



Antimicrobial Activity of Coriander Oleoresin Mediated Selenium Nanoparticles Against Oral Pathogens.

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ABSTRACT

Aim: The aim of the present study was to prepare selenium nanoparticles using coriander oleoresin and evaluate its antimicrobial activity.

Materials and Method: In a conical flask, 99 mL of distilled water was taken and added with 0.5ml of Coriander oleoresin extract. 0.519 g of Sodium selenite was added to the extract and kept in the orbital shaker for nanoparticle synthesis and the colour change was noted. The absorbance of the reaction mixture was noted using UV- Visible spectroscopy periodically and the final product was centrifuged for 10 minutes and selenium nanoparticles were collected. The prepared coriander oleoresin mediated Selenium Nanoparticles were evaluated for its antibacterial activity against Streptococcus mutans and Lactobacillus sp and antifungal activity against Candida albicans by standard procedure.

Results and Discussion: In this, In Vitro study, visual observation of the colour change showed the formation of selenium Nanoparticles and was further confirmed by UV- Visible spectrophotometer with a peak at 360 nm. The different concentration of coriander oleoresin mediated selenium nanoparticles showed dose dependent antimicrobial activity against the tested microorganism. Streptococcus mutans, Lactobacillus sp and Candida albicans. It was showing better effect on S.mutans with a maximum zone of inhibition 25mm at 150 µL and against C.albicans it showed a zone of inhibition of 30mm.

Conclusion:The present study showed that coriander oleoresin mediated selenium nanoparticles proven to be a better choice against oral bacteria Streptococcus mutans, and fungal species Candida albicans. Hence, this green synthesised coriander oleoresin mediated selenium nanoparticle may be utilized for the control of such infection.

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INTRODUCTION

Coriander is an annual herb that belongs to the family of Apiaceae. All parts of the plant are edible, but the fresh leaves and dried seeds are the parts traditionally used for cooking. Apart from cooking, ethanol extract of coriander possesses antihyperglycemic and antidiabetic properties, Coriander oleoresins are prepared by solvent extraction of dried, ripe fruits of the herb *Coriander sativum*. The oleoresin contains the volatile oil, non volatile pungent principles, pigments, fats and other substances derived from seeds[1]. Plants such as *Tamarindus indica* [2], ajwain oil[3] and *Caralluma fimbriata*[4] also possess antidiabetic activity like coriander. *Caralluma fimbriata* is also known to possess cytotoxic activity against human colon cancer cells[5].

The uniqueness in physiochemical, optical, electrical and crystallographic properties of nanoparticles is mainly governed by the particle size, shape and crystallinity. Because of the large surface-to-volume ratio of nanoparticles, they can easily react with other particles[6]. Selenium is an essential non-metal that is colourless and a biologically inert material due to its Zero oxidation state[7]. Selenium Nanoparticles have paved their way into the field of biomedicine by serving as an antioxidant agent, anticarcinogenic agent, antidiabetic agent or as a nutritional supplement, also as a drug supplement against AIDS or in the treatment of various autoimmune ailments. The nanoparticle form of Selenium poses a low toxicity when compared with other chemical forms of selenium[8]. Being an antioxidant, selenium nanoparticles reduces risk of certain cancers, protection against heart diseases, etc. The maximum safe dosage is 300µg/day[9, 10].

Previous studies have shown that Selenium Nanoparticles containing a variety of polysaccharides have a size range of 20-200nm hence, demonstrating the importance of using higher order saccharides to synthesise biologically therapeutic selenium nanoparticles. Using plants

for Nanoparticle synthesis can eliminate the extensive process of cell culture maintenance and can provide large scale Nanoparticle synthesis[11, 12]. This study aims to provide conjunction between the antimicrobial activity of Coriander oleoresin and Selenium Nanoparticles in order to prove the antimicrobial activity of Coriander oleoresin mediated Selenium nanoparticles. The antibacterial effects have been attributed to the formation of free radicals produced by different selenium compounds, including the selenium oxyanions. They have the capability of reacting with intracellular thiols and proceeding in the formation of superoxide radicals that cause oxidative stress. Selenium Nanoparticles have also been studied in various inflammation mediated disorders such as arthritis, cancer, diabetes and nephropathy[13]. Selenium Nanoparticles have shown good effects on Kidney stone disease[14].

