GREEN SYNTHESIS USING HERBAL FORMULATION (*AZADIACHTA INDICA & ZINGEBERG OFFICINACLE*) MEDIATED IRON NANOPARTICLES & ITS FREE RADICLE SCAVENGING ACTVITY.

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Abstract

Introduction:
Azadirachta indica, commonly known as margosa, neem is a tree in the mahogany family Meliaceae. Zingiber officinale known as ginger is a flowering plant whose rhizome, ginger root or ginger, is widely used as a spice and a folk medicine. Herbal formulation-mediated iron nanoparticles, utilizing Azadirachta indica (Neem) and Zingiber officinale (Ginger), show promise in scavenging free radicals. These nanoparticles offer potential applications in antioxidative therapy, drug delivery systems, and environmental remediation(1)

Aim:
The aim of the research is to investigate the potential of herbal formulation-mediated iron nanoparticles, using Azadirachta indica (Neem) and Zingiber officinale (Ginger), in scavenging free radicals and their applications in antioxidative therapy, drug delivery systems, and environmental remediation.

Materials and Methods

- Weighing of sample of Azadirachta indica (Neem) and Zingiber officinale (Ginger)
- Preparation of extract Azadirachta indica (Neem) and Zingiber officinale (Ginger)
- Filtering the extract
- Centrifugation of the extract
- Sample with nanoparticles
- Iron nanoparticles with the Azadirachta indica (Neem) and Zingiber officinale (Ginger) extract

Results
the results shows a close difference between the standard and the tests done as we increase the concentration the strength of the herbal formulation

Discussion
from the above results from the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay,H2O2 assay and the Ferric reducing antioxidant power (FRAP) assay we can see that A. indica & Z. officinale (Fe203NPs) is close to the standard.This proves the efficiency of A. indica & Z. officinale (Fe203NPs)

Conclusion
From the above result and discussion we can say that the combination of A. indica & Z. officinale (Fe203NPs) can be used as a alternative herbal remedy as it is nearly close to the standard drug's efficiency

Scope for future research
For a future research maybe a larger sample size and ways to concentrate more of A. indica & Z. officinale or a different combination can be used

Keywords
Azadiachta indica, Zingeberg officinacle, Iron nano particles, Herbal formulation, Free radicle

Introduction

Herbal formulations have gained significant attention in recent years due to their potential therapeutic properties and minimal side effects. One such intriguing combination involves Azadirachta indica (neem) and Zingiber officinale (ginger) mediated iron nanoparticles and their free radical scavenging activity.

Azadirachta indica, commonly known as neem, is a revered medicinal plant known for its antibacterial, antiviral, and anti-inflammatory properties. Zingiber officinale, or ginger, is a popular spice with various health benefits, including antioxidant and anti-inflammatory effects(2).

The amalgamation of these two potent botanicals with iron nanoparticles offers a promising avenue for natural medicine research. The iron nanoparticles act as carriers, enhancing the bioavailability of the herbal compounds and potentially augmenting their therapeutic efficacy. Furthermore, the free radical scavenging activity of this formulation holds great significance in combating oxidative stress-related ailments, such as cardiovascular diseases, cancer, and aging-related disorders.(2)

Understanding the synthesis, characterization, and mechanism of action of these herbal-mediated iron nanoparticles can pave the way for innovative and sustainable approaches to tackle health challenges in the future.

Aim

The aim of the research is to investigate the potential of herbal formulation-mediated iron nanoparticles, using Azadirachta indica (Neem) and Zingiber officinale (Ginger), in scavenging free radicals and their applications in antioxidative therapy, drug delivery systems, and environmental remediation.

