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Free Radical Scavenging Activity of Clove and Cumin Formulation Mediated Selenium Nanoparticle

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ABSTRACT

Background: Selenium nanoparticles (SeNPs) have the potential to be used for various applications.The green SeNPs (selenium nanoparticles) are formed by simple mixing Withania somnifera (W. somnifera) leaves extract and selenious acid (H2SeO3) solution. Nanoparticles have revolutionized for targeted drug delivery by minimizing the toxicity and side effects that commercially available drugs may have on patients. In this study we have chosen the clove and cumin because it protects from cholesterol, inflammatory damage and it has antioxidant property

Aim: The aim of the study is to analyze the antioxidant activity of clove and cumin formulation mediated selenium nanoparticles.

Materials & Methods: Cumin and Clove were powdered and stored in an air-sealed container. 1g of cumin and clove formulation was mixed with 100 ml of distilled water and boiled for 15 minutes and the formulation was filtered with Whatmann No.1 filter paper. 30mM sodium selenite was prepared in 50 ml of distilled water. 50 ml of sodium selenite solution and 50 ml of clove and cumin formulation was mixed and kept in a rotary shaker for 48 hours. UV spectroscopy reading based on color change was observed.

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.

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INTRODUCTION

Nanoparticles can be used in many different domains and have unique catalytic, optical, magnetic, biological, and physicochemical capabilities, research on them is essential today. Temperature, solvent polarity, precursor concentration, and reduction agent concentration all have a significant impact on these properties(1). On a specific note, chemical and physical methods can be used to produce nanoparticles. In bio-nanotechnology, it is preferable to use sources of synthesis such as microorganisms, enzymes, plants, and plant extracts rather than hazardous chemicals and expensive mechanical devices. Nanoparticles display great applications in the field of medicine for treatments and diagnostics as they are eco-friendly(2).

Selenium is a necessary trace element that has anticancer properties and is crucial for maintaining the body's antioxidant defense system, redox homeostasis, and immunological modulation. It has been claimed that selenium can successfully prevent oxidative damage to the liver, heart, and kidneys(3).

KEYWORDS:
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cumin,
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Due to the small window between the hazardous and functional dosage, selenium's bioavailability and biological activity are significantly constrained(4). In comparison to other selenium species, selenium nanoparticles (SeNPs) have substantially lower toxicity and increased bioactivity and bioavailability. *SeNPs* have received a lot of attention because of their distinctive physicochemical characteristics and wide range of uses(5). *SeNPs* exhibit the nanosize effect, which indicates that smaller nanoparticles exhibit increased activity, similar to other nanomaterials. The application of the selenium nanoparticles as antioxidants, antibacterial, and anticancer agents is also widespread(6).

Since ancient times, medicinal plants have served as the foundation of traditional herbal medicine among rural people all over the world. Clove, or *Syzygium aromaticum*, is an 8–12 m (median) tall tree that is indigenous to the Maluku Islands in eastern Indonesia. For a very long time, this region's economic growth has been influenced by the commerce of *cloves* and the pursuit of this priceless spice(7). While the essential oils and other components of this plant play an important function as a spice, they also contain important antibacterial, antifungal, antioxidant, and anti-diabetic properties(8). A significant source of phenolic chemicals such as flavonoids, hydroxybenzoic acids, hydroxycinamic acids, and hydroxyphenyl propens is the spice clove.The primary bioactive component of *clove* is *eugenol*, which is present in quantities of 9 381.70 to 14 650.00 mg per 100 g of fresh plant material(9).

A member of the *Apiaceae* family, *cuminum cyminum* L. has long been used as a food and medicine throughout Asia, Africa, and Europe. Numerous metabolites, including polyphenols, cuminaldehyde, sabinene, and myrcene, are present in this species. (10)The essential oil, which makes up around 2.5% to 4.5% of the entire fruit, is the main phytochemical of *cumin*. It is without a doubt possible to treat several diseases, including as piles, the common cold, cancer, sleeplessness, disorders of the skin, respiratory tract, kidney, and liver, etc., by regularly consuming their seeds(11).

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.

