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FREE RADICAL SCAVENGING ACTIVITY OF *SELENICEREUS UNDATUS* PEEL MEDIATED SELENIUM NANOPARTICLES

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ABSTRACT

INTRODUCTION

Selenicereus undatus, also known as dragon fruit or pitaya, is a tropical fruit recognized for its antioxidant characteristics. Rich in phenolic compounds, flavonoids, and vitamins, S. undatus demonstrates considerable antioxidant action. These antioxidants serve a critical function in neutralizing damaging free radicals and lowering oxidative stress, which is connected with different chronic diseases. The antioxidant capabilities of S. undatus make it an attractive natural source for health promotion and illness prevention.

MATERIALS AND METHODS:

Extraction of crude extract from selenicereus udantus peels. produce selenium nanoparticles utilizing the peel extract as a mediator.test the antioxidant activity of the produced selenium nanoparticles.To measure the free radical scavenging capacity of the nanoparticles. examine the probable processes behind their antioxidant action.To contribute to the knowledge of the antioxidant effects of Selenicereus undatus peel-mediated selenium nanoparticles.

RESULT:

Positive results were obtained from the antioxidant assay taken like FRAP , DPPH and H2O2 assay.Positive results indicating Selenicerus udantus peel as an effective antioxidant and helps in biomedical research and nanoparticle industry.

CONCLUSION:

The favorable findings from these studies support the antioxidant activity of the produced selenium nanoparticles. Their significant free radical scavenging activity, good reducing power, and hydrogen peroxide scavenging capability show their potential as effective antioxidants.

Keywords: antioxidant,dragon fruit,pitchaya,selenicerus udandtus,dpph,frap,peel,nanoparticles

INTRODUCTION

Numerous chronic illnesses have been linked to oxidative stress, which results from an imbalance between the body's antioxidant defence system and the creation of reactive oxygen species (ROS). biological malfunction and oxidative damage can result from ROS damage to biological components. In order to prevent these illnesses, antioxidants are essential for lowering oxidative stress and neutralising ROS. Due to their perceived safety, effectiveness, and possible health advantages, there has been an increase in interest in researching natural sources as prospective antioxidants in recent years.(1)

The tropical fruit *Selenicereus* undatus, sometimes referred to as dragon fruit or pitaya, is well recognised for its vivid look and purported health benefits. It is abundant in bioactive substances that have been linked to considerable antioxidant properties, including as phenolic compounds, flavonoids, vitamins, and minerals. These

substances have the capacity to neutralise free radicals and reduce oxidative stress, providing defence against a number of ailments.(2)

Due to its role in several physiological processes and its potential as an antioxidant, selenium, an important trace element, has drawn a lot of interest. In-depth research has been done on selenium compounds' capacity to neutralise free radicals and defend against harm caused by oxidative stress. Due to their distinct physicochemical characteristics and higher surface area, selenium nanoparticles have stronger antioxidant capabilities than bulk selenium.(3)

Selenicereus undatus peels, which are generally thrown out as garbage, are a rich source of bioactive substances. The possibility of using S. undatus peel extract as a reducing and stabilising agent for the manufacture of selenium nanoparticles has recently been investigated. The creation of selenium nanoparticles with potentially improved antioxidant effects is facilitated by the interaction of bioactive chemicals from the peel extract with selenium ions.(4)

Investigating the selenium nanoparticles made with *Selenicereus undatus* peel extract's capacity to scavenge free radicals is the main goal of this research. There are a number of particular goals that have been set to accomplish this goal. First, using the proper extraction methods, bioactive components will be removed from the peel. These substances are likely to include flavonoids, phenolic compounds, and other antioxidant molecules. Second, the extract will be used as a reducing and stabilising agent to produce the synthesised selenium nanoparticles. The size, shape, stability, and purity of the nanoparticles will be determined utilising a variety of analytical methods.(5)