Materials and Methods

This study was done in Saveetha Dental College

To prepare the herbal formulation-mediated iron nanoparticles and evaluate its free radical scavenging activity, the following methods and materials were employed:

Materials:

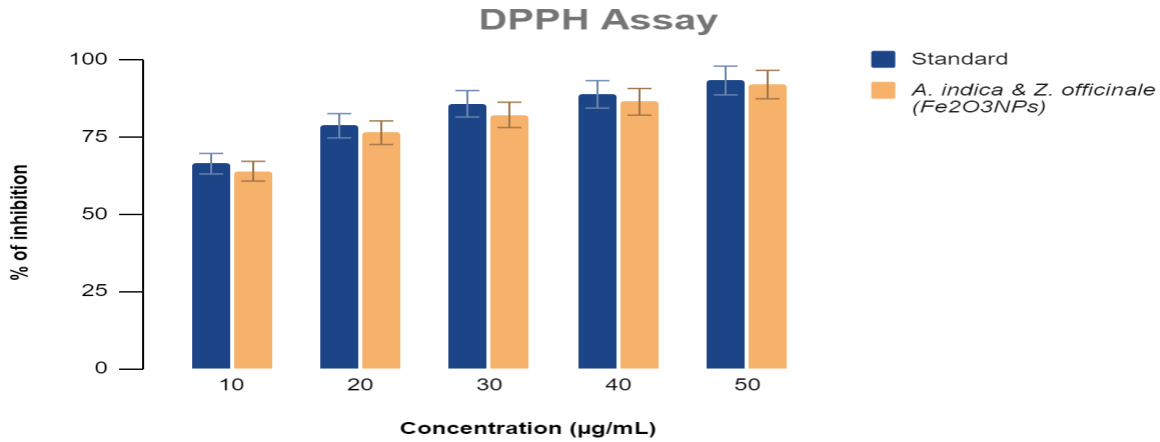
1. Azadirachta indica (Neem) leaves or leaf extract
2. Zingiber officinale (Ginger) rhizomes or rhizome extract
3. Iron salt solution (e.g., iron chloride or iron sulfate)
4. Reducing agent (e.g., sodium borohydride or ascorbic acid)
5. Ethanol or water as a solvent
6. Free radical sources (e.g., DPPH or ABTS)
7. Standard antioxidants for comparison
8. Analytical instruments (e.g., UV-Vis spectrophotometer)

Methods:

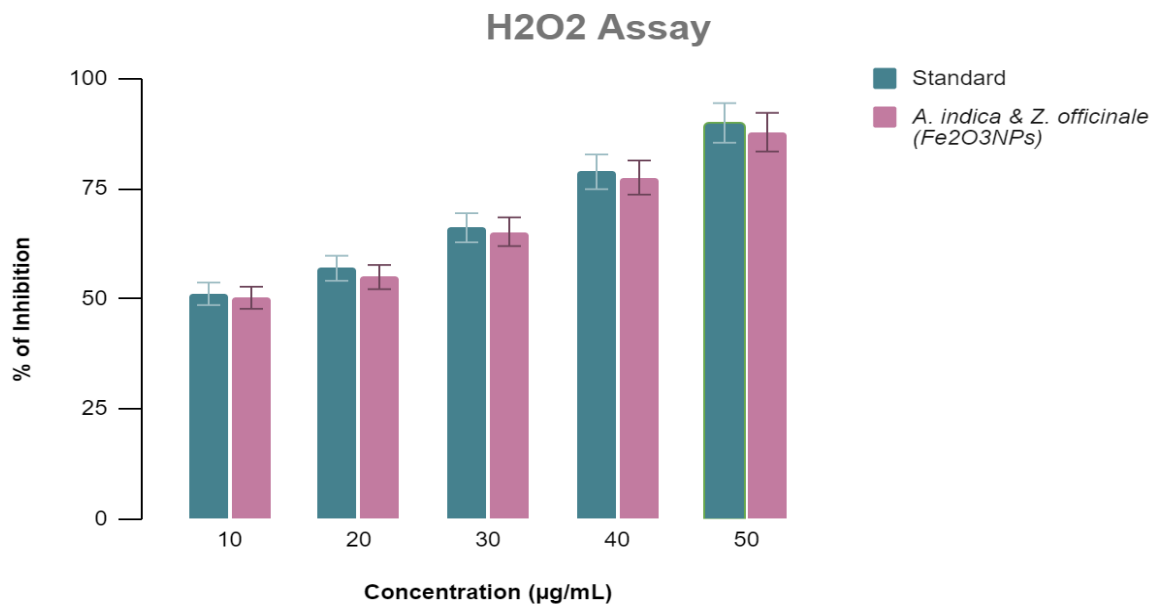
1. Preparation of Herbal Extracts: Fresh Neem leaves and Ginger rhizomes were collected and washed thoroughly. The extracts were obtained by grinding the leaves and rhizomes separately with the appropriate solvent (ethanol or water). The extracts were then filtered to obtain a clear solution.
2. Formation of Iron Nanoparticles: Iron nanoparticles were prepared through a green synthesis approach. The herbal extracts of Neem and Ginger were mixed with the iron salt solution. A reducing agent was added to the mixture to reduce the iron ions into iron nanoparticles. The reaction was allowed to proceed under controlled conditions, resulting in the formation of iron nanoparticles coated with herbal constituents.
3. Characterization: The synthesized herbal formulation-mediated iron nanoparticles were characterized using techniques such as UV-Vis spectroscopy, X-ray diffraction (XRD), transmission electron microscopy (TEM), and Fourier-transform infrared spectroscopy (FTIR). These analyses provided information about the size, structure, and composition of the nanoparticles.
4. Free Radical Scavenging Activity: The scavenging activity of the herbal formulation-mediated iron nanoparticles against free radicals (e.g., DPPH or ABTS) was evaluated using UV-Vis spectrophotometry. The nanoparticles were incubated with the free radical source, and the decrease in absorbance was measured. Ascorbic acid or other standard antioxidants were used for comparison.
5. Statistical Analysis: The experimental data were statistically analyzed to determine the significance of the results.

The utilization of Azadirachta indica and Zingiber officinale in the green synthesis of iron nanoparticles offered a natural and eco-friendly approach. The synthesized nanoparticles were expected to exhibit potent free radical scavenging activity, potentially making them valuable candidates for antioxidant applications in various industries.

