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Antibacterial And Antifungal Activity of Acacia Nilotica Assisted Strontium Nanoparticles

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ABSTRACT

Aim: The aim of the study is to identify the antibacterial and antifungal activity of Acacia nilotica assisted strontium nanoparticles.
Method: Antibacterial activity of respective nanoparticles against the strain Staphylococcus aureus, Bacillus, and E.coli. Mueller Hinton Agar was utilised for this activity to determine the zone of inhibition using Muller Hinton agar.

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KEYWORDS:
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INTRODUCTION

Plants and items made from plants have long been used as folk cures for a variety of illnesses due to their extraordinary therapeutic potential.

A blooming tree in the Fabaceae family, Acacia nilotica is also referred to as Vachellia nilotica, babul, thorn mimosa, Egyptian acacia, and thorny acacia. It is native to the Middle East, Africa, and the Indian subcontinent. Traditional healers in Chhattisgarh, India, employed the leaves of A. nilotica to treat bone, skin, and mouth cancers. In many parts of Africa, the bark and gums are also utilised to cure malignancies of the testicles, eyes, or ears. Numerous bioactive substances, including gallic acid, kaempferol, naringenin, and catechin, to name a few, are found in Acacia spp.

In a variety of fields, including biology and medicine, drug delivery, electronics, biosensors, catalysts, industrial and agricultural research, the application of nanoparticles is constantly growing. Among all nanoparticles, metallic nanoparticles have garnered the greatest attention recently because of their unique physical and chemical characteristics. Strontium is a metallic element in Group II of the periodic table, much like calcium and magnesium. Strontium is frequently used as a calcium signalling stimulant, growth promoter, and bone regenerator. Since then, strontium-based nanoparticles have piqued interest in the disciplines of medicine and dentistry due to a shared property with calcium. In addition to having antibacterial qualities, strontium-conjugated nanoparticles are efficient at removing hazardous chemicals from industrial waste water.

Candida albicans is used as a test pathogen by agar well diffusion assay. Rose Bengal Agar is used to prepare the fungal medium. The prepared and sterilised medium was swabbed with test organisms and nanoparticles with different concentrations (25µL, 50 µL ,100 µL)were added to the wells and in the fourth well standard antibiotic fluconazole was loaded. The plates were incubated at 37˚C for 48-72 hours. After the incubation time the zone of inhibition was measured.

Human oral, gastric, vaginal, and skin mucosal surfaces all harbour the yeast fungus Candida albicans, which is considered to be commensal. C. albicans can turn into an opportunistic pathogen and cause crippling mucocutaneous disease and/or life-threatening systemic infections as a result of antibiotic-induced dysbiosis, iatrogenic immunosuppression, and/or medical interventions that compromise the integrity of the mucocutaneous barrier and/or disrupt protective host defence mechanisms.

The nosocomial and community-acquired infections caused by Staphylococcus aureus place a heavy cost on the healthcare system. The development of a mature biofilm by S. aureus on host tissue and medical implants is crucial to the persistence of chronic infections. These infections are challenging to treat because the development of a biofilm and the encapsulation of cells in a polymer-based matrix reduces the susceptibility to antimicrobials and immunological defences. Dispersal of cells from the biofilm during infection can cause the infection to spread to additional sites and get worse.

Escherichia coli serves as an example of a flexible bacterial species that includes both benign commensal bacteria and several pathogenic variations that can inflict extraintestinal or intestinal diseases on humans and a variety of animal hosts. E. coli is an excellent model organism to study bacterial evolution and adaptability to various growing circumstances and habitats because of its wide range of phenotypes and lifestyles.

However, strain typing and risk assessment are both hampered by the diversity of genes and phenotypes. The significant genomic flexibility that underlies this species' high degree of variety.

MATERIALS AND METHODS

Antibacterial Activity

Antibacterial activity of respective nanoparticles against the strain Staphylococcus aureus, Bacillus, and E.coli. Mueller Hinton Agar was utilised for this activity to determine the zone of inhibition. Mueller hinton agar was prepared and sterilised for 15 minutes at 121oC. Media poured into the sterilised plates and let it stable for solidification. The wells were cut using a 9mm sterile polystyrene tip and the test organisms were swabbed. The nanoparticles with different concentrations (25µL, 50 µL ,100 µL)were loaded and in the fourth well standard antibiotic amoxyrite was loaded. The plates were incubated for 24 hours at 37 °C. After the incubation time the zones of inhibition were measured.