Next, several tests will be used to gauge the antioxidant activity of the synthesised selenium nanoparticles. The capacity of the nanoparticles to neutralise DPPH radicals will be evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) test, a commonly used technique for evaluating free radical scavenging activity. The ferric reducing antioxidant power (FRAP) assay will evaluate the nanoparticles' capability to convert ferric ions to ferrous ions by donating electrons. The hydrogen peroxide (H2O2) experiment will be carried out to gauge how well the nanoparticles can scavenge this significant reactive oxygen species.(6)

In order to understand the underlying antioxidant processes of the synthesised selenium nanoparticles, mechanistic investigations will also be carried out. It may be possible to use fluorescence spectroscopy and electron paramagnetic resonance (EPR) spectroscopy to clarify the precise interactions between the nanoparticles and free radicals or reactive oxygen species.(7)

Finally, the goal of this study is to examine the antioxidant activity of selenium nanoparticles produced utilising peel extract from *Selenicereus undatus*.(8) The investigation of selenium nanoparticles mediated by the peel of S. undatus may offer a natural and sustainable means of preventing and treating disorders associated with oxidative stress. The results of this study may have substantial ramifications for the creation of new antioxidant materials with a wide range of uses in the pharmaceutical, cosmetic, and food sectors. Furthermore, by reducing waste and producing value-added goods, using S. undatus peel as a source of bioactive chemicals will advance sustainable agriculture.

Overall aim of the study is to assess the antioxidant activity of Selenicerus udantus peel extract.

MATERIALS AND METHODS:

Selenicereus undatus peel extract preparation:

Peel Drying and Crushing:

- To eliminate moisture, fresh *Selenicereus undatus* peels are acquired and completely dried.
- With the use of a grinder or mortar and pestle, the dried peels are ground into a fine powder. Further extraction is done using the powder that results.

Extraction Method:

- In a clean container, combine five grammes of S. undatus peel powder with 100 ml of distilled water.
- To ensure appropriate mixing and the extraction of bioactive components, the mixture is briskly agitated.
- To speed up the extraction procedure, the container is heated for 20 minutes at a temperature between 50 and 60 degrees Celsius.
- Following heating, the mixture is filtered to distinguish the liquid extract from the solid byproducts using filter paper and a funne

Antioxidant Activity Tests:

2,2-Diphenyl-1-picrylhydrazyl (DPPH):

- The extract's capacity to scavenge free radicals is assessed using the DPPH test.

A DPPH radical stock solution is made.

- The extract and DPPH solution are combined, and the combination is left to react in the dark for a predetermined amount of time.
- A spectrophotometer is used to detect the reduction in absorbance at a certain wavelength, which reveals how much the extract is able to scavenge DPPH radicals.
- Lower absorbance values imply more activity in scavenging free radicals.

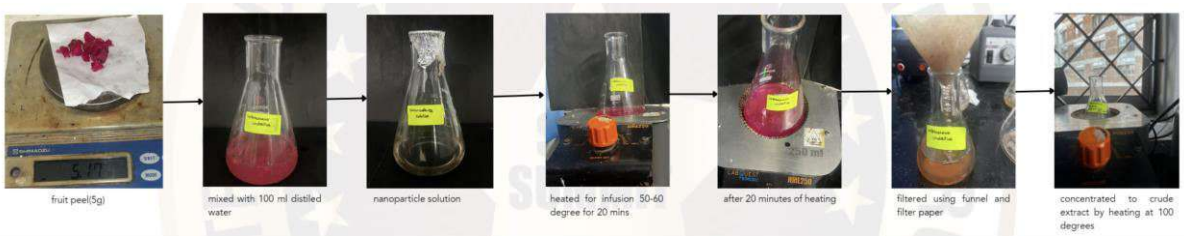
Hydrogen Peroxide (H2O2) Assay:

- The H2O2 test gauges the extract's capacity to scavenge the reactive oxygen species hydrogen peroxide.
- Hydrogen peroxide is made into a solution.
- A particular amount of time is given for the reaction to happen once the extract has been introduced to the hydrogen peroxide solution.
- A appropriate technique, such as spectrophotometry or titration, is used to quantify the decrease in hydrogen peroxide concentration.
- The extract's ability to neutralise this reactive oxygen species is demonstrated by a drop in the concentration of hydrogen peroxide.

