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RESEARCH ARTICLE
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Antidiabetic activity of selenium nanoparticle synthesized using clove and cumin formulation

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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. Clova 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- diabetic activity of silver nanoparticles.

Results: The antioxidant effect of selenium nanoparticles showed a higher percentage of inhibition at 50µg/ml in DPPH Assay and H2O2 Assay. The clove and cumin extract showed an increased percentage of inhibition with increasing concentration.

Conclusion: The clove and cumin formulation mediated selenium nanoparticles acts as potent antioxidant agents. It also has the least side effects compared to commercial drugs.

Keywords: *clove, cumin, anti diabetic, selenium synthesis, nanoparticles*

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 (1).

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.(2)

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 (3). It is primarily grown in India, China, Saudi Arabia, and the Mediterranean Sea-adjacent countries. Cumin seeds are broadly utilized 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.(4)

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 (5). 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. (6)

Inflammation is a mechanism of response to injury which includes the deposition of cells and secretions in injured tissues to protect against further damage (7). 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,

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 formulations were then filtered using Whatman No. 1 filter paper. The filtered extract was obtained and stored for further use.

Synthesis of Selenium Nanoparticles

30 mM of selenium nanoparticles 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.

Purification And Characterization Of Np Using Tem &Ft-Ir

The collected selenium nanoparticles solution was kept for centrifugation at 8000 rpm for 10 min. The pellet was dried at 70°C in a hot air oven for 12h. The dried pellet was grinded using mortar and pestle and the powder was stored for further use.

In-vitro antidiabetic assay

The in-vitro anti-diabetic assay was performed using two different techniques: Alpha-amylase inhibitory assay and Alpha-Glucosidase Enzyme Inhibition assay.

Alpha-amylase inhibitory assay

Alpha-amylase inhibition was determined by quantifying the amount of maltose liberated during the experiment. The method reported by Happy has been followed Happy et al., 2018). Different concentrations of nanoparticles (10, 20, 30, 40, 50 µL) was pre-incubated with 100 µL of α-amylase solution (1 U/mL) at room temperature for 30 minutes. 100 µL of starch solution (1% w/v) was further added to it and the mixture was incubated at room temperature for 10 minutes. 100 µL of 96 mM (3, 5-dinitrosalicylic acid solution) DNSA reagent was added to it to stop the reaction and the solution was heated in a water bath for 5 minutes. Control was maintained where the equal quantity of enzyme extract was replaced by sodium phosphate buffer maintained at a pH value of 6.9. Reading was measured at 540 nm. The

experiment was performed in triplicate. Acarbose was used as a positive control.

% inhibition was calculated using the formulae-

Where, C= control, T= test sample.

Evaluation of the Alpha-Glucosidase Enzyme Inhibition

The AgNP solutions at concentrations of 10,20,30,40,50 µg/ml were mixed with starch substrate solution (2% w/v maltose or sucrose) in the presence of 0.2 M Tris buffer at pH 8.0 and incubated for 5 min at 37° C. Subsequently, 1 ml of the alpha-glucosidase enzyme (1 U/ml) was added and incubated at 35° C for 40 min. The reaction was terminated with the addition of 2 ml of 6 N HCl. acarbose was used as a standard control. The colour intensity was measured at 540 nm using an ELISA reader, and alpha-glucosidase enzyme inhibition (I%) was calculated using the formula below: I% = 100 − As − Ab Ac − Ab × 100, ð3Þ where I% is the inhibition percentage and As, Ab, and Ac are the average absorbance of the sample (AgNPs), blank, and control (acarbose), respectively.