Antioxidant Activity

1.Dpph Method

Antioxidant Activity

DPPH assay was used to test the antioxidant activity of biogenic synthesized selenium nanoparticles. Diverse concentrations (10µg/ml,20µg/ml,30µg/ml,40µL,50µg/ml) of clove and cumin extract interceded selenium nanoparticle was mixed with 1 ml of 0.1 mM DPPH in methanol and 450 µg/ml of 50 mM Tris HCl buffer (pH 7.4) and incubated for 30 minutes. Later, the reduction in the quantity of DPPH free radicals was observed dependent on the absorbance at 517 nm. Ascorbic acid was used as standard. The percentage of inhibition was determined from the following equation,

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

Hydroxyl Radical Scavenging Assay

All solutions were prepared freshly.1.0mL of the reaction mixture contained 100µg/ml of 28mM of 2-deoxy-2-ribose (dissolved in phosphate buffer,pH 7.4), 500µg/ml solution of various concentrations of the clove and cumin (10µg/ml,20µg/ml,30µg/ml,40µg/ml,50µg/ml) 200µg/ml of 200µg/ml Fecl3 and 1.04mM EDTA (1:1 v/v),100µg/ml H_2O_2(1.0mM) and 100µg/ml ascorbic acid(1.0mM).After an incubation period of 1 hour at 37°C the extent of deoxyribose degradation at about 532nm against the blank solution . Vitamin E was used as a positive control.

RESULT AND DISCUSSION

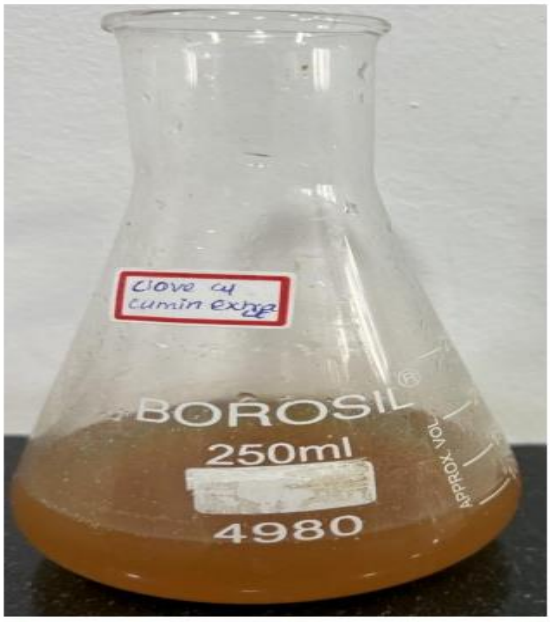

Figure 1: plant preparation

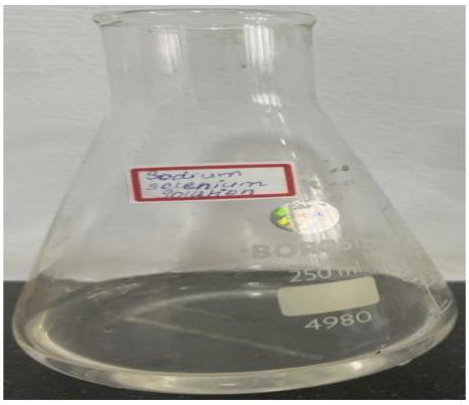

Figure 2: Nanoparticles preparation

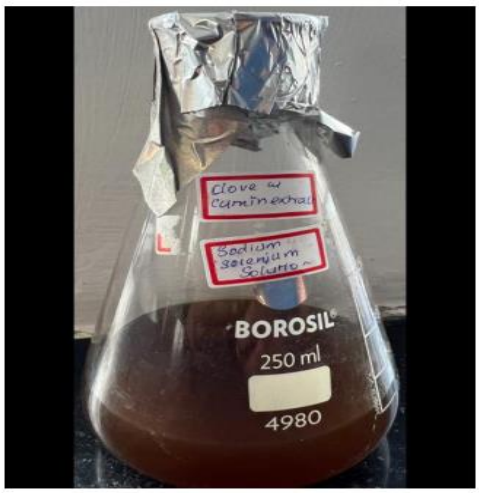

Figure 3: Clove and cumin extract with selenium solution

Figure 4: Visible Observation

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.

