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CHARACTERIZATION OF BIOSYNTHESIZED SILVER NANOPARTICLES USING UV-VISIBLE AND FTIR SPECTROSCOPY

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ABSTRACT: *This study reports the biosynthesis of Chromoleana odorata mediated silver nanoparticles (AgNps) under ambient temperature. The biosynthesized nanoparticle was characterized by UV-visible spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, and scanning electron microscopy. The AgNp solution produced a shade of colours from yellow through brown to dark brown within a period of 10 minutes with a maximum absorbance at 444.50 nm. The FTIR showed strong peaks at 3423.76 cm^{-1} and 1629.90 cm^{-1}, indicating that proteins acted as the capping and stabilization molecules in the biotransformation process of silver AgNps. The scanning electron microscope revealed that the Chromoleana odorata mediated AgNps are slightly spherical.*

KEYWORDS: Chromoleana Odorata, Silver Nanoparticle, UV-Visible, Spectroscopy, FTIR

INTRODUCTION

Recently, many researcher's attention has been drawn to the green synthesis route of producing nanoparticle because of the simplicity of the process, low cost and its eco-friendliness (W.M Salem *et al*., 2014). This has given rise to the use of diverse biological substances including agro-wastes, plant extracts, algae, bacteria, fungi among others as capping and stabilization molecules for green synthesis of nanoparticles (Philip, 2010; Sreelakshmi *et a*l., 2011; Shivaji, *et al*, 2011; Rajeshkumar *et al*., 2014; Sarsar *et al*., 2015., Lateef *et a*l.,2015; Dhand *et al*., 2016; Gogoi *et a*l., 2014, Anwar *et al*., 2015., Nayak *et al*., 2016; Dare *et al*., 2015; Logeswari *et al*., 2015). Green synthesized nanoparticles have wide application in many fields of study including biomedical, agriculture, material engineering, environmental sciences among others (Lateef *et al*., 2016).

Chromoleana odorata is a weed with a native range in the Americas but is found widely in the tropical and subtropical region of the world from west, central and southern Africa to India, Bangladesh, Taiwan, Thailand etc. The weed is notorious for its ability to grow rapidly affecting agriculture, pasture and biodiversity due to suppress neighboring vegetations (Vaisakh and Pandey, 2011).

Traditionally, the weed has many medicinal uses ranging from wound healing to treatment of skin infections. It is also used as an anti-inflammatory, anti-hypertensive, anti-diarrheal, astringent, antipyretic, anti-spasmodic, diuretic and heart tonic (Vital *et al*., 2009; Suksamrarn *et al*., 2004). It has been scientifically shown that the leaf extract of *C. odorata* has antimicrobial, antioxidant, analgesic, anti-inflammatory properties (Suksamrarn *et al*., 2004;

Ling *et al*., 2007; Bhargava *et al*.,2013). *C. odorata* plant is rich in phytochemicals that account for its many medicinal uses (Afolabi *et al*., 2007).

Silver nanoparticle is known for its size and shape dependent properties giving rise to its antimicrobial applications, incorporation into coating materials, usability in biosensor materials, electronic components, composite fibres, etc. (A.S Khanna, 2008).

This study reports the UV-visible spectroscopy, FTIR spectroscopy and SEM characterization of *C. odorata* mediated silver nanoparticle.

MATERIALS AND METHODS

Sample Collection

C. odorata leaves were collected at Oduduwa university, Ipetumodu, premises and identified at the Department of Botany, Obafemi Awolowo University, Ile-Ife, State of Osun, Nigeria. The leaves were cleansed with running tap water, and dried under shade at room temperature for 7 days. The dried leaves were grounded into powder with an electric blender.

Preparation of C. odorata Extract

C. odorata extract was obtained as described by Lateef *et al*., 2016. 0.1 g of the powder was weighed and suspended in 10 ml of distilled water, and heated in a water bath at 60 ℃ for 1 hour. The extract was filtered with Whatman No. 1 filter paper and centrifuged at 4000 rpm for 20 minutes. The supernatant was collected and stored at 4 ℃ for further use.

Green Synthesis of C. odorata Mediated AgNp and Characterization

The procedure previously described by Lateef *et al*., 2016 was used in synthesizing *C. odorata* AgNps. 1 ml of the extract was added to 40 ml of 1 mM silver nitrate at room temperature (30 $\pm$ 2 ℃) and the reaction mixture was allowed to stand for few minutes. Changes in the colour of the reaction mixture was visually observed and followed by the measurement of its absorbance spectrum using UV-Visible spectrophotometer operated at the range of 350-750 nm. The synthesized C. odorata leave extract was subjected to FTIR spectroscopy analysis IRAffinity-IS spectrometer to identify the functional groups of the biomolecules that partook in the biosynthesis. Scanning electron microscopy (SEM) was carried out on the biosynthesized AgNPs to determine its morphology.

