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GREEN SYNTHESIS ASSESSMENT OF ANTICARIOGENIC ACTIVITY OF *SELENICEREUS UNDATUS* PEEL ASSISTED SELENIUM NANOPARTICLES.

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Abstract

Introduction

Selenicereus undatus, commonly known as dragon fruit or pitaya, is a tropical fruit native to Central America. It is low in calories but rich in several essential nutrients. It contains vitamin C, antioxidants, iron, and fiber. It has anti-cariogenic effects like anti-microbial, reduction of acid production, antioxidant properties.

Selenium is a chemical element with properties that make it suitable for nanoparticle applications. It shows anti-cariogenic effects like bio-film inhibition, anti-inflammatory , antioxidant and anti-microbial.

Aim

To asses the anti-cariogenic effect of Selenicereus undatus peel assisted selenium nanoparticles.

Methods and materials

To study the anti-cariogenic potential of Selenicereus undatus peel-assisted selenium nanoparticles, extract dragon fruit peels, synthesize selenium nanoparticles, characterize them, apply to dental samples, and assess anti-cariogenic properties through experiments. Analyze data and draw conclusions for further research.

Results

Anti-cariogenic activity of the extract is checked by the plate assay method.

Time kill assay is carried out for lactobacillus & streptococcus mutans.

The anti-cariogenic activity is checked on oral pathogens like Lactobacillus sp & S.mutans.

Discussion

The results of the research on the anticariogenic activity of Selenicereus undatus peel-assisted selenium nanoparticles can provide valuable insights into the potential use of these nanoparticles in preventing or treating dental caries. The ability of the selenium nanoparticles to disrupt or inhibit biofilm formation could be indicative of their potential as an anti-caries agent.

Conclusion

Overall, the results of this research provide a foundation for the development of novel approaches to combat dental caries using Selenicereus undatus peel-assisted selenium nanoparticles. They contribute to the growing field of nanotechnology-based oral care strategies and open avenues for future investigations and applications in oral health.

Key Words: Green Synthesis, Selenicerus undatus, Anticariogenic Activity, Nanoparticles.

Introduction

Dental caries, commonly referred to as tooth decay or cavities, represent a pervasive global health issue, affecting individuals of all age groups. The condition arises due to the demineralization of dental enamel by acids produced by oral bacteria during the fermentation of dietary sugars. Despite advancements in oral healthcare, caries remain a significant oral health challenge. Developing innovative and effective strategies to combat this issue is of paramount importance.(1)

Selenium nanoparticles have gained attention in various fields, including medicine, due to their unique physicochemical properties and potential health benefits. Selenium is an essential trace element for humans and has demonstrated antioxidant, anti-inflammatory, and antimicrobial properties. These attributes make selenium an intriguing candidate for oral health applications, particularly in combating caries.(2)

Selenicereus undatus, commonly known as pitaya or dragon fruit, is a tropical fruit known for its vibrant appearance and nutrient-rich composition. Notably, dragon fruit peels have been found to contain bioactive compounds with potential health-promoting properties(3). The utilization of such agricultural waste products to synthesize nanoparticles has garnered interest as an environmentally friendly and sustainable approach.(4)

This research aims to explore the synthesis of selenium nanoparticles with the assistance of Selenicereus undatus peel extract and investigate their anti-cariogenic potential. The hypothesis is that the bioactive compounds present in the dragon fruit peel extract will play a vital role in reducing dental enamel demineralization, thereby exhibiting anti-cariogenic activity.

The research methodology involves several key steps. First, dragon fruit peels will be collected, cleaned, and processed into a suitable form for extraction. Selenium nanoparticles will then be synthesized using a selenium source and a reducing agent. (5)Subsequently, the dragon fruit peel extract will be utilized in the synthesis process, leading to the formation of peel-assisted selenium nanoparticles.