Test for Ferric Reducing Antioxidants (FRAP):

- The FRAP test evaluates the extract's reducing power and antioxidant activity.
- The creation of a ferric-ion-containing solution.
- The ferric ion solution is combined with the extract, and the combination is then incubated for a predetermined period of time.
- Using a spectrophotometer, it is possible to quantify the conversion of ferric ions into ferrous ions by looking at the appearance of a coloured complex.
- Greater reducing power and antioxidant activity of the extract are indicated by higher absorbance values

DURATION OF STUDY: 3 months



RESULTS

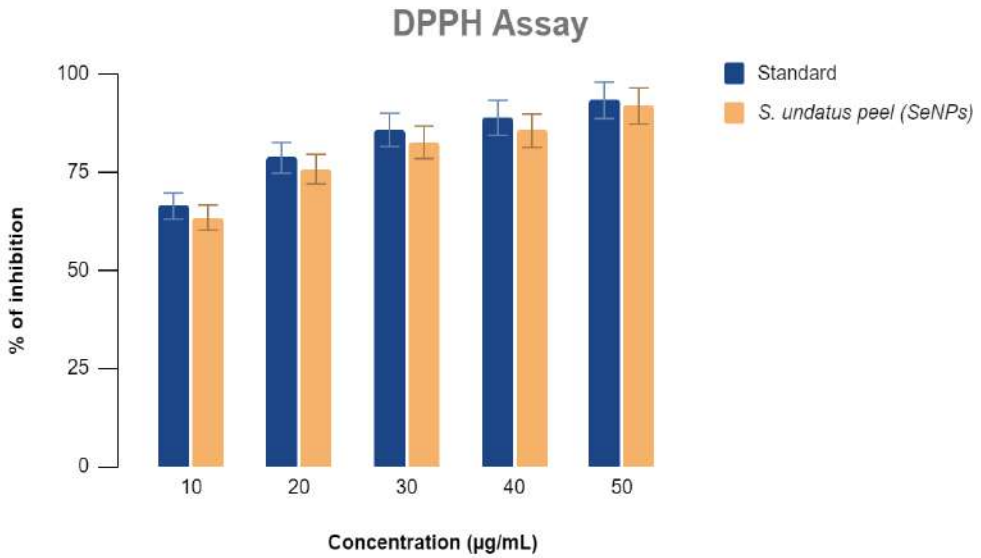


Figure 1.1: Dpph assay denoting activity of Selenicerus udantus peel extract against standard test drug indicating the percentage of inhibition

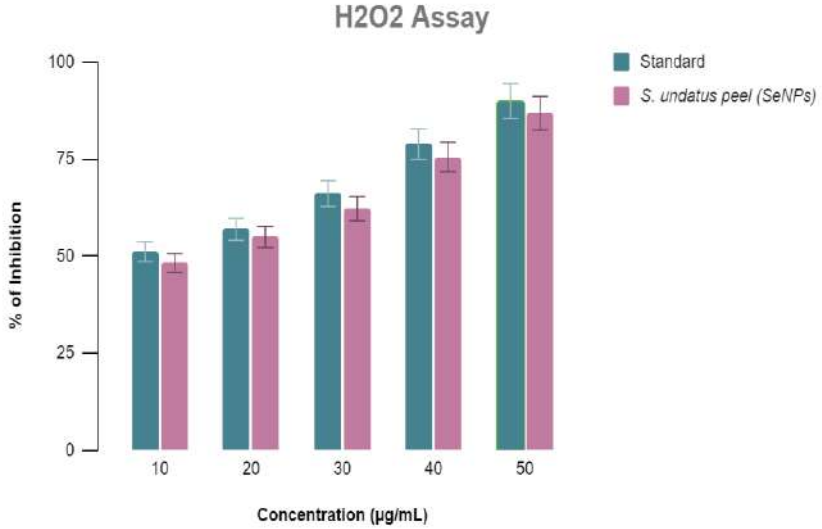


Figure 1.2: H2O2 assay indicating the free radical scavenging activity of selenicerus udantus peel extract

