

Green Synthesis of Selenium Nanoparticles Study Using Clove and Cumin and Its Anti-Inflammatory Activity

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ABSTRACT

Background: Nanotechnology explores a lot of interesting approaches in the field of biomedicine. Researchers have recently developed interest in biomolecule mediated nanoparticle production because of its eco-friendly and non-toxic properties. Clove and cumin have long been used in traditional medicine to treat various illnesses.

Aim: The purpose of this study is to use clove and cumin extract to produce the selenium nanoparticles via green approach.

Materials And Method: Collection of clove and cumin extract then 1 g of clove and cumin, powder was dissolved in distilled water and boiled for 5-10 min at 60-70C. The solutions were then filtered using Whatman No. 1 filter paper. The filtered extract was collected, synthesis of selenium nanoparticles using an herbal formulation, and to finalise the anti-inflammatory activity of silver nanoparticles.

Results: It is one of the most effective methods in synthesis of selenium nanoparticles utilising green sources such as clove and cumin as antiinflammatory agents. The benefits are that they are nontoxic materials, requiring relatively less complicated and affordable equipment, biodegradable material processing, improved selectivity, and high yields.

Conclusion: The findings of this study imply that selenium nanoparticles mediated by clove and cumin can be employed in biomedical applications in the future.

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INTRODUCTION

Syzygium aromaticum is also known as clove and it belongs to the family Myrtaceae. Clove is one of the most expensive spices and has been used for centuries as a food preservative and for a variety of therapeutic uses (Tiwari and Dubey, 2022). The clove tree is native to Indonesia, although it has been grown in a number of countries with particularly warm climates, including Mexico, Sri Lanka, and Kenya. This plant represents one of the excellent sources of phenolic chemicals including eugenol, eugenol acetate, and gallic acid, which has a lot of potential in the pharmaceutical, cosmetic, food, and agricultural industries. Clove has higher antioxidant and antibacterial activity than many fruits, vegetables, and other spices, hence it deserves special attention.

KEYWORDS:

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Cumin is a spice which is widely used all over the world. Cumin's scientific name is cumin cyminum. It is a dried seed and it is a member of the Apiaceae family. The cumin plant grows to 30-50 cm tall. It is primarily grown in India, China, Saudi Arabia, and the Mediterranean Sea-adjacent countries. Cumin seeds are broadly utilised as culinary spices and aromatic herbs. It is one of India's most popular condiment spices, and it's also frequently used in Ayurvedic medicine to cure dyspepsia and jaundice.

Nanotechnology is the way of forming nanomaterials with ideal properties and a nanometer-scale size. In comparison to bulk materials, nanoparticles have a huge surface area. Bioinspired nanoparticle development is a rapidly growing field in modern technology. Nanomaterials are natural or manmade materials that include particles in their free state or as aggregates, with 50% or more of the particles in terms of quantity, size, distribution, or one or more external dimensions size ranges from 1-100 nm.

Inflammation is a mechanism of response to injury which includes the deposition of cells and secretions in injured tissues to protect against further damage. Celsius identified the four main signs of inflammation (rubor, calor, dolor, and tumour, or redness, heat, pain, and swelling) and utilised willow leaf preparations to treat them in AD 30. Natural products with anti-inflammatory activity have long been regarded as a folk cure for inflammatory conditions like fevers, pain, migraines, and arthritis.

MATERIALS AND METHODS:

Preparation Of Plant Extract

clove and cumin was collected and ground into a fine powder. From that, finely ground 1 g of clove and 1 g of cumin was taken and dissolved in distilled water and boiled for 5-10 min at 60-70°C. The solutions were then filtered using Whatman No. 1 filter paper. The filtered extract was obtained and store for further use

Synthesis of Selenium Nanoparticles

30 mM of selenium nanoparticle dissolved in 50 mL of distilled

water. To that, 50 mL of clove and cumin extract was slowly added. Then the reaction mixture was kept on a magnetic stirrer at 650-700 rpm for 48-72 hours. The collected selenium nanoparticle were kept for centrifugation at 8000 rpm for 10 min. The pellet obtained dried at 70°C in hot air oven for 12 h. The dried pellet was grinded using mortar and pestle and the powder was stored for further use.

Anti-inflammatory activity

Albumin Denaturation Assay:"

The following convention, as modified by Muzushima and Kabayashi, was used to investigate the anti-inflammatory activity of clove and cumin using selenium nanoparticles (Pratik Das et al.,2019). Bovine serum albumin (1% aqueous solution) and 0.05 mL of clove and cumin with selenium nanoparticles of varied fixation (10, 20, 30, 40, and 50 mL) were combined, and the pH of the mixture was adjusted to 6.3 using a little amount of 1N hydrochloric acid. These samples were heated to 55 °C in a water bath for 30 minutes after being incubated at room temperature for 20 min. After cooling the samples, the absorbance at 660 nm was calculated spectrophotometrically. The benchmark was diclofenac sodium. Control is provided by DMSO.