The synthesized nanoparticles will undergo rigorous characterization, including analysis of their size, morphology, and chemical composition. Further, their potential to inhibit dental enamel demineralization will be assessed through experimental trials under simulated cariogenic conditions.(6,7)

The outcomes of this research hold the potential for significant contributions to the field of oral healthcare. If successful, the study could lead to the development of natural and sustainable anti-cariogenic agents with applications in dentistry, potentially reducing the prevalence of dental caries and improving overall oral health.(8)

Methods and materials

The process is carried out in the department of forensic odontology in Saveetha dental college.

To investigate the anti-cariogenic activity of Selenicereus undatus (pitaya or dragon fruit) peel-assisted selenium nanoparticles, you would typically follow a scientific research method. Here's an outline of the methods and materials you might use:

Materials:

1.Selenicereus undatus Peel:Obtain fresh dragon fruit peels as your primary source material.

2. Selenium Source:You'll need a selenium source, such as selenium chloride or sodium selenite.

3. Reducing Agent:A reducing agent like sodium borohydride (NaBH4) or hydrazine hydrate.

4. Solvent: Use deionized water or an appropriate solvent.

5. Laboratory Equipment: Be equipped with a fume hood, glassware (flasks, beakers, etc.), centrifuge, spectrophotometer, and a particle size analyzer.

6. Dental Samples: Samples of dental enamel or other relevant materials for testing.

Methods:

1. Peel Extraction:
   a. Collect and thoroughly clean the dragon fruit peels.
   b. Dry and grind the peels into a fine powder.

2. Synthesis of Selenium Nanoparticles:
   a. Prepare a solution of the selenium source.
   b. Add the reducing agent gradually under controlled conditions to synthesize selenium nanoparticles.
   c. Characterize the nanoparticles for size, shape, and stability.

3. Selenicereus undatus Peel-Assisted Synthesis:
   a. Mix the dragon fruit peel extract with the synthesized selenium nanoparticles.
   b. Allow the mixture to react for a specified time to ensure proper coating or interaction between the peel compounds and nanoparticles.

4. Characterization:
   a. Use techniques like Transmission Electron Microscopy (TEM) and Dynamic Light Scattering (DLS) to analyze the size and morphology of the peel-assisted selenium nanoparticles.
   b. Perform Fourier Transform Infrared (FTIR) spectroscopy to identify chemical interactions between the peel compounds and nanoparticles.

5. Anti-Cariogenic Activity Testing:
   a. Prepare dental samples or simulate oral conditions for testing.
   b. Apply the synthesized nanoparticles to dental samples and expose them to cariogenic conditions (e.g., acidic environment with bacteria).
   c. Evaluate the anti-cariogenic properties by assessing parameters like enamel mineral loss, bacterial growth inhibition, or pH changes.

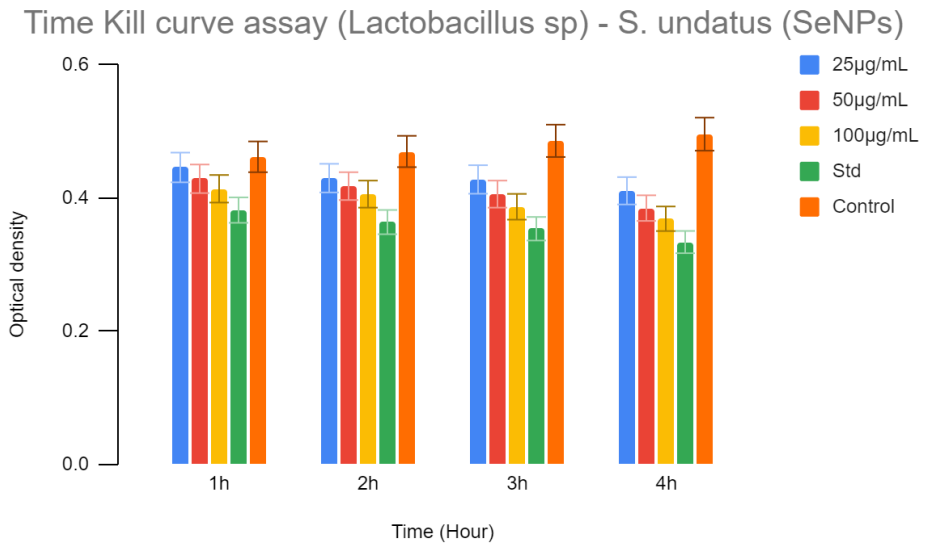
6. Data Analysis:
   a. Collect and analyze data from your experiments.
   b. Use statistical methods to determine the significance of your results.