RESULT AND DISCUSSION

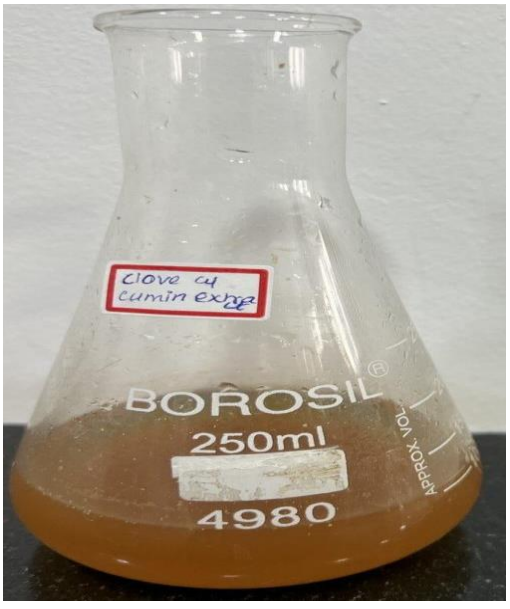


FIGURE 1: plant preparation

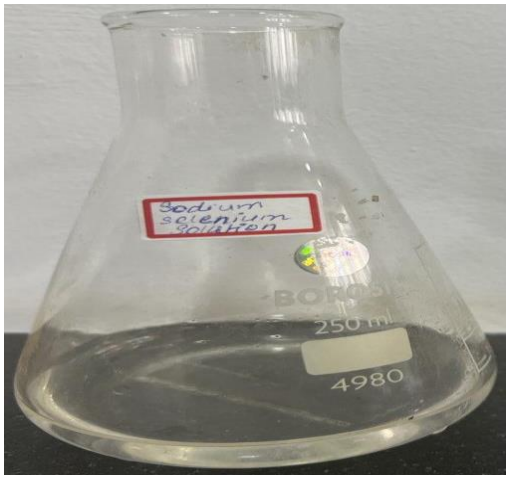


FIGURE 2: Nanoparticles preparation

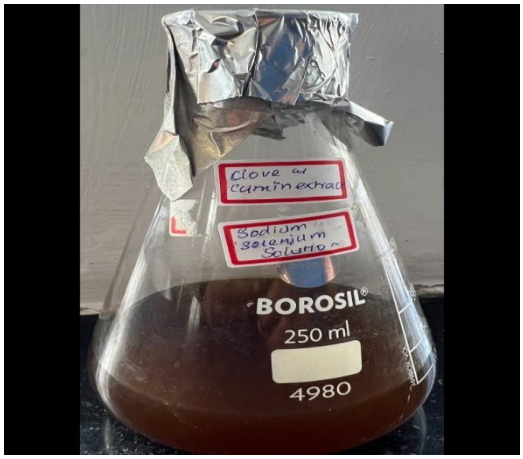
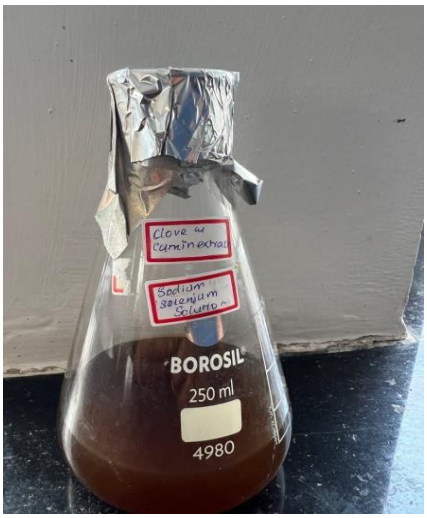


FIGURE 3: Clove and cumin extract with selenium solution



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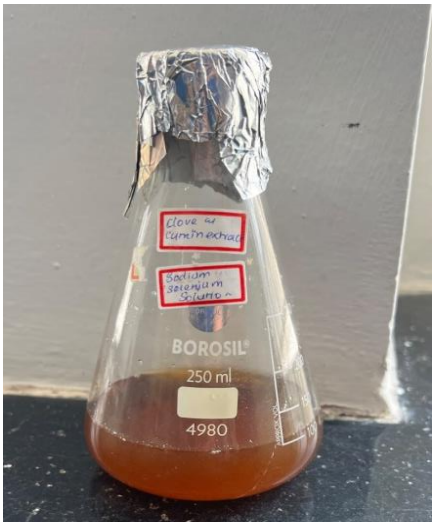

FIGURE 4: Visible Observation of Nanoparticles

The clove and cumin mediated selenium nanoparticle undergoes visible observation which is used to observe the color change which was brown color on the first day and it changes to light brown color.