MATERIALS AND METHOD

Plant extracts preparation

The glassware utilized were washed with distilled water and dried in a hot air oven before its use. In a conical flask, 100mL of distilled water was taken and added with 0.5mL of coriander oleoresin extract.

Synthesis of Coriander oleoresin selenium nanoparticles:

0.519g of Sodium selenite was added to the extract. Then the Coriander oleoresin selenium solution was kept in an orbital shaker with a magnetic stirrer for nanoparticle synthesis. The absorbance was measured using UV-Visible spectroscopy at regular intervals. The colour change was observed visually and photographs were obtained. (Figure 1 and 2). The final product was centrifuged for 10 minutes at 8000 rpm using Lark refrigerated centrifuge and the pellets were collected and washed with distilled water twice and the purified pellet was dried at 60°C for 2 hours and stored in airtight eppendorf tube for evaluation of its antimicrobial activity.



Figure 1: Image showing the Synthesis of Coriander oleoresin mediated selenium nanoparticles.

Test Pathogens

Streptococcus mutans, Lactobacillus sp and Candida albicans were used for the study.

Antibacterial activity of Coriander oleoresin mediated selenium nanoparticles:

50µL, 100µL, 150µL of coriander mediated selenium Nanoparticles were loaded into the wells in the Mueller-Hinton agar plates previously streaked with Streptococcus mutans, Lactobacillus sp and incubated for 24 hours at 37°C. The antibiotic used was Amoxicillin. The zone of inhibition was measured to assess the antibacterial activity.

Antifungal activity of Coriander oleoresin mediated selenium nanoparticles:

Candida albicans were inoculated on rose bengal

agar plates and wells were created. Coriander mediated Selenium Nanoparticles were loaded into the corresponding well with varying volumes like 50µL, 100µL, 150µL and incubated for 48 hours at 37°C. Flucanazole was used as the standard. After the incubation period, the zone of inhibition was measured and mean values for each pathogen were recorded .

RESULTS AND DISCUSSION

The synthesis of nanoparticles was confirmed with the help of UV Visible spectrometer (Figure:2). The selenium nanoparticle’s surface plasmon resonance peak occurred at 360 nm with high absorbance indicative for synthesis of selenium nanoparticles.

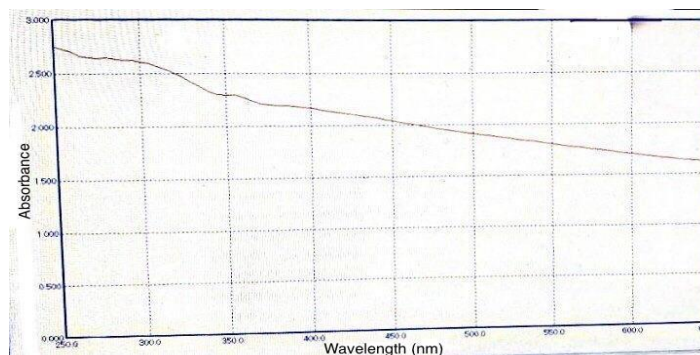


Figure 2: Graph showing UV- Visual spectroscopy of the Coriander oleoresin mediated selenium nanoparticles. The selenium nanoparticle’s surface plasmon resonance peak occurred at 360 nm with high absorbance indicative for synthesis of selenium nanoparticles.

The different concentration of coriander oleoresin mediated selenium nanoparticles showed dose dependent antimicrobial activity. against the tested microorganism. Streptococcus mutans, Lactobacillus sp and Candida albicans. It was

showing better effect on S.mutans with a maximum zone of inhibition 25mm at 150 µL and against C.albicans it showed a zone of inhibition of 30mm.