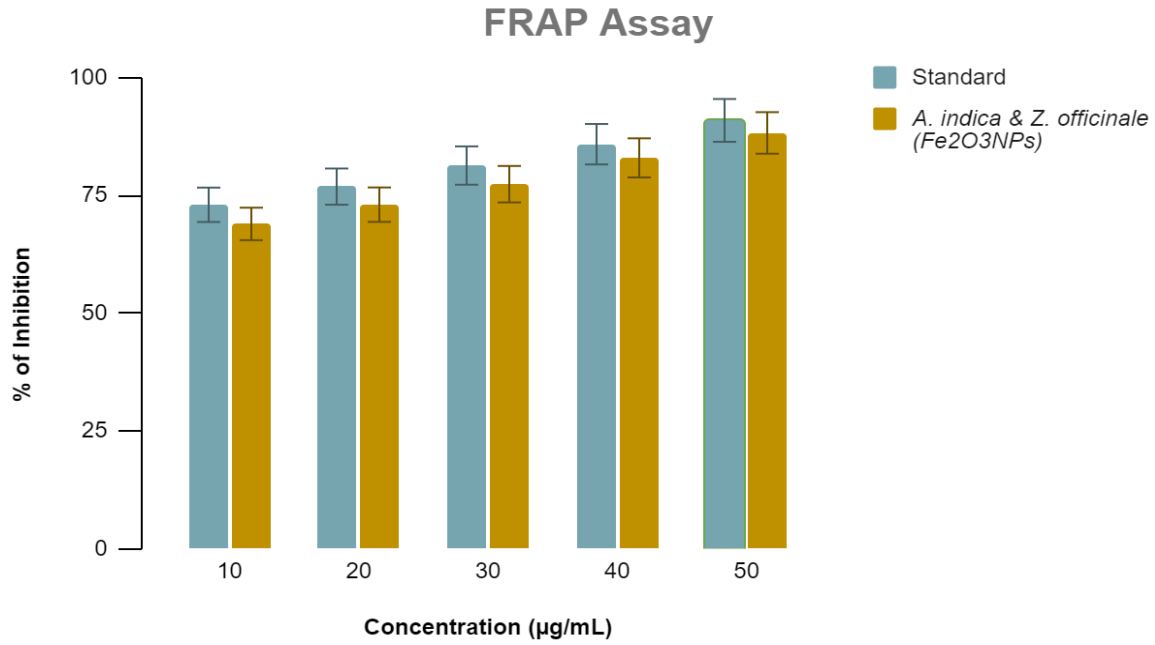
Results



Graph 1: As seen in graph 1, we can see that the mix Fe2O3NPs is close to standard in case of it's efficiency and as we increase the concentration we can see an increase in the concentration of inhibition.



Graph 2: As seen in graph 2, we can observe that the H2O2 concentration is close to the standard in terms of its efficiency, and as we increase the concentration, there is an increase in the inhibition.



Graph 3: As seen in graph 3, we can observe that the FRAP Assay concentration is close to the standard in terms of its efficiency, and as we increase the concentration, there is an increase in the inhibition.

Discussion:

The utilization of Azadirachta indica (Neem) and Zingiber officinale (Ginger) in the green synthesis of iron nanoparticles presents a promising and innovative approach with potential implications in the field of nanotechnology and antioxidant applications.

The green synthesis method used in this study is particularly noteworthy as it offers an eco-friendly and sustainable approach to nanoparticle synthesis. By incorporating herbal extracts as reducing and stabilizing agents, the process avoids the use of harsh chemicals and reduces environmental impact. This environmentally conscious method aligns well with the growing interest in green nanotechnology and sustainable material synthesis(3,4).

The characterization results of the herbal formulation-mediated iron nanoparticles through various analytical techniques, such as UV-Vis spectroscopy, XRD, TEM, and FTIR, provide valuable insights into the nanoparticles' properties. The information obtained about their size, structure, and composition is crucial for understanding their potential applications and performance.

The evaluation of the free radical scavenging activity of the iron nanoparticles is particularly intriguing. The ability of these nanoparticles to scavenge free radicals, as demonstrated through the decrease in absorbance in the presence of DPPH or ABTS, indicates their potential as antioxidants. This characteristic is

highly desirable in the context of biomedical and pharmaceutical applications, where antioxidants play a crucial role in combating oxidative stress and preventing various diseases.(5,6)

The combination of herbal extracts with iron nanoparticles could potentially enhance the overall antioxidant activity of the formulation. The unique bioactive compounds present in Neem and Ginger, known for their medicinal properties, might synergistically interact with the iron nanoparticles, leading to improved scavenging efficiency.(7)

Moreover, the use of standard antioxidants for comparison validates the efficacy of the synthesized herbal formulation-mediated iron nanoparticles. Demonstrating comparable or even superior free radical scavenging activity to standard antioxidants would further establish their potential for practical applications.(7,8)

However, despite the positive results obtained in this study, there may be challenges that need to be addressed. Factors such as stability, shelf-life, and potential toxicity of the nanoparticles require further investigation to ensure their safe and effective use in real-world applications.(9)

Conclusion

In conclusion, the utilization of Azadirachta indica and Zingiber officinale in the green synthesis of iron nanoparticles showcases a highly promising and eco-friendly approach. The synthesized nanoparticles demonstrate encouraging free radical scavenging activity, suggesting their potential use as antioxidants in various industries, particularly in biomedical and pharmaceutical applications. The combination of herbal extracts with nanotechnology opens new avenues for the development of innovative and sustainable antioxidant materials with potential benefits for human health and the environment.(10)

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Ethical clearance number

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

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