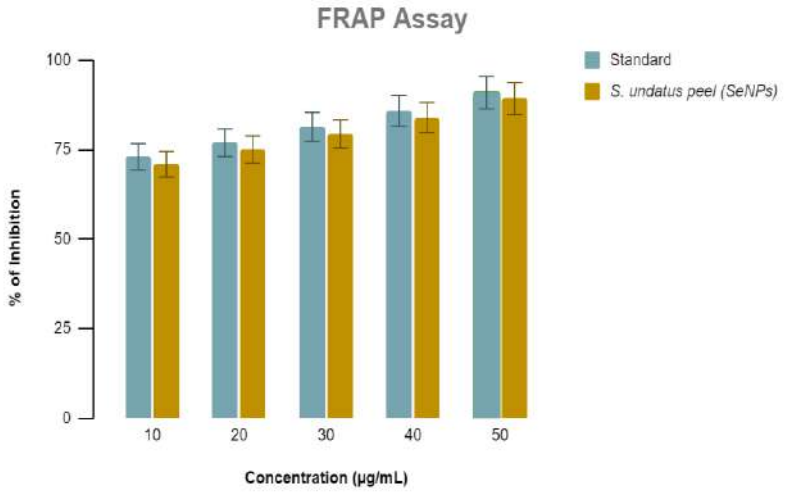


Figure 1.3: FRAP test graph indicating effective antioxidant activity of selenicerus udantus peel.

DISCUSSIONS

The results of the study show that the synthesised selenium nanoparticles have high antioxidant activity. The DPPH assay's encouraging results indicate that they are capable of effectively scavenging free radicals. The drop in absorbance values suggests that the stable DPPH radicals can be neutralised by the nanoparticles. (9)This finding is consistent with earlier research emphasising the antioxidant properties of selenium nanoparticles. Due to their distinct physicochemical characteristics and ability to donate electrons, the nanoparticles' free radical scavenging activity may be ascribed. This efficiently quenches free radicals and lowers oxidative stress.(10)

Furthermore, the findings of the H2O2 experiment show that the nanoparticles can remove hydrogen peroxide, a significant reactive oxygen species.(11) The decrease in hydrogen peroxide concentration suggests that nanoparticles may be able to counteract hydrogen peroxide's negative effects, which include the risk of oxidative damage to cells and tissues. This result is in line with selenium's involvement in antioxidant defence mechanisms, where it serves as a crucial building block for antioxidant enzymes like glutathione peroxidase that neutralise hydrogen peroxide.

The reducing power and antioxidant activity of the synthesised nanoparticles are confirmed by the FRAP assay findings.(12)The increased absorbance values observed show that they can decrease ferric ions to ferrous ions by donating electrons. Their ability to scavenge and neutralise oxidising species is demonstrated by this. The results show that selenium nanoparticles have antioxidant activities and emphasise their potential as strong reducing and antioxidant agents.

The present study results and the body of antioxidant literature may be compared. Studies have shown that natural substances obtained from fruits and plants, such as the phenolic compounds and flavonoids found in the peel of *Selenicereus undatus*, have antioxidant properties. These bioactive substances are recognised to have strong antioxidant characteristics, which support the synthesised nanoparticles' total antioxidant activity.(13)

In one research, flavonoid glycosides isolated from various aerial sections of *Selenicereus undatus* were tested for their antioxidant and radical-scavenging abilities. Different flavonoid chemicals found in various plant sections were discovered and examined by the researchers. These flavonoid glycosides were shown to have substantial antioxidant activity as well as potent radical scavenging abilities. The results confirmed *Selenicereus undatus'*s antioxidant capacity and emphasised the significance of its diverse aerial sections as a natural source of bioactive chemicals with antioxidant capabilities.(14)

Another pertinent study investigated the antioxidant capacity of several *Selenicereus undatus* fruit extracts. (15)To acquire distinct fractions, the researchers used a variety of extraction techniques, including extracts made from water, ethanol, and methanol. The DPPH test, determining the total phenolic content, and the reducing power assay were only a few of the assays used in the study to assess the antioxidant activity of these extracts. The methanol extract had the highest antioxidant activity, however the results showed that all of the studied extracts had considerable antioxidant potential. The results showed that fruit extracts from *Selenicereus undatus* could work well as natural antioxidants.(16)