Percentage of protein denaturation was determined utilising following equation,

$$\% \text{ inhibition} = \frac{\text{Absorbance of control} - \text{Absorbance of sample}}{\text{Absorbance of control}} \times 100$$

Egg Albumin Denaturation Assay

A 5ml solution was created using 2.8ml of freshly manufactured, pH-6.3 phosphate buffered saline and 0.2ml of hen's egg albumin extraction. Separate preparations of specific concentrations of selenium nanoparticles (10 L, 20 L, 30 L, 40 L, and 50 L) were made for the spices clove and cumin. Diclofenac sodium served as the experimental drug. The mixes were then cooked for 15 minutes at 37°C in a water bath. The samples were then allowed to cool to ambient temperature, and absorbance at 660 nm was measured.

RESULT AND DISCUSSION



Figure 1: Clove and cumin powder weighed

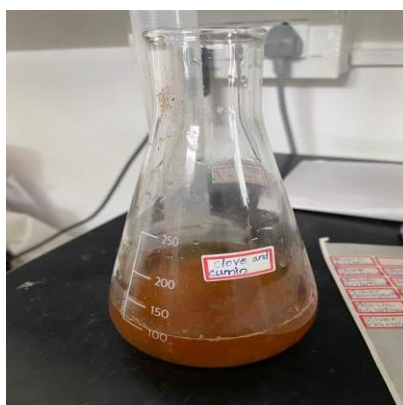


Figure 2: Clove and cumin powder Mixed with 100ml distilled water

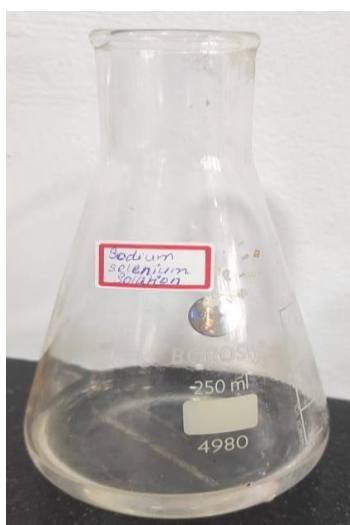


Figure 3: Sodium selenate solution

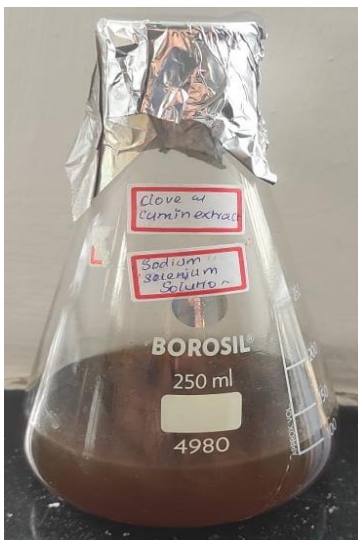


Figure 4: Selenium nanoparticles



Figure 5: Pellet of Selenium nanoparticles

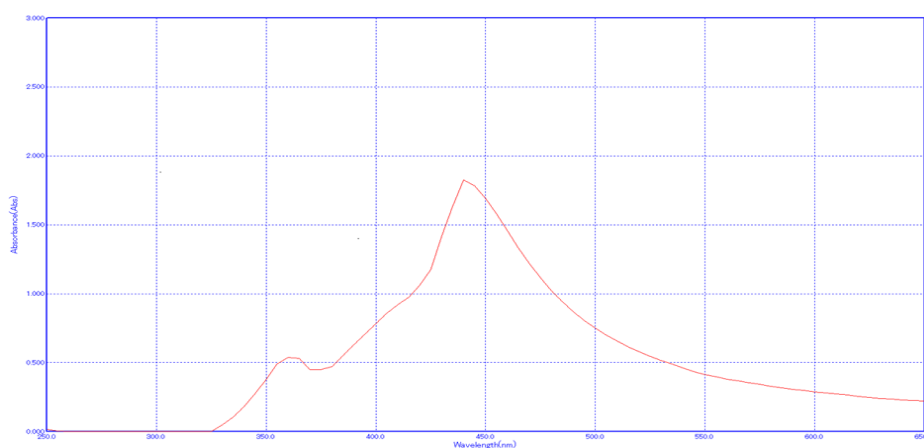


Figure 6: UV- Spectroscopy representation of Selenium nanoparticles

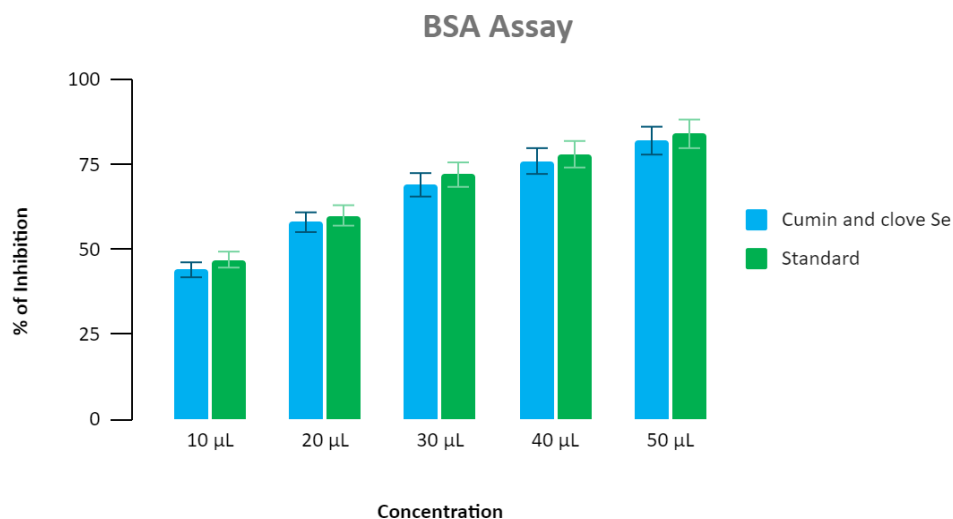


Figure 7: Bovine serum albumin assay graphical representation

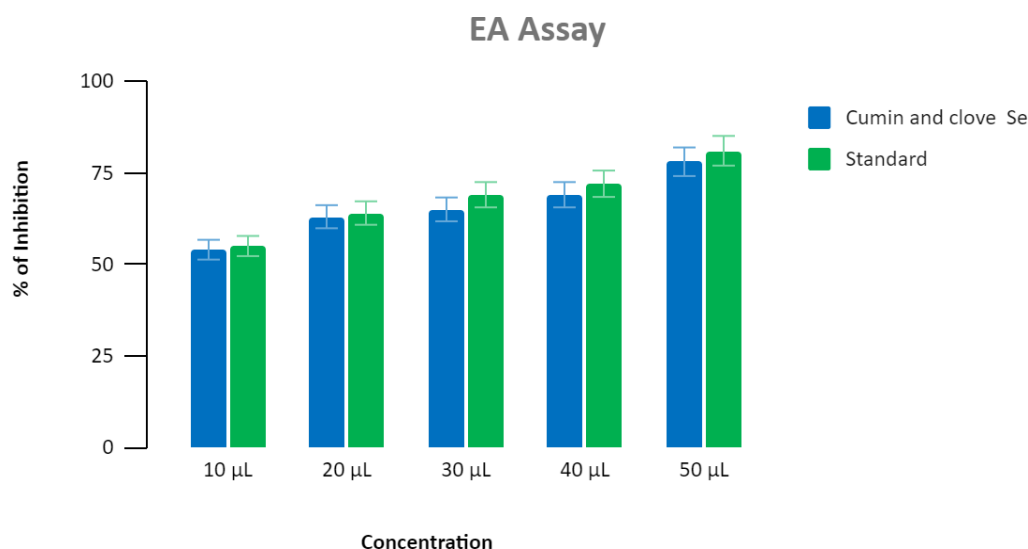


Figure 8: Egg albumin denaturation assay graphical representation

DISCUSSION

The results of this study show that the combination of clove and cumin extract with selenium nanoparticles had a better percentage of inhibition by both albumin denaturation assay and egg albumin denaturation assays analysis. Spectrophotometry analysis of antioxidant assay revealed that 50 µL of the herbal formulation with silver nanoparticles had the highest absorption percentage of about 93.15%, whereas the anti-inflammatory assay revealed that 50 µL has absorption percentage of about 92.9% when compared to the reference standard (Amoxicillin). In previous research work Morinda Citrifolia Leaf Mediated Selenium Nanoparticles shows the size of generated SeNPs in Morinda citrifolia was anticipated to be 12-160 nm based on TEM images. The antioxidant activity of selenium NPs was discovered to be 66.7 to 83.7% of free radical

inhibition. One article showed that the

CONCLUSION

It can thus be concluded that clove-cinnamon mediated selenium nanoparticles have the ability to be used as an effective antibiotic. This formulation needs to be further purified to isolate the component in the extract that makes it effective to be used in large scale production for targeted drug delivery against a wide array of microbial infections.

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Conflict of interest-NA

Informed Consent- None declared

Authorship contribution

JV compiled the manuscript RKS conducted the study TL designed the study SG Performed Proof reading of the Manuscript

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