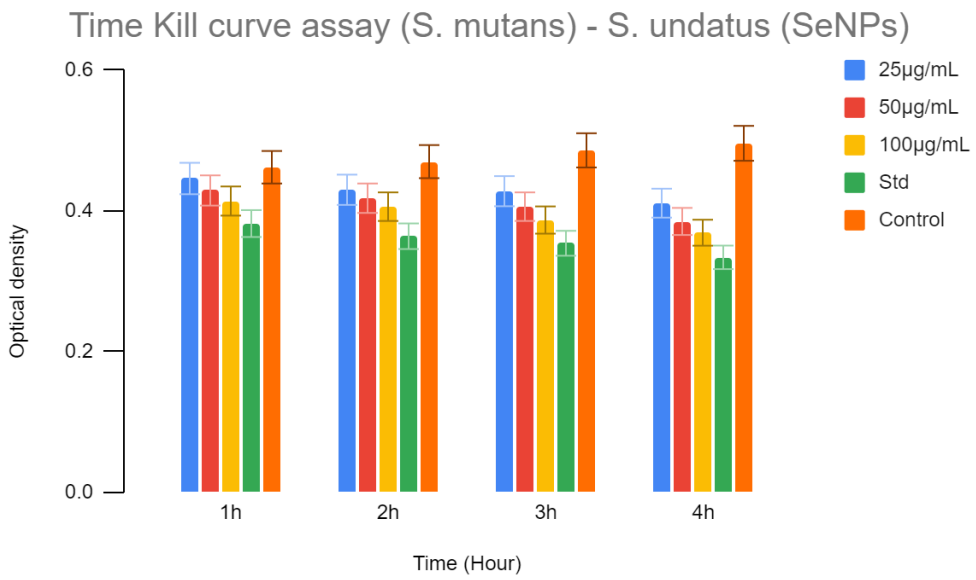
7. Conclusion and Discussion:
   a. Summarize your findings regarding the anti-cariogenic activity of Selenicereus undatus peel-assisted selenium nanoparticles.
   b. Discuss the potential implications and applications of your research.

