensis, Tabernaemontana sp.Datura metel flower as reducing agent and capping agent. UV-Vis spectrophotometer shows the synthesis of silver nanaoparticles maximum in Hibiscus rosa sinensis, comparatively less in Tabernaemontana sp. and least in Datura metel. Synthesized silver nanaoparticles were characterized using UV-Vis spectrophotometer. Further , these biologically synthesized nanoparticles exhibited a tremendous antifungal activity. Tabernaemontana sp showed maximum antifungal activity in comparison to Hibiscus and Datura metel.*

Keywords: *Hibiscus; Tabernaemontana; Datura; Silver nanoparticles; Antifungal activity.*

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Introduction :

Nanotechnology has induced a great scientific advancement in the field of research and technology. Nanoparticle is a core particle which performs as a whole unit in terms of transport and property (Nour *et al.,* 2010). Nanosized particles are quite unique in nature because nanosize increases surface to volume ratio and its physical chemical and biological properties are also different from bulk material.

So, the main aim to study its minute size is to trigger chemical activity with distinct crystallography that increases the surface area (Sinha *et al.,* 2009). In the present work biological method is adopted for the synthesis of AgNps.

Green synthesis of silver, nanoparticles using flower is cost effective, eco friendly, easily available, non-toxic and acts as reducing and capping agent as compared to the chemical method which is very costly and it emits hazardous by-products as well (Kaler *et al.,* 2010). These biologically synthesized nanoparticles exhibit moderate antifungal activities and play a vital role in drug development programs of pharmaceutical industries.

Materials and Methods:

For synthesis of silver naoparticles : Fresh flowers required for the study were collected from local temples. The flowers were washed and kept in open air for drying. Dried flowers were then grounded to powder. After this powered samples (*Datura and Hibiscus* - 5 g, *Tabernaemontana* -10 g) were dissolved in 150 ml distilled water. Resultant crude extract was filtered through Watman no. 1 filter paper and stored in refrigerator at 4ºC (Heemsagar *et al.,* 2014).

To 90 ml of distilled water 0.015g of sample was added and kept in shaker incubator at 120 rpm for 10 minutes (Nethradevi Devi *et al.,* 2012). 10 ml of each flower extract was added separately to the above solution. The solutions were incubated in dark at room temperature.

UV-Vis spectra analysis was carried out to confirm the silver nanoparticles formation in UV Spectrophotometer.

For antifungal assay : The MGYPA media was prepared and sterilized by autoclaving. After autoclaving the media, it was poured in sterilized petriplate to a uniform depth of 4mm. The petriplates were placed in the incubator at 37ºC for 24 hours. 5 ml of saline water was taken in test tube and sterilized by autoclaving. A loop full of each isolated fungus was inoculated into the test tubes.

1ml of each isolate was pipette out and dropped on the plate and was evenly spread on the surface of the media. 6 discs (2 for each sample solvent) were loaded per plate separately. 2 discs each for control were also loaded on 2 plates. The plates were placed in incubator at 25ºC for 28 hours.

After 48 hours of incubation the resulting zone of inhibition was checked (Sharma *et al.,* 2009).

Result and Discussion:

UV-Vis spectra analysis : Reduction of Ag+ into Ag° during exposure to the flower extract was observed as a result of colour change. When flower extract was mixed in the aqueous solution of silver nitrate, it started to exhibit yellowish orange for *Datura metel* (Nethradevi *et al.,* 2012) and dark brown for *Hibiscus* and *Tabernaemontana* (Heemasagar *et al.,* 2014). These colour changes arise because of the excitation of the surface Plasmon vibration with silver nanoparticles.

The UV spectroscopy scanning was performed from 400 to 600nm (Nethradevi *et al*., 2012). In Table 1, the spectra displayed the characteristic surface plasmon resonance (SPR) bands of AgNps at about 450nm, indicating the formation of AgNps. The maximum synthesis was reported in *Hibiscus* (4.237), comparatively less in *Tabernaemontana* (3.706) and least in *Datura* (1.872).

Spectra band of *Datura metel* at 435 nm, *Hibiscus rosa sinensis* at 421 nm, *Tabernaemontana sp* at 420 nm, has been reported by many workers (Nethradevi *et al.,* 2012; Heemasagar, 2014). Our results are in close association with previously reported UV-Spectra analysis i.e. at 450 nm.

Table 1 : UV-Vis spectrophotometer analysis

Wavelength (nm)	*Tabernaemontana sp.*	*Hibiscus rosa sinensis*	*Datura*
400	3.309	3.883	1.770
450	3.706	4.237	1.872
500	3.392	4.044	1.649
550	2.456	2.657	1.243
600	1.652	1.931	0.953

Antifungal assay : The antifungal assay of the crude extracts of *Datura metel, Hibiscus rosa sinensis* and *Tabernaemontana sp.*were carried out against *Candida albicans* by disc diffusion method. After 48 hours of incubation the zone of inhibition was formed in the plates.

It is clear from Table 2, that among the solutions of *Tabernaemontana sp.*,*Datura metel* and *Hibiscus rosa sinensis* containing silver nitrate, *Tabernaemonatana* showed powerful antifungal effect. Thus, the biosynthesized silver nanoparticles showed effective antifungal activity against human pathogen *Candida albicans* (Cowan, 1999).

Table 2: Antifungal activity (showing zone of inhibition)

Sample	Pathogen (*Candida albicans*) Zone of inhibition (mm)	Control (Distilled water)
Datura metel	13	–
Hibiscus rosa sinensis	9	–
Tabernaemontana	22	–

Conclusion:

In the present study it was found that fresh flowers are good source for green synthesis of AgNps. The flowers of *Hibiscus, Datura, Tabernaemontana* can be used to discover bio active natural products that may serve as leads in the development of new pharmaceutical research activities as it is very cost effective, eco friendly, easily available and non toxic. The antifungal activity of green synthesized silver nanoparticles may be a novel approach and play a vital role in drug development programs of pharmaceutical industries.

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