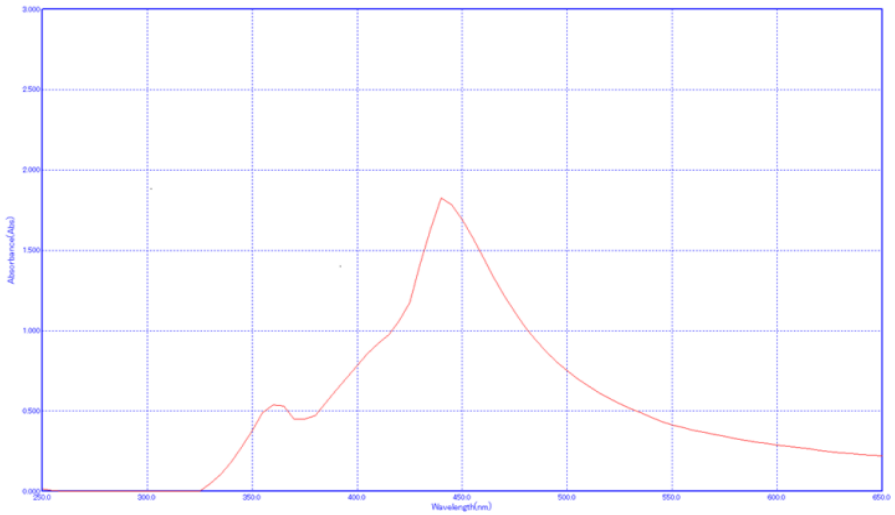

Figure 5: UV- Spectroscopy representation of Selenium nanoparticles

Figure 5 shows the UV-vis spectra for the selenium nanoparticles As evidenced, the suspension of Se nanoparticles produced at different times of reaction exhibited a strong absorption peak. The peak is higher when it is between 430 nm to 440 nm .

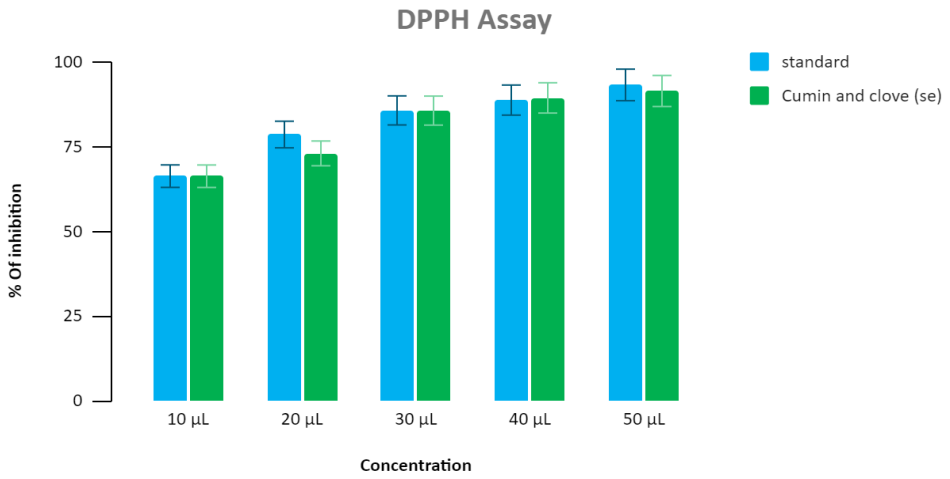

Figure 6: The figure represents the antioxidant potential of clove and cumin formulation mediated selenium *nanoparticles* by DPPH assay

Antioxidant activity was determined by clove and cumin formulation mediated selenium *nanoparticles* performing DPPH free radical scavenging assay (Figure 4). The extract showed dose-dependent increase in the antioxidant activity although its activity is less compared to the standard drug