Antifungal activity

RESULT AND DISCUSSION

Table 1

	25µL	50µL	100µL	control
Candida albicans	12	14	15	14
Staphylococcus aureus	9	9	10	40
Escheria coli	10	10	11	20
Staphylococcus mutans	9	9	9	20

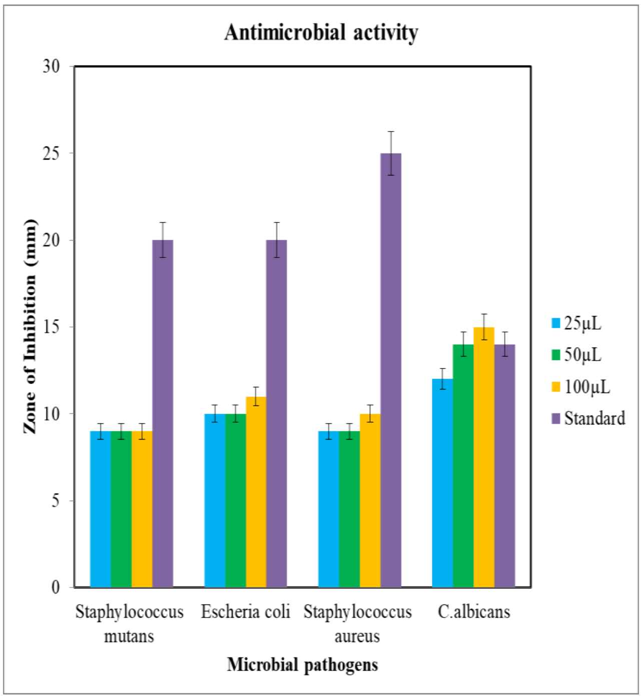

Figure 1: Plant Preparation

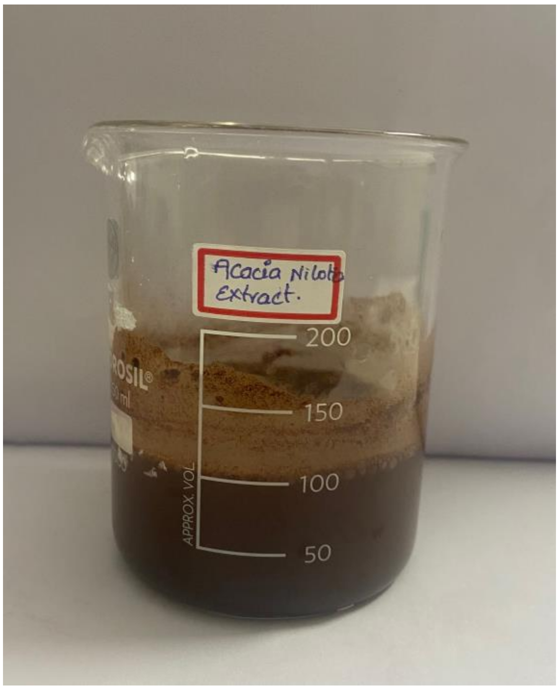

Figure 2: Preparation Of Nanoparticles

Figure 3: Acacia Nilotica Strontium Extract

Figure 4

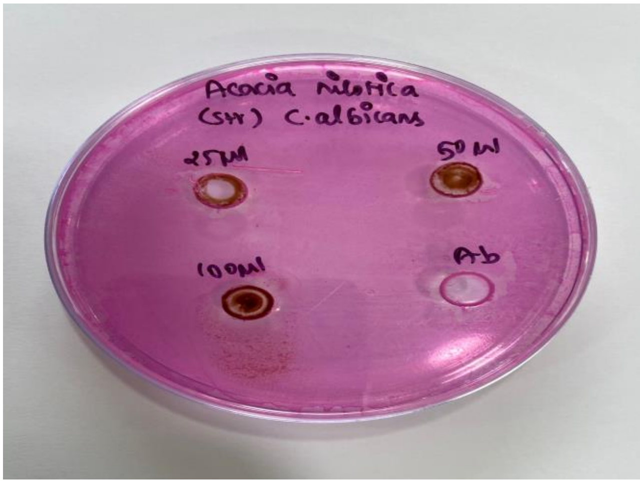

Figure 5

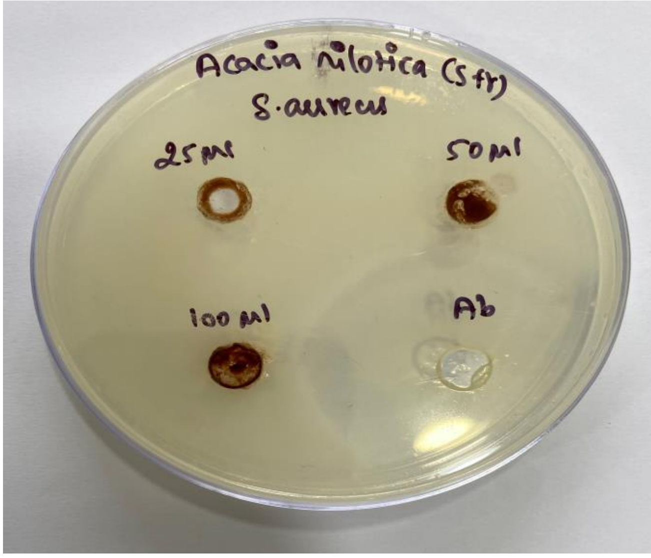

Figure 6

Figure 7

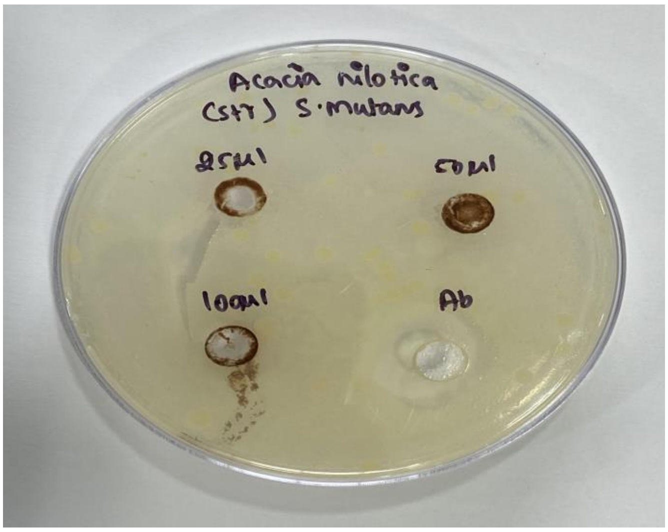

Figure 8

Studies by Ali Mahmoud Muddathir et al.in the year 2020 tested the properties of A. nilotica against oral bacteria and concluded that A. nilotica bark, besides their antibacterial potentiality and GTF inhibitory activity, it may be used as adjuvant antioxidants in mouthwashes

Another study by Rokaia in 2020 focused on the anti-biofilm activities of this extract. They concluded that the plant extract significantly reduced the biofilm activity of E. coli, K. pneumoniae, P. mirabilis, and P. aeuroginosa by 62.6, 59. 03, 48.9 and 39.2%, respectively. The challenge to improve the production of A. nilotica phytochemicals is considered a very low price for the return.

John V Anyam in the year 2021 extracted Two New Antiprotozoal Diterpenes From the Roots of Acacia nilotica. The compound displayed high activity, particularly against T. brucei, T. evansi, and L. mexicana (0.88-11.7 μM) but only a modest effect against human embryonic kidney cells and no cross-resistance with the commonly used melaminophenyl arsenical and diamidine classes of trypanocides. The effect of compound 4 against L. mexicana promastigotes was irreversible after a 5-h exposure, leading to the sterilisation of the culture between 24 and 48 h.

CONCLUSION

From the above study it can be concluded that Acacia nilotica is good anti-bacterial and anti-fungal agent.The plant extract significantly reduced the activity of E.coli, Staphylococcus aureus, Staphylococcus mutans, Candida albicans. So it's an potent anti bacterial and antifungal agent.

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