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SYNTHESIS OF SILVER NANOPARTICLES USING *NARDOSTACHYS JATAMANSI* AND STUDYING ITS ANTIOXIDANT ACTIVITY

Gopakumar T*, Vasanthi C, Seethalakshmi S, Anish Stephen

Department of Pharmacology, Sri Ramachandra Medical College & Research Institute, Chennai, Tamil Nadu, India.

ABSTRACT

Nardostachys jatamansi, known as spikenard has an array of proven therapeutic properties like anti-epileptic, anti-depressant and anti-arrhythmic properties. In this study we have synthesized silver nanoparticles using *Nardostachys jatamansi* which will act as reducing and capping agent and characterized by UV- Vis spectroscopy. The synthesized silver nanoparticles were evaluated for its antioxidant properties by subjecting it to DPPH (diphenyl picryl hydrazine) assay. Also the extract solution was evaluated for its antioxidant properties in order to study any bioenhancing effects by the synthesized silver nanoparticles .It has been found that both the synthesized silver nanoparticles and the *Nardostachys jatamansi* extract have significant antioxidant properties when compared with the standard curcumin. It is seen that synthesized silver nanoparticles have better antioxidant properties than the extract at lower concentrations like 25& 50mcg/ml.

Key Words:- *Nardostachys jatamansi*, Silver nanoparticles, Antioxidant, Bioenhancer.

INTRODUCTION

Nardostachys jatamansi (Picture 1) (Spikenard-English, Jatamashi-Tamil) is an indigenous drug found in high altitudes. Ayurveda has mentioned the uses of roots and the rhizomes of *N. jatamansi*, as having anti-epileptic properties, Anti-depressant properties and also has therapeutic value against tension head ache, hair loss and cardiac diseases like arrhythmias .Studies have shown that it possesses antioxidant and lipid peroxidation activities (Rao *et al*., 2005; Rasheed *et al*., 2010; Gloria Karkada *et al*., 2012). The sesquiterpenes (jatamansic acid, jatamansone), lignans, and neolignans are reported to be present in the roots of this plant (Chauhan 1999). In one of the studies the sesquiterpene, valeranone was isolated from *N.jatamansi* and further pharmacological evaluation revealed sedative, tranquilizing and antihypertensive properties in animals (Rucker *et al*., 1978).

Synthesis of silver nanoparticles using plants (Green Synthesis) is a growing area of research since this ensures an ecofriendly methodology of synthesis which at the same time can be scaled up to commercial requirements. Silver Nanoparticles have found an irreplaceable position in therapeutics since ages and has been acknowledged in various texts of Ayurveda, Siddha & Unani Medicine.

This study aims to synthesize Silver nanoparticles using the root extracts of *Nardostachys jatamansi* which will act as both reducing and capping agent and its antioxidant property is evaluated in vitro by DPPH assay.

Corresponding Author

Dr. Gopakumar T
Email:- drgopakumart@gmail.com

MATERIALS & METHODS

Materials

Silver nitrate was purchased from Sigma Aldrich and 1mM strength aqueous solution was prepared using Milli-Q. Dried roots of *Nardostachys jatamansi* was purchased locally.

Preparation of the Extracts

20 gm of sample (root) were added into the beaker containing 150ml of 70% Ethyl alcohol. The beaker was kept in a shaker for 24- 48 hrs. After the incubation period, the extracts were filtered and stored (Sharma *et al*., 2012).

Synthesis of Silver Nanoparticles

For the synthesis of Silver Nanoparticles, 10 ml of the extract was added drop by drop using micropipette into 100 ml of aq.solution of 1mM silver nitrate. The reaction was allowed to carry out by autoclaving the mixture at 15 psi, 121°C for 5 min. The color change in reaction mixture was recorded through visual observation .The final product was obtained through centrifugation at 15,000 rpm for 10mins. After centrifugation the supernatant was discarded and the pellet was resuspended in double distilled water and centrifuged again to eliminate uncoordinated biological molecules and free ions present in it. They were freeze dried using Lyophilizer and subjected to Characterization studies (Geoprincy *et al*., 2013; Krishna raj 2010).