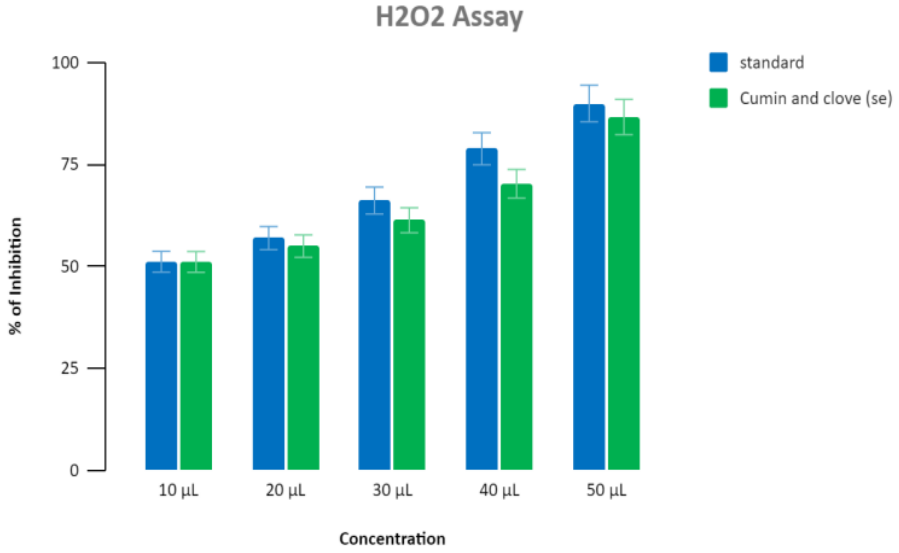

Figure 7: The figure represents the antioxidant potential of clove and cumin formulation mediated selenium nanoparticles by H2O2 assay

Antioxidant activity was determined by clove and cumin formulation mediated selenium *nanoparticles* performing H2O2 free radical scavenging assay (Figure 4). The extract showed dose-dependent increase in the antioxidant activity although its activity is less compared to the standard drug.

DISCUSSION

Due to their health-promoting properties, spices have historically been used to create nutraceuticals or functional meals, and modern scientific study has given medicinal spices a lot of attention. India ranks third in the world's spice market with an 8.8% market share(12). As a contrast agent for magnetic resonance imaging (MRI), hyperthermia, and targeted drug delivery, nanotechnology is opening up a wide range of theranostics possibilities(13). In this vein, radioactive isotopes of higher atomic number elements are also possessing research breakthroughs for the treatment of tumors due to their enhanced photoelectric effect. Since the element interacts with X-rays more intensely than light elements like O, N, H, and C, those substances could increase the energy deposition and

radiolytic hydrolysis in and around the material(14).Since ancient times, medicinal plants have served as the foundation of traditional herbal medicine among rural people all over the world(15). Ancient traditional medical systems like Ayurveda, Chinese, and Egyptian all made extensive use of natural products. According to estimates, 40% of the world's population relies solely on plant-based medicines for their medical needs(16). Clove and Cumin is regularly used in traditional medicine to cure a number of disorders in addition to being widely used as a spice because of its distinctive aroma. Due in great part to its bioactive components, such as terpenes, phenols, and flavonoids, cumin oil has therapeutic effects on diseases like chronic diarrhea, acute gastritis, diabetes, and cancer(17).

In these studies Figure 4 represents the clove and cumin combined with selenium nanoparticles is always accompanied by the color change. The brown color solution changes into light red after 5 days.UV spectroscopy reading based on color change was observed(18).

Antioxidant activity of clove and cumin mediated selenium nanoparticles was determined by performing DPPH free radical scavenging assay (Figure 5). The extract showed dose-dependent increase in the antioxidant activity although its activity is less compared to the standard Ascorbic acid. Free radicals are molecules possessing unpaired electrons(19). Antioxidants are the most effective ingredients to eliminate free radicals which can create oxidative stress and are possible protective tools that protect the cells from reactive oxygen species.They stop the development of many diseases as well as lipid peroxidation. Additionally, they also possess anti-inflammatory, anti-viral and anti-cancer properties(20). The extract of clove and cumin mediated selenium exhibited a significant antioxidant potential where 50 ul/ml has more than 75% of inhibition. In this study it shows the potential health benefits of the extracts in prevention and scavenging of free radicals(15).

Free radicals are electrically charged molecules, and a disproportionate generation of these free radicals is linked to many human diseases like cell damage, allergies, and inflammatory and viral disease(21). Reactive oxygen species (ROS) along with hydroxyl radicals cause damage to the structure and function of cells, oxidation of lipids, proteins, and DNA; leads to the development of various diseases(22).Antioxidant activity of clove and cumin mediated selenium nanoparticles determined by performing H202 free radical scavenging assay (Figure 6). The extract showed dose-dependent increase in the antioxidant activity although its activity is less compared to the standard vitamin E(23). Hence our study showed that even though the extract is showing less activity compared to Ascorbic acid, since the extract is natural in origin it can avoid the adverse side effects by the synthetic drugs.

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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