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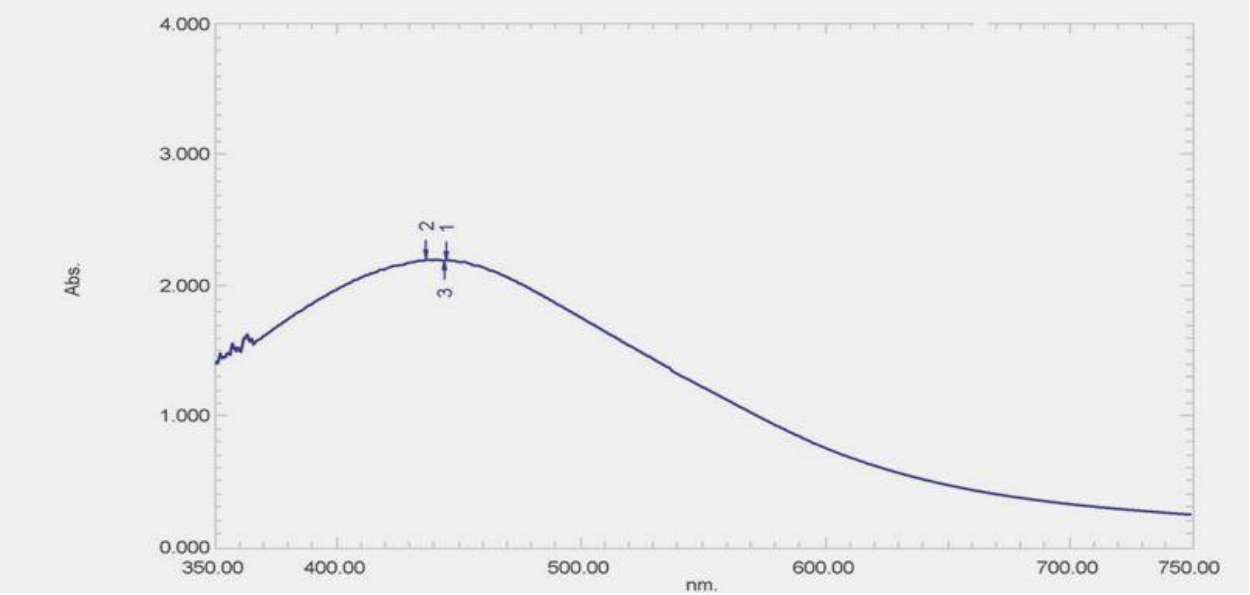