Characterization of Silver Nanoparticle

The Change in color of the Solution is noted after mixing the extract with the Aq. Silver Nitrate solution .Change in the color to yellowish brown signifies the formation of silvernanoparticles (Picture 2). Change in color is due to excitation of surface plasmon vibrations in silver nanoparticles (Jae Yong Song *et al*., 2009). The solution was scanned at the wavelength of 390 to 700 nm in UNICAM UV 300 spectrophotometer. The presence of silver nanoparticles gives a characteristic sharp peak in the visible region of the electromagnetic spectrum (Picture 3).

***Invitro* Antioxidant property evaluation**

Antioxidant activity assay is based on DPPH free radical scavenging assay. Aliquot 2 ml of freshly prepared DPPH (diphenyl picryl hydrazine) solution in 6 test tubes. Then, add 1 ml of methanol (99.8%) to one test tube and mark it as control. Add 1ml of Curcumin to tube marked as standard. Then, finally add the synthesized silver nanoparticles suspension (in methanol) solution in the following concentrations: 25mcg/ml, 50 mcg/ml, 75 mcg /ml & 100 mcg/ml to all the test tubes excluding the control and standard and mark it as A1 to A4 based on increasing concentrations. In the same way, repeat with the extract solution at concentrations 25mcg/ml, 50 mcg/ml, 75 mcg /ml & 100mcg/ml and name the test tubes as E1 to E4 respectively. Incubate all test tubes in room temperature at dark condition for minimum of 30 minutes. Then, check absorbance of all samples at 517nm.

$$\text{Percentage of Inhibition of DPPH Activity} = \frac{\text{Abs control - Abs sample}}{\text{Abs control}} \times 100$$

Where, Abs control= Optical density of Control

Abs Sample = Optical density of sample extract / silver nanoparticle (Naveena *et al*., 2013)

RESULTS & DISCUSSION

Visual observation revealed a change in color of the solution to dark brown after incubation post mixing. The dark yellowish brown color of the solution indicates the formation of silver nanoparticles (Picture 2). UV-Vis spectroscopy (Chauhan *et al*., 2013) shows an absorption peak of 430nm which confirms the presence of silver nanoparticles (Picture 3). Results of Antioxidant activity evaluated using DPPH assay is given in Picture 4 and Table 1. It showed that inhibition of free radical scavenging activity is 47%, 63%, 66% and 72% with silver nanoparticle at 25, 50, 75 and 100 mcg/ml concentrations respectively. It is compared with the plant extract which showed 25%, 51%, 58% and 74% inhibition at respective concentrations. The above results were compared with curcumin as a standard with the percentage inhibition of 71%, 74%, 81% and 85% at respective concentrations. The synthesized silver nanoparticles have more efficacies with maximum inhibition of 47, 63 and 66% at concentrations 25, 50 and 75 mcg/ml respectively. When it is compared with curcumin, the percentage of inhibition is less; but with the plant extract, it is more.

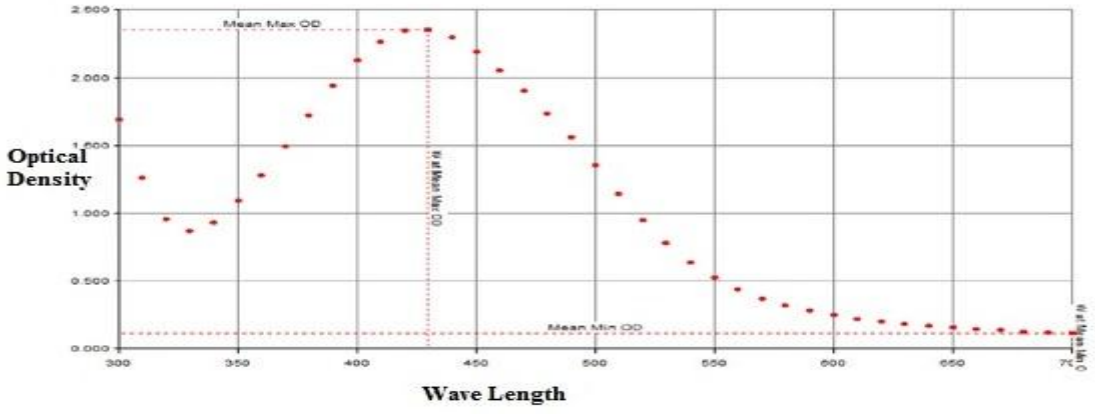
Table 1. DPPH assay showing percentage inhibition at various concentration