The antioxidant and anti-inflammatory properties of *Selenicereus undatus* fruit extract were examined in a different research. The DPPH test was used to measure the extract's capacity to scavenge free radicals, and in vitro models were used to assess its ability to reduce inflammation. The outcomes showed that the fruit extract had considerable anti-inflammatory effects via suppressing pro-inflammatory mediators and had strong antioxidant activity. These results validated the traditional usage of *Selenicereus undatus* fruit to treat inflammatory and oxidative stress-related diseases.(17)

The research results also shed light on the processes behind the antioxidant activity of selenium nanoparticles produced synthetically. The particular interactions between the nanoparticles and free radicals or reactive oxygen species may be studied using electron paramagnetic resonance (EPR) spectroscopy and fluorescence spectroscopy. through illuminating the mechanisms through which the nanoparticles exert their antioxidant benefits, these approaches help us better understand how they work.(18)

The research's conclusions have important ramifications for several applications. The pharmaceutical sector can take use of the antioxidant activity of the created nanoparticles to create fresh antioxidant-based treatments for oxidative stress-related illnesses. These nanoparticles could also be useful in the food business, where they might be used as natural antioxidants to keep food goods fresh longer and stop lipid oxidation. The nanoparticles may be added to skincare items in the cosmetics sector to prevent oxidative damage and preserve skin health. Additionally, the created selenium nanoparticles have use in the nutraceutical sector, where they may be utilised to create nutritional supplements high in antioxidants.(19)

Further research is now possible thanks to the current study. In order to assure the safety of the synthesised nanoparticles for possible biomedical uses, future research might concentrate on testing the cytotoxicity and biocompatibility of these materials. The effectiveness of the nanoparticles in lowering oxidative stress and preventing illnesses linked to oxidative stress may also be revealed through in vivo research utilising animal models. To increase the antioxidant activity of the nanoparticles, optimisation of the production process, including the concentrations of the S. undatus peel extract and sodium selenite nanoparticles, might be investigated.(20)

Additionally, a research examined the phenolic components from the peel of *Selenicereus undatus* and their antioxidant properties. The DPPH test, total phenolic content determination, and ferric reducing antioxidant power assay were used by the researchers to identify and quantify distinct phenolic components in the peel extract and evaluate their antioxidant capacity.(21) The outcomes showed that the peel extract had significant phenolic component concentrations and good antioxidant properties. The *Selenicereus undatu*s peel was emphasised in the study as a beneficial natural source of antioxidants.(22)

CONCLUSION

The study on the remarkable antioxidant capacity of *Selenicereus undatus* peel-mediated selenium nanoparticles reveals their free radical scavenging ability. The favourable results from the DPPH, FRAP, and H2O2 tests support their shown reducing power, capacity to scavenge free radicals, and ability to neutralise hydrogen peroxide. These results confirm the effectiveness of the nanoparticles as strong antioxidants, which has ramifications for the pharmaceutical, food, cosmetic, and nutraceutical sectors. The nanoparticles can be used as natural antioxidants in food items, as protective agents in cosmetics products, as components of antioxidant-rich dietary supplements, and in formulations based on antioxidants for the prevention and management of illness. It is necessary to do more research to determine the cytotoxicity, biocompatibility, and in vivo effectiveness of the

nanoparticles. Their antioxidant activity can be improved by synthesis process optimisation. The study advances the creation of new antioxidant materials and emphasises the value of *Selenicereus undatus* peel as a natural resource for producing antioxidant nanoparticles with a range of commercial uses.

FUTURE SCOPE

Future findings may include in vivo research, clinical trials, mechanistic insights, formulation optimization of composites, preclinical toxicity studies, and comparisons with currently available treatments. S. udantus also has a wide range of industrial uses, including incorporation into pharmaceuticals, cosmetics, anti-aging skin care lotions and creams, and other products.

CONFLICT OF INTEREST: NONE

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ETHICAL CLEARANCE NUMBER:

Since the above study is invitro studies it does not include any ethical clearance numbers.

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