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A study on green synthesis of silver nanoparticles using *Murraya koenigii* aqueous leaf extract

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Abstract
The herbal plant *Murraya koengii* is currently used in medicinal practices for treating various diseases. *Murraya koenigii* is a small spreading shrub belongs to family Rutaceae. The study was carried out to synthesize silver nanoparticles from the leaves of *Murraya koengii*. Silver nanoparticles are synthesized by the reduction of silver ions from Ag+ to Ag using reducing agents. These silver nanoparticles were further confirmed by using UV-Vis spectroscopy. Absorption spectra of silver nanoparticles formed has absorbance peak between 440-460 nm. SEM provides the morphology and size details of the silver nanoparticles. SEM results showed that the diameters of prepared nanoparticles in the solution with a specific sizes range.

Keywords: *Murraya koengii*, nanoparticles, SEM, silver and biosynthesis

Introduction
The 'green' practices in scientific technologies are becoming enormously popular and are much important as a result of worldwide problems associated with environmental concerns (Thuesombat *et al*., 2014) [1]. Green synthesis includes synthesis of nanoparticles from plants, fungi and bacteria. Nanotechnology refers to the research and technology development at atomic, molecular, and macromolecular scales, which leads to the controlled manipulation and study of structures and devices with length scales in the range of 1-100 nanometers. The metal nanoparticles have novel magnetic, electronic and optical properties, which differs in their size, shape and composition. Nanoparticles play an important role in drug delivery, diagnostics imaging, sensing, gene delivery, artificial implants and tissue engineering (Prathna *et al*., 2010) [2].

Silver nanoparticles are synthesized by the reduction of silver ions from Ag+ to Ag using reducing agents. Micro molar concentrations of silver have no harmful effects on humans (Berger *et al*., 1976) [3]. Therefore, silver has been widely used for the development of many biological and pharmaceutical processes, products, and appliances such as coating materials for medical devices (Raad and Hanna, 2002) [4], orthopedic or dental graft materials (Hotta *et al*., 1998 and Matsuura *et al*., 1997) [5, 6], topical aids for wound repair (Dowsett, 2004) [7], water sanitization (Lin *et al*., 2002) [8] and textile products (Takai *et al*., 2002) [9].

Murraya koenigii is a small spreading shrub belongs to family Rutaceae. It is a small tree, growing 4–6 m (13–20 feet) tall, with a trunk up to 40 cm diameter. Murraya koenigii commonly known as Meetha neem and is a native of India. In India, it is found in Tamilnadu, Karnataka, Kerala, Maharashtra and Madhya Pradesh. *Murraya koenigii* is an herbal plant and used in Ayurvedic medicinal practices for treating various diseases.

Materials and Methods
Collection of plant material
Murraya koenigii was collected from nursery of Kapoor Chandar Kulish Smriti Van, Jaipur.

Fig 1: Plant of *Murraya koenigii*

Surface sterilization and preparation of the extract

Surface sterilization were done with 0.1% $Hgcl_2$ to remove the contaminants present on the surface of leaves and washed with distilled water (3times) to remove the chemical. 20g leaves were taken and cut into small pieces with the help of ethanol sterilized knife and air dried. Leaves were placed into flask (500 ml) containing deionized water(100ml) and boiled in water bath at 100 °C for 20 min. Mixture were cooled and filtered through Whatman filter paper 1 and filtrate was used for Nanoparticles synthesis.

Synthesis of Silver Nanoparticles

1mM aqueous solution of Silver nitrate ($AgNO_3$) was prepared and used for the synthesis of silver nanoparticles. 5ml leaf extract and 100 ml silver nitrate solution were mixed and placed on shaker at 150 rpm at 30 °C for 48hrs in dark conditions. Then the bio reduced aqueous component was used to measuring UV-Vis spectra of the solution.

Results and Discussion

Biosynthesis of silver nanoparticles

Silver reduction is well known that silver nanoparticles exhibit yellowish brown colour in aqueous solution due to excitation of surface Plasmon vibrations in silver nanoparticles (Raj *et al.* 2010) [10]. Silver nitrate is used as reducing agent as silver has distinctive properties such as good conductivity, catalytic and chemical stability. The complete reduction of silver ions was observed after 48 h of reaction at 30 °C under shaking condition. The color change in the reaction mixture was observed during the incubation period, because the formation of silver nanoparticles was able to produce the particular color. The appearance of dark yellowish-brown color was a clear indication of the formation of silver nanoparticles in the reaction mixture. The flasks were observed periodically for change in colour from yellow to different shades of yellow and brown.