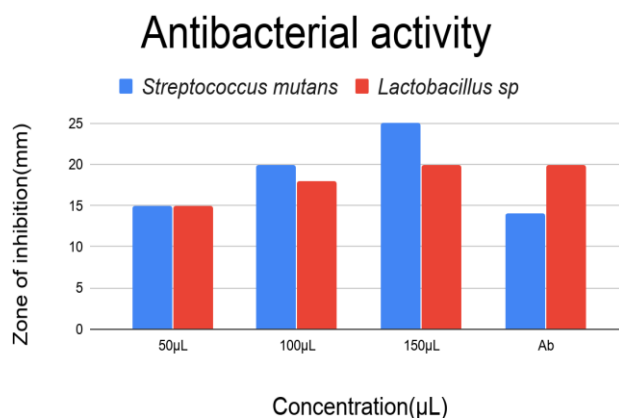


Figure 3: Bar Graph showing Antibacterial activity of Coriander oleoresin mediated selenium nanoparticles, wherein blue color denotes Streptococcus mutans and red color denotes Lactobacillus sp . X-Axis represents the concentration in µL and Y-Axis represents the zone of inhibition in mm. Maximum zone of inhibition

was seen against *Streptococcus mutans* (25 mm) when compared to *Lactobacillus sp* (20 mm) at a concentration of 150µL.

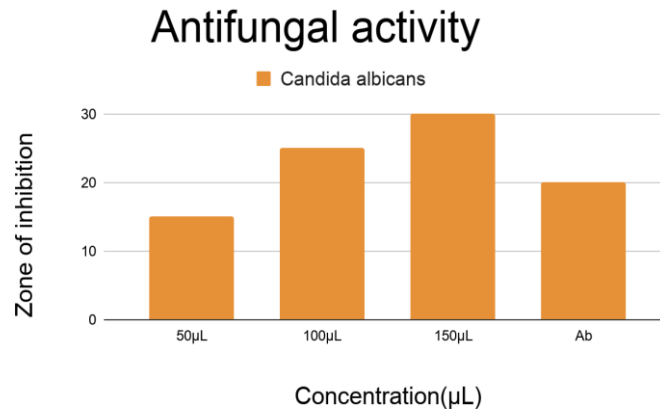


Figure 4: Bar Graph showing Antibacterial activity of Coriander oleoresin mediated selenium nanoparticles, wherein orange color denotes *Candida albicans*. X-Axis represents the concentration in µL and Y-Axis represents the zone of inhibition in mm. Maximum zone of inhibition of 30 mm against *Candida albicans* was seen at a concentration of 150µL.

Using nanoparticles to impede bacterial growth is an increasingly active approach to prevent and treat infections [15]. Selenium nanoparticles are synthesized by several methods using the biological as well as both chemical and physical methods. Previous studies have reported the synthesis of selenium nanoparticles using biological sources such as bacteria, fungi and yeasts [16]. One such study performed by E. Cremonini et al showed no effect against *Candida albicans* strains [17]. Coriander oleoresin mediated selenium nanoparticles proved to be very effective against *Streptococcus mutans* and had a zone of inhibition of 15 mm at 50µL concentration where as ginger oleoresin mediated silver nanoparticles showed a maximum zone of inhibition of 12 mm at 50µL against *Streptococcus mutans* [18], rosemary oleoresin mediated silver nanoparticles showed a maximum zone of inhibition of 11 mm at 50µL against *Streptococcus mutans* [19], nutmeg oleoresin mediated silver nanoparticles showed a maximum zone of inhibition of 11 mm at 50µL against *Streptococcus mutans* [20], and cumin oil mediated silver nanoparticles were not so effective against *Streptococcus mutans* [21] but the same preparation possesses a good anti-diabetic activity [22], anti-oxidant [23] and anti-inflammatory activity [24]. Anti-inflammatory properties are also seen in cinnamon mediated silver nanoparticles [25].

CONCLUSION

Coriander oleoresin mediated Selenium Nanoparticles showed very good dose dependent inhibitory effect against the tested pathogens such

as *Streptococcus mutans* and *Lactobacillus* and *C. albicans* compared to the standard antibiotic. Hence, Coriander oleoresin mediated Selenium Nanoparticles proves to be a better choice against infections caused by oral bacteria *Streptococcus mutans*, and fungal species *Candida albicans*.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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