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Antimicrobial activity of Zinc Nanoparticles Synthesized by Ginger (Zingiber officinale) Extract against selected Bacteria

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Abstract
Zinc nanoparticles are known to be one of the multifunctional inorganic nanoparticles with effective antimicrobial activity. This study aims to determine the antimicrobial efficacy of green synthesized zinc nanoparticles against various bacterias. The main objective of present study was to evaluate the antibacterial activities of Zincoxide nano particles synthesized from the roots of Ginger (Zingiber officinale) aqueous extract against selected bacteria E coli, Salmenolla typhi, & Shingella SP, Staphylococcus and antimicrobial activity checked by agar disc disc diffusion method.
Zinc nanoparticles shows antimicrobial activity against all the bacterias. Effectiveness also depends upon the synthesis method, Nanopaticles synthesized by green methods are rather more effective than prepared by other methods. And green methods are also easy, convenient, not costly and most important its ecofriendly

Keywords: Zingiber officinale, Ginger extract, Antimicrobial, disc diffusion

Introduction

Spices used in foods are generally antimicrobial and antioxidant agents. Spices have been used as traditional medicines from thousands of years. The scientific name of Ginger is Zingiber officinale which belongs to the Zingiberaceae family.
A number of medicinal properties can be shown by various parts of the *Ginger* tree[1]. Antimicrobial agents are very important for the control of pathogenic microbes, especially for the treatment of infections caused by resistant microbes. Medicinal herbs with antimicrobial activities are considered a potent source of novel antimicrobial functions. Zingiber officinale is widely used as a vegetable, functional food and medicinal plant that has rich nutritional composition with diverse pharmacological activities [2-4].In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems.[5]. Ginger is a natural antioxident, antidiabetic, antiulcer, antiobessity, antibiotic, outstanding immune builder used in many countries from ancient times Ginger not only adds flavor to food but also it provides nutritious values also. A few researchers have investigated the antimicrobial activity of *GINGER* (Lam) extracts against some pathogenic bacteria .[7-8] In this present study focuses on the Antimicrobial action of Zinc nanoparticles prepared from Ginger extract. The present work also focuses on discovering new techniques for green synthesis of metal nanoparticles of ginger water extract extract.
Nanoparticles contains antimicrobial and antioxidant substance could be considered as new trend of antimicrobial therapeutic agents for prevention and reduction of deterioration of food and pathogrnic microorganisms.
Nanosized metals have been shown to have a good antimicrobial effect and they can be introduced as a solution for the resistance problem. Moreover Nanometals have diverse applications which can be explained by attaining a high surface area to volume ratio.
The main advantage of green metods was the presence of naturally occurring biomolecules, such as proteins, enzymes, tannins,phenols, sugars etc. tat can be used safely as reducing agents to form stable nanometals.

Materials and Methods

Collection of Plant Material

Fresh Ginger roots were obtained from campus of Siddhartha College, Jafrabad, Jalna (Maharashtra). The roots were identified and confirmed by the Botanist at the Botany Department of the present institution. All materials were washed with tap water to remove impurities. It were dried under shade for 1 week, all dried materials were ground in a mixer grinder separately, which were easily grinded into the powder form. Same processes repeated 4 to 5 times and it stored in an air tight container for further use.

Preparation of Extracts

From each 20 gm of the powdered sample was extracted in 500ml conical flasks with 100 ml of deionised distilled water (aqueous extraction). The conical flask was plugged with rubber corks, then shaken at 120 rpm for 30 min and allowed to stand at room temperature for 6 day. The extracts was separately filtered using Whatman filter paper no. 1. The resulting filtrate was centrifuged. Extract was properly labeled and kept at 4ºC until use.

Preparation of Zinc oxide nanoparticle using Ginger extract

50 ml of Ginger extract was taken and boiled upto 80 c using stirring heater. 5gm of zinc nitrate was added to the solution. This solution was boiled and color was observed to deep yellow. A light colored powder obtained which was collected properly.

Characterisation of Nanoparticle prepared

Characterisation of Zinc oxide Nanoparticles done by using different characterization methods such as UV-VISIBLE SPECTROSCOPY, XRD, SEM, TEM etc.

Antimicrobial properties of Zinc oxide nanoparticles

The antimicrobial activity of the extract was tested using the disc diffusion method and minimum inhibitory concentration (MIC) determination. For this different solutions of different concentrations prepared as 1000µg, 500µg, 250µg.

The pathogenic microorganism

The three selected common pathogenic microorganism were used in the study, among those one was gram negative *Escherichia Coli* , Salmonella Typhi and Shingella SP

Preparation of microbial cultures

All these bacterias were cultured on the Muller Hinton Agar. On this agar a loop full of each bacterial strain was inoculated in 6 ml of nutrients both.These plate agars were incubated in incubator for 24 hours at room temperature. And these were used for incolumns.

Inoculum preparation:

To prepared bacterial inoculums , pure culture of micro-organisms was inoculated into 5 ml of sterile nutrient broth followed by incubation at 37˚C. Till moderate turbidity developed.

The density of suspension inoculated onto the media for susceptibility test was determined by comparison with 0.5 McFarland standard of Barium sulphate solution. [10]

Antimicrobial activity by Kirby-Bauer agar disc diffusion method

The antimicrobial activity of each plant extracts was determined by disc agar diffusion technique described by Kirby Bauer et al (1966)[9] . The nutrient broth cultures of test bacteria were spreaded on the Muller Hinton Agar media in petriplates and microbes broth culture were applied on media by swabbing. The Whatmann filter paper discs 6mm were dipped in the 3 different concentrations of the plant extracts and were placed on to 3 different spots surface of agar plat. The diameter of zone of inhibition was measured in mm using a ruler and results were recorded.

Results and Discussion

Table.1 Antibacterial activity of zinc oxide nanoparticle prepare from Ginger extracts of different concentrations against E.Coli, S.Typhi, Shingella SP

Inhibition zone	**Solutions of different concentrations**		
	1000µg	*500µg*	*250µg*
E.Coli	9	14	16
Salmonella typhi	10	12	14
Shingella SP	8	6	8
Staphylococus	13	11	13
Klebsiella phemonial	11	15	17

Conclusion

The result of this research has demonstrated that *Z. Officinale* could become promising natural antimicrobial agents with potential application in therapeutic drugs for controlling the pathogenic bacteria. Inhibition of both Gram-positive and Gram-negative organisms by this plant extract depicts that it can serve as a source of broad spectrum antibiotics, which justified the traditional use of this plant for therapeutic purposes.

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