Microbial synthesis of silver nanoparticles and its effect on plant growth promoting bacteria

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Introduction

Globally, the significance and demand for environment-friendly technologies have grown, which has accelerated the advancement of techniques for creating nanoparticles utilizing biological agents. The field of nanotechnology is also being explored as a new source of key improvements in the agricultural sector. Agriculture plays a significant role in the overall socio-economic fabric of India. Soil microorganisms play an important role in agricultural productivity . Due to these properties, plant growth-promoting bacteria are used as soil inoculants to increase agricultural productivity. Biogenic synthesis of metal nanoparticles is a more reliable method than any other green synthesis process due to their high growth rate, ease of cultivation, and ability to grow in ambient temperature, pH, and pressure conditions(2). The present study show microbial synthesis of silver nanoparticles and its effect on beneficial bacteria.

Methodology

The present study shows the microbial synthesis of silver nanoparticles from plant growth-promoting bacteria(PGPR). During the microbial formulation of silver nanoparticles, silver nitrate salt solution was added to the bacterial culture supernatant. The flask was kept in an incubator shaker at 28 °C and 120 rpm. The formation of silver nanoparticle was observed by change in colour. Further, synthesized silver nanoparticles were characterized and confirmed by UV-Vis Spectrophotometric analysis and FTIR. The effect of synthesized silver nanoparticles was checked on different PGPR strain at various concentration by macrodilution method(1)

Results

The synthesized silver nanoparticle was visually confirmed by color change from colorless to reddish brown(Fig1a). UV-Vis Spectrophotometric analysis showing an absorbance peak at 440nm which confirm silver nanoparticle formation. In this study(Fig1b), FTIR analysis was carried out to figure out the possible molecules associated with the formation of nanoparticles. This is evident from the FTIR spectrum of AgNPs which gave peaks at 3 510 cm^{-1} corresponding to the OH stretch of carboxylic acid and 1 636 cm^{-1} corresponding to N-H bending of primary amines.(Fig 1c). FESEM was done and size of synthesized nanoparticle was found to be 20µm.

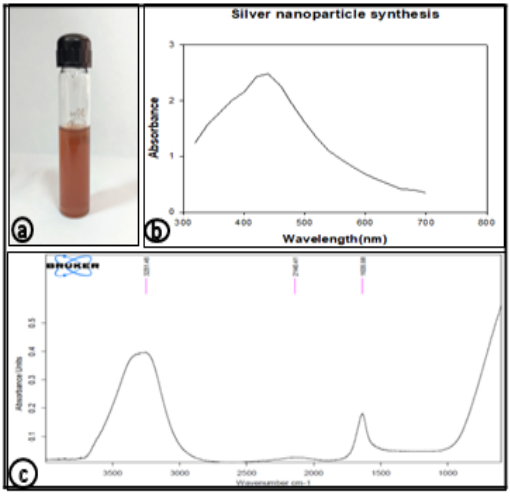

Fig.1. Formation of silver nanoparticles :**a** -appearance of shiny reddish brown colour: **b** - UV-Vis Spectrophotometric analysis : **c-** FTIR analysis

The effect of synthesized silver nanoparticle was checked on growth of different pgpr strains.. *It was found that Rhizobium species* , *Burkholderia dolosa*, *Rhizobium aegyptiacum* show highest growth at 8µg/ml, 12 µg/ml, 20 µg/ml respectively.

