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Anti-inflammatory activity of cinnamon oil mediated silver nanoparticles -An *in vitro* study

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ABSTRACT

Cinnamon is one of the main spice which is not only used for cooking but also for medicinal purpose. Recently, plant-based silver nanoparticles are explored in various research areas. In this study, Silver nanoparticles were prepared with cinnamon oil using 1mM silver nitrate solution, and its formation was confirmed by using UV -Vis spectroscopy. The prepared cinnamon oil mediated silver nanoparticles were further evaluated for its anti-inflammatory property. It is done using a technique by Inhibition of albumin denaturation assay, and the result was compared with standard diclofenac sodium. It was found that there was a dose-dependent inhibitory effect on inflammatory activity and at 100uL, the cinnamon oil mediated silver has showed almost equal activity of diclofenac sodium, the standard used in the study. Silver nanoparticles synthesised using cinnamon oil exhibited potent anti-inflammatory activity, and hence, it may be used for its anti-inflammatory activity.

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INTRODUCTION

Nanotechnology is a fast developing branch which deals with the dimensions and tolerances of the particles which sizes are ranging from 1-100 nanometer. Nanotechnology is producing great development in various fields (Dubey *et al.*, 2009). Nanotechnology is introduced into medicine to increase the standards of therapeutic drug design and to advance diagnostic cancer imaging (Menon *et al.*, 2018; Rajeshkumar and Bharath, 2017). Silver nanoparticles was composed of a large proportion of silver oxide because of their large magnitude relation of surface-to-bulk silver atoms. It can be made in numerous shapes. Spherical silver nanoparticles are commonly used, but other shapes like thin sheets, octagonal, diamond are also popular (Rajeshkumar and Naik, 2018; Santhoshkumar *et al.*, 2017).

Silver nanoparticles are used as a carrier for delivering payloads from small drug molecules to large biomolecules to a particular specific targets (Rajeshkumar, 2016). Once the silver nanoparticles reached its specific target, the release of its payload is probably stimulated by an external or internal stimulant (Agarwal *et al.*, 2017). The accumulation and specification of AgNP's could give large amounts of payload at targeted sites and will minimise side effects. Till now, metallic nanoparticles are mostly prepared by using noble metals (Noginov *et al.*, 2007). Among all noble metals, silver (Ag) is the best choice to use in the field of biological systems, living organisms and medication (Geethika *et al.*, 2018). The investigation on silver nanoparticles has also gained importance due to

their use in the field of Opta Electronics and their antimicrobial activity (Haripriya and Ajitha, 2017). The products containing silver has proved useful to minimise bacteria colonisation on vascular grafts, human skin, dental materials, stainless steel materials, textile fabrics and prosthesis due to its antibacterial activity. (Seethalakshmi *et al.*, 2015).

Inflammation is the local response of living tissues to injury due to any agent. It acts as a body's defence mechanism. This is characterised by pain, swelling, heat, redness and loss of function. The Anti-inflammatory activity of a plant extract can be found using silver nanoparticles by coating the plant extract above the silver nanoparticles (Baharara *et al.*, 2017)

Cinnamon is an Indian spice which is obtained from the inner bark of Cinnamomum tree. It is used in a wide variety of cuisines, breakfast cereals, mainly as an aromatic condiment and flavouring additive in a many dishes and traditional foods. The aroma and flavour of cinnamon is derived from its essential oil, and the principal component present in it called cinnamaldehyde, it also contains eugenol (Jakhetia *et al.*, 2010; Vangalapati *et al.*, 2012). Cinnamon oil boosts up brain function by improving brain circulation. Then other uses like Antioxidant, Respiratory Problems, Heart Diseases, Diabetes. It is used as a mouth freshener as well (Tung *et al.*, 2008).

MATERIALS AND METHODS

Preparation of Silver Nanoparticle using Cinnamon oil

1mL of the cinnamon oil was dissolved in 9 mL of distilled water and kept in a beaker. To this, 90 mL of 1mM Silver nitrate in distilled water was added and mixed and kept in boiling water bath for 30-60 minutes. A magnetic stirrer was used for the nanoparticle synthesis. The colour change was observed and recorded periodically.