	% Free Radical scavenging activity		
Conc/ ml	**Plant extract (*Nardostachys jatamansi*)**	**Silver nanoparticles synthesized using *Nardostachys jatamansi***	**Curcumin**
25 mcg	25.79 %	47.00%	71.45%
50 mcg	51.13 %	63.8%	74.29%
75 mcg	58.5%	66.5%	81.00 %
100 mcg	74.00 %	72.5%	85.22%

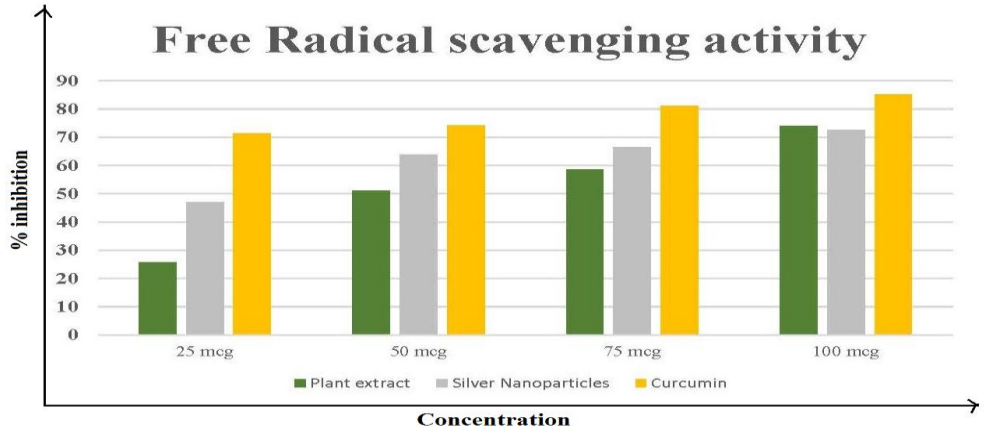
Picture 1: N. jatamansi

Picture 2: Silver Nanoparticle solution synthesized using N.jatamansi

Picture 3. UV absorption spectra of the synthesized silver nanoparticles shows mass peak at a wavelength of 430 nm



Picture 4. Comparison of free radical scavenging



Thus it proves that the synthesized silver nanoparticles are more effective at lower concentrations. This may be due to the following phytochemicals - jatamansic acid and jatamansone. From the literature it shows that sesquiterpene jatamansone is present in the taken concentration which is proved by our study.

It is seen that both root extract of *Nardostachys jatamansi* and silver nanoparticles synthesized using root extract of *Nardostachys jatamansi* have significant antioxidant properties. But data projects that silver nanoparticles have better antioxidant properties when compared to the antioxidant properties of the extract at lower concentrations.

CONCLUSION

Silver nanoparticles are synthesized by low cost, simple, ecofriendly green method using the root extracts of *Nardostachys jatamansi*. The synthesized silver nanoparticles have significant antioxidant property. This study proves that there is a dose dependent inhibition of free radicals. As observed, synthesized silver nanoparticles showed better antioxidant properties at lower concentrations than that of plant extract which signifies bioenhancing effects of silver nanoparticles. Further studies are required to evaluate the therapeutic efficacy.

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