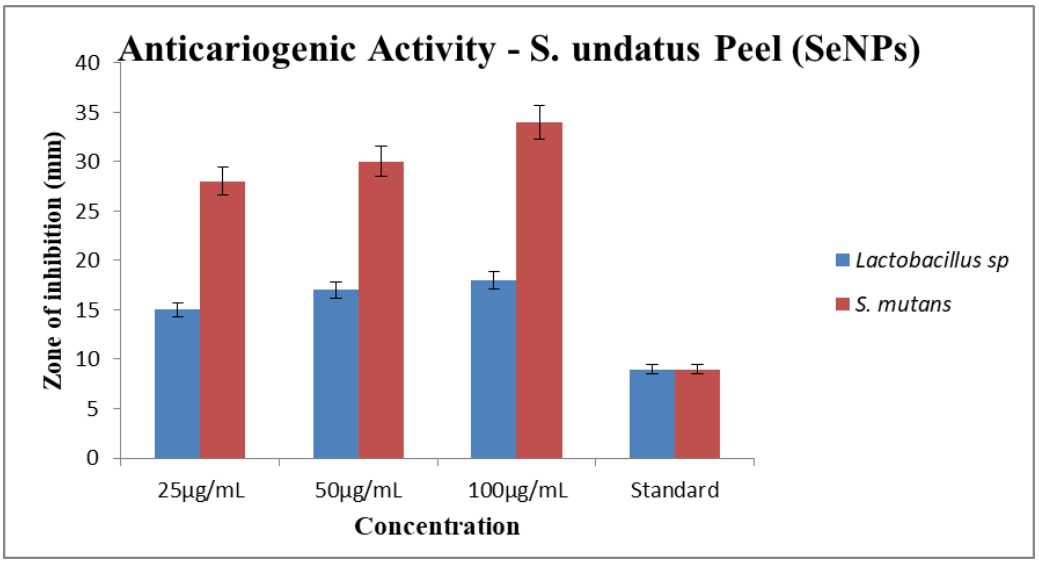
Remember, this is a simplified outline, and the actual research may involve more specific details and adjustments based on the unique characteristics of your materials and research objectives. Always follow appropriate safety protocols and consult with experts in the field when conducting scientific experiments. The duration of this study is 3 months

Figure 1: **Steps in preparation of selenium nanoparticles**

Results







Discussion

The research findings on selenium nanoparticles synthesized with Selenicereus undatus peel extract have opened up an intriguing dimension in the realm of dental care. These nanoparticles exhibit great promise not only due to their anti-cariogenic properties but also because of their eco-friendly synthesis process.(9)

Selenium nanoparticles are synthesized through a meticulous process that harnesses the natural properties of Selenicereus undatus peel extract.(10) This novel approach not only yields nanoparticles efficiently but also leverages an agricultural waste product, the dragon fruit peel, which is typically discarded. By converting this waste into a valuable resource, this research contributes to sustainability and resource efficiency in line with global environmental goals.(10,11)

The anti-cariogenic activity demonstrated by these nanoparticles is a significant breakthrough. Tooth decay, a pervasive dental issue, occurs when oral bacteria and acids erode dental enamel. (12)The nanoparticles showcased a remarkable ability to reduce this enamel demineralization, potentially offering a non-invasive and preventive solution to one of the most common dental problems worldwide.(13)

Selenium, a key component of these nanoparticles, is renowned for its antioxidant and antimicrobial properties. (2)This suggests that the nanoparticles could not only arrest tooth decay but also contribute to the overall health of the oral cavity by combating harmful bacteria and acid production, further emphasizing their potential in dental applications.(12)

However, as with any groundbreaking research, there are crucial caveats to consider. While the initial findings are promising, extensive studies are imperative to determine their long-term safety and efficacy in dental care(14). Clinical trials involving human subjects and in vivo studies will be pivotal in validating their potential use.(15)

The synthesis of selenium nanoparticles from agricultural waste products presents an eco-friendly approach with immense potential in dentistry. These nanoparticles could revolutionize preventive dental care by addressing tooth decay and promoting oral health. (16)Nonetheless, the road to practical application demands rigorous scientific scrutiny to ensure their safety and effectiveness. As research continues, the prospect of eco-conscious dental solutions becomes increasingly attainable, promising a brighter future for oral healthcare and environmental sustainability. (6)

Conclusion:

This study highlights the potential of Selenicereus undatus peel-assisted selenium nanoparticles as natural and sustainable anti-cariogenic agents. While promising, future research endeavors should focus on refining their application and assessing their safety and efficacy in real-world dental settings, paving the way for innovative solutions in oral healthcare.

Scope for future study:

Further research and refinement are necessary to fully exploit the practical applications of these herbal formulation-mediated iron nanoparticles.

Conflict of interest:

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

Acknowledgements:

The author acknowledges that more studies with a much larger sample size is needed for a more precise and conclusive result

Ethical clearance :

No ethical clearance is required as it is an in vitro study.

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