UV Spectrometric analysis of synthesised nanoparticles

The synthesised nanoparticles solution was preliminarily confirmed d by using UV- Visible spectroscopy. 3mL of the solution was taken in a cuvette and scanned in double beam UV Visible spectrometer from 300nm – 550nm wavelength. The results were recorded for the graphical analysis.

Inhibition of albumin denaturation assay

The anti-inflammatory activities of nanoparticles were done based on our previous studies (Jain *et al.*, 2019).

The % Inhibition was calculated using the following formula,

$$\% \ Inhibition = \frac{Control\ O.D - Sample\ O.D}{Control\ O.D}$$

RESULTS AND DISCUSSION

Visual observation

The silver nanoparticles exhibit a silvery-white colour in aqueous solution due to excitation of the surface Plasmon vibrations in silver nanoparticles. The appearance of a brown coloured pigment confirms the existence of silver nanoparticles in the solution (Figure 1).

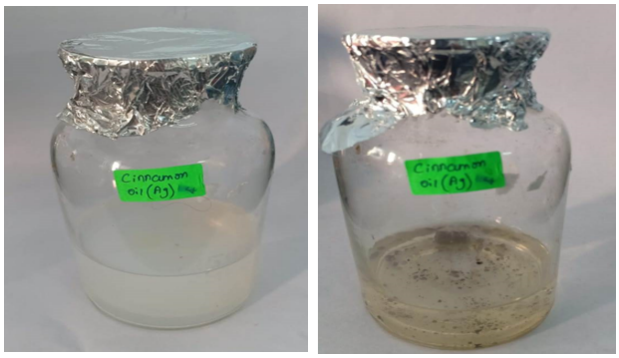

Figure 1: Colour change indicating the presence of silver nanoparticles

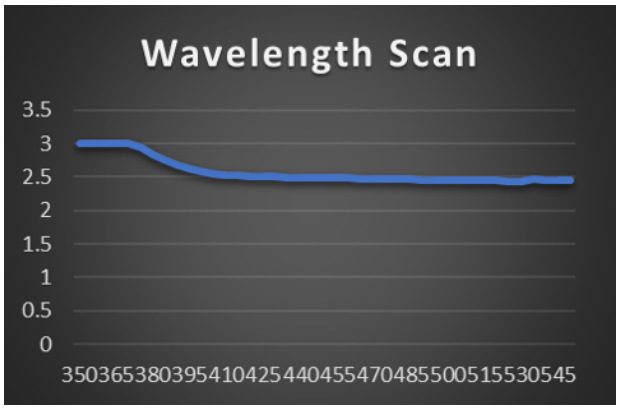

Figure 2: UV-Vis Spectroscopy

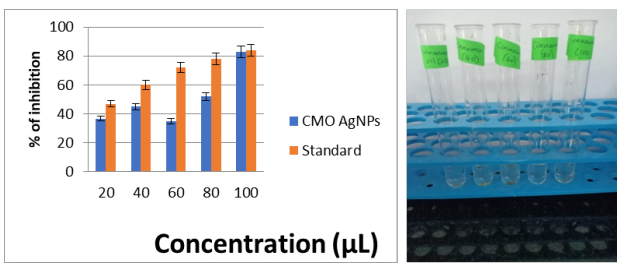

Figure 3: Anti- inflammatory activity at different concentrations

UV-Vis Spectroscopic study

The cinnamon oil silver nanoparticles were characterised using UV-vis spectroscopy which is the

widely used techniques for the structural characterisation of the silver nanoparticles. The intensity of the silver nanoparticles reached its absorption peak at 370 nm as shown in the (Figure 2).

Anti-inflammatory activity

The cinnamon oil mediated silver nanoparticles were showing a dose-dependent anti-inflammatory activity in this study. When compared with the standard diclofenac sodium, the cinnamon oil mediated silver nanoparticles gave almost equal anti-inflammatory activity at 100μL (Figure 3). Many plants are used for the synthesis of nanoparticles. Cinnamon oil is known for its medicinal properties and being a natural product. It may be beneficial to use it instead of synthetic agents to control inflammation.

CONCLUSION

In this study, a simple, biological and low-cost approach was done for the preparation of silver nanoparticles using cinnamon oil and was shown to have good anti-inflammatory property. Hence, it may be used for the management of inflammatory conditions.

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