Fig. 1: The UV Spectrum of Biosynthesized *C. odorata* AgNps

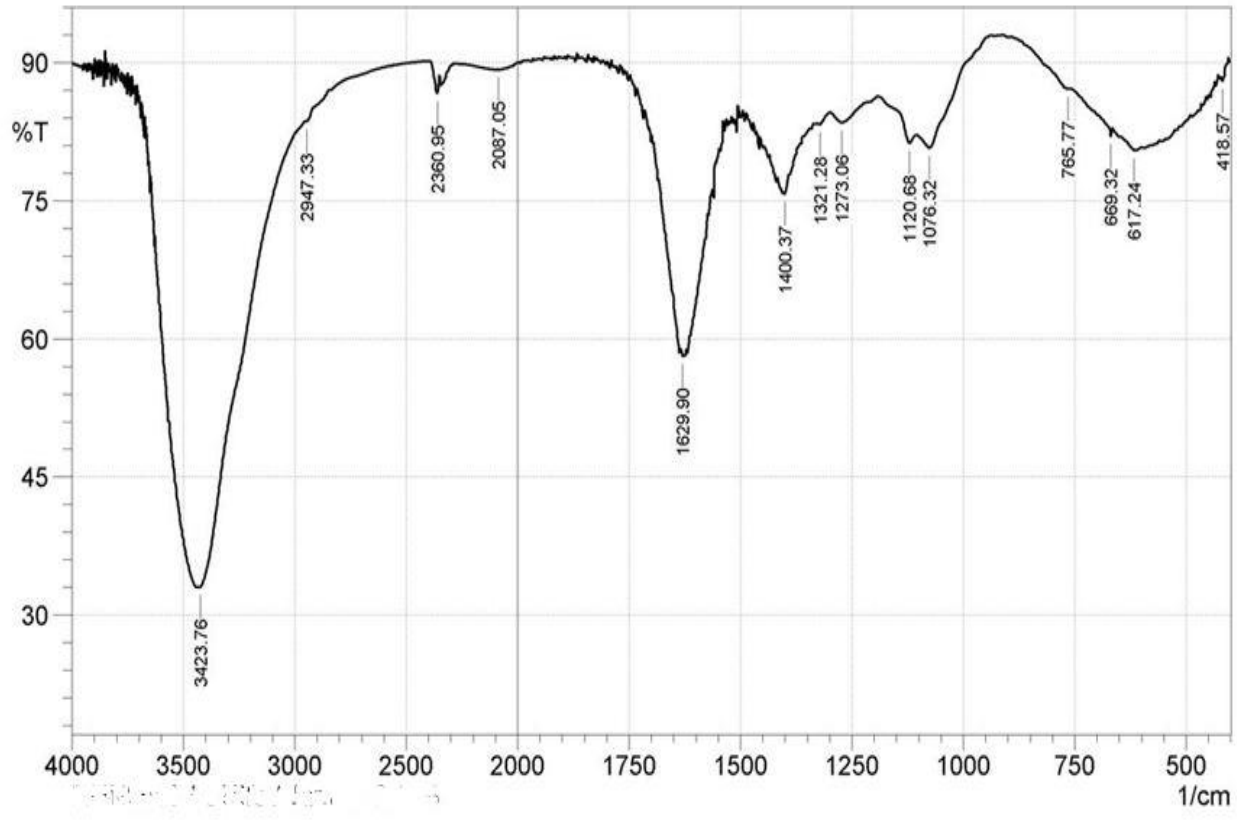

Fig. 2: FTIR Spectrum of Biosynthesized *C. odorata* AgNps

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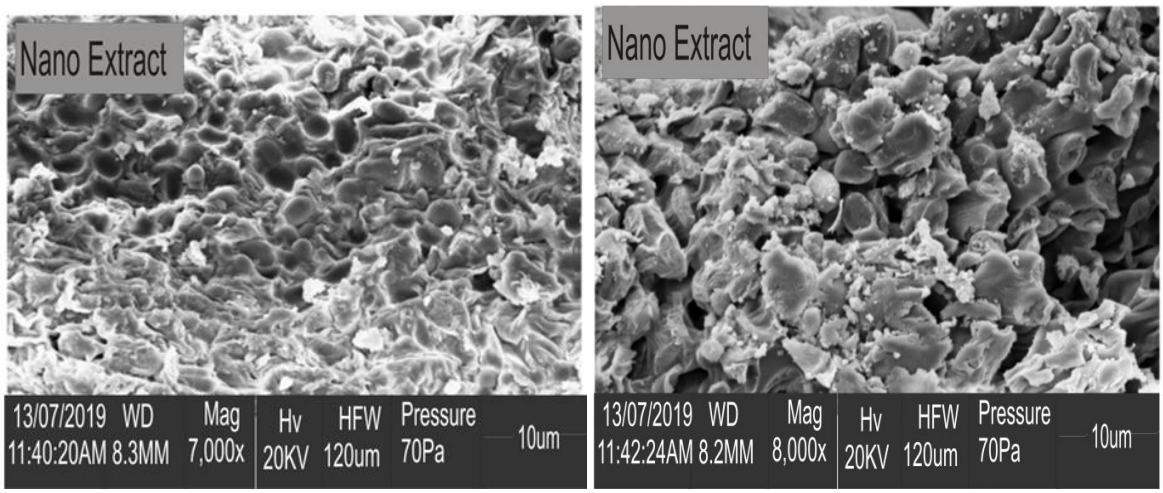

Fig. 3: SEM of Biosynthesized AgNps at Different Magnification

RESULTS AND DISCUSSION

Green Synthesis of C. odorata AgNPs

C. odorata mediated the formation of AgNps within a period of 10 min, with the development of dark brown color. Several authors have reported the formation of colloidal green-synthesized AgNp solutions showing shades of color from yellowish through brown to dark brown (Lateef *et al*, 2015a; Lateef *et al*, 2015b; Lateef *et al*, 2015c) indicating the presence of different biomolecules in the extract that acted as catalyst and stabilizing agent in the formation of the AgNps. C. odorata mediated AgNps showed a maximum absorbance reading at wavelength of 444.50 nm (Fig 1). This value obtained is in agreement with that reported by Singh *et a*l, 2015.

The FTIR spectrum for *C. odorata* mediated AgNps showed strong peaks at 3423.76 cm^{-1} and 1629.90 cm^{-1} (Fig 2). The band 3423 and 1629.90 are indicative of N-H bond of amine and C=C stretch of alkenes or C=O stretch of amides respectively (Huang *et al*, 2007) suggesting that proteins and phenolic compounds played the role of capping and stabilization molecules in the biosynthesis of *C. odorata* AgNps. Previous studies (Phan *et al*, 2001; Afolabi *et al*, 2007) have shown *C. odorata* to be rich phenolic compounds.

The Scanning electron microscope revealed the formation of high-density, slightly spherical AgNps mediated by *C. odorata* leave extract and further confirm the presence of AgNps.

Further studies are necessary to evaluate the antioxidant and antibacterial activities of *C. odorata* mediated AgNps in order to demonstrate its usefulness.

CONCLUSION

This study has shown the biosynthesis of AgNps mediated by *C. odorata* leave extract by a simple biological process. This can enhance the already established medicinal properties of C. odorata leave extract or possibly induce new ones but further studies are necessary to establish this.

Conflict of Interest: The Authors declare no conflict of interests.

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