Fig 2: Leaf extracts 1mM $AgNo_3$ with leaf extract

The appearance of yellowish dark brown colour confirms the existence of silver nanoparticles. The reduced silver particles are in the range of nano size (Wiley *et al.*, 2006 and Laura *et al.*, 2011) [11, 12].

SEM Analysis

SEM provides the morphology and size details of the silver nanoparticles. SEM results showed that the diameters of prepared nanoparticles in the solution have sizes ranges from 89-311nm. The size of the nanoparticles observed was more than the size of nanoparticle which should be i.e.; between 1-100 nm. Spherical to oval shape of nanoparticles were observed by SEM analysis.

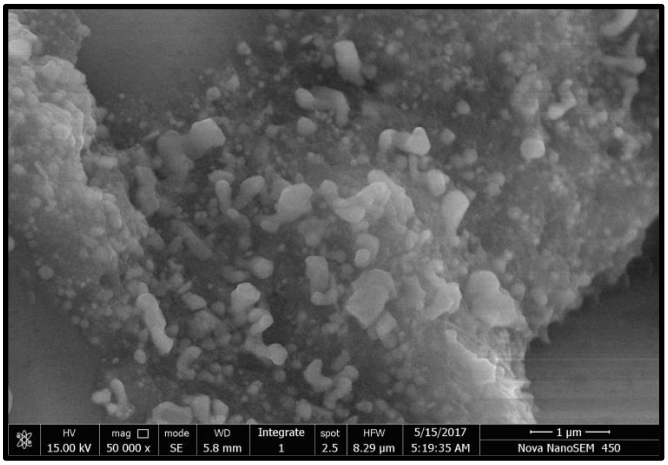

Fig 3: Morphology of Silver Nanoparticles

UV-Vis Spectrophotometer analysis

UV-Vis spectroscopy analysis showed that the absorbance band of synthesized silver nanoparticles using *Murraya koenigii* leaf extract was observed. Similar results were reported by Laura *et al*., 2006 [12], Honary *et al*., 2011 [13] and Vikas *et al*., 2013 [14].

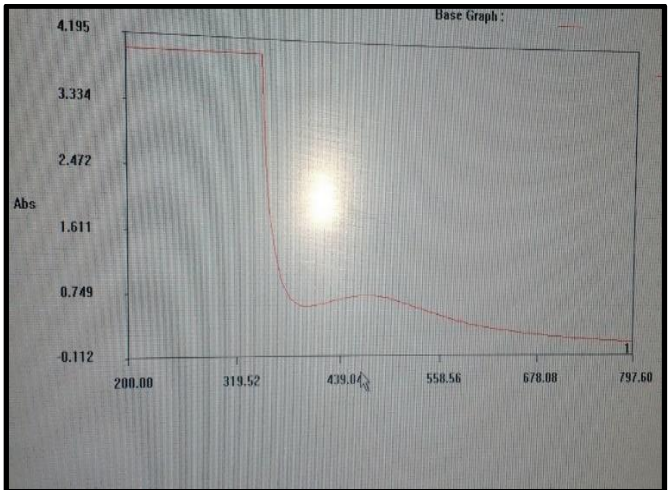

Fig 4: UV-Vis spectrum of Silver Nanoparticles

Conclusion

The present study included the bio reduction of silver ions through *Murraya koengii* plant extract. As the leaf extract of *Murraya koenigii* was mixed to silver nitrate solution it started to change the color from watery to dark yellowish brown due to reduction of silver ions. Color change confirms the synthesis of silver nanoparticles. These environmentally caring silver nanoparticles were further confirmed by using

UV-Vis spectroscopy. Absorption spectra of silver nanoparticles formed has absorbance peak between 440-460 nm. SEM provides the morphology and size details of the silver nanoparticles. SEM results showed that the diameters of prepared nanoparticles in the solution have sizes ranges from 89-311nm.

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