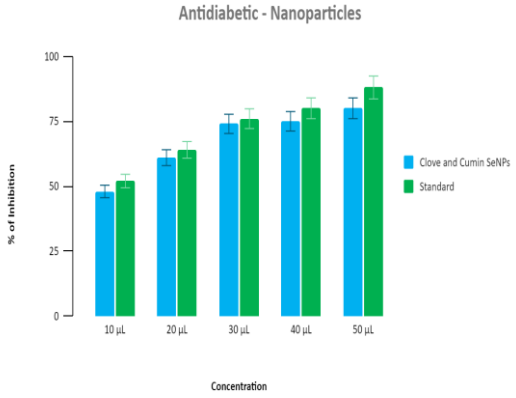

FIGURE 5 : Antidiabetic activity of selenium nanoparticles

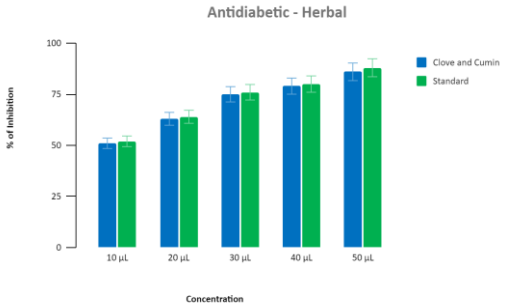

FIGURE 6: Antidiabetic activity of herbal formulation

DISCUSSION

Spices have historically been used to make nutraceuticals or functional foods because of their health-promoting qualities, and recent scientific research has focused a lot on medicinal spices. With an 8.8% market share, India is third in the world for spices. Nanotechnology is expanding the variety of theranostics options by acting as a contrast agent for magnetic resonance imaging (MRI), hyperthermia, and targeted drug delivery (8) . In a similar vein, the enhanced photoelectric effect of radioactive isotopes of elements with greater atomic numbers is enabling new discoveries in the treatment of tumors. Light elements like O, N, H, and C could intensify the energy deposition and radiolytic hydrolysis in and around the material because they interact with X-rays more powerfully than the element does .Ever since antiquity,(9)

The clove and cumin paired with selenium nanoparticles in these tests is represented in Figure 4 by a color change that occurs every time. After five days, the solution's brown hue turns light crimson.Colour change was used to determine the UV spectroscopic reading.(10)

The DPPH anti diabetic experiment was used to investigate the antioxidant activity of clove and cumin mediated selenium nanoparticles (Figure 5). Even though the extract's antioxidant activity is lower than that of ascorbic acid, it did exhibit a dose-dependent rise (11). Free radicals are compounds with unpaired electrons. The best elements for removing free radicals, which can lead to oxidative stress and may operate as protective measures to shield cells from reactive oxygen species, are antioxidants.Along with lipid peroxidation, they halt the progression of numerous diseases. They also have anti-inflammatory, antiviral, and anti-cancer properties(20). Inhibition at 50 ul/ml of the selenium-mediated clove and cumin extract is greater than 75%. This study illustrates the potential health benefits.(12)

The findings of this study demonstrate that the combination of clove and cumin extract with selenium nanoparticles had a superior percentage of inhibition by both albumin denaturation assay and egg albumin denaturation assays analysis. Spectrophotometry analysis of the antioxidant

assay revealed that 50 L of the herbal formulation containing silver nanoparticles had the highest absorption percentage of approximately 93.15%, whereas the anti-inflammatory assay revealed that 50 L has an absorption percentage of approximately 92.9% when compared to the reference standard (Amoxicillin) (13-21).

CONCLUSION

The clove and cumin formulation mediated selenium nanoparticles acts as potent antioxidant agents. Even Though the extract showed dose-dependent increase in the antioxidant activity although its activity is less compared to the standard Ascorbic acid, but the extract is natural in origin it can avoid the adverse side effects by the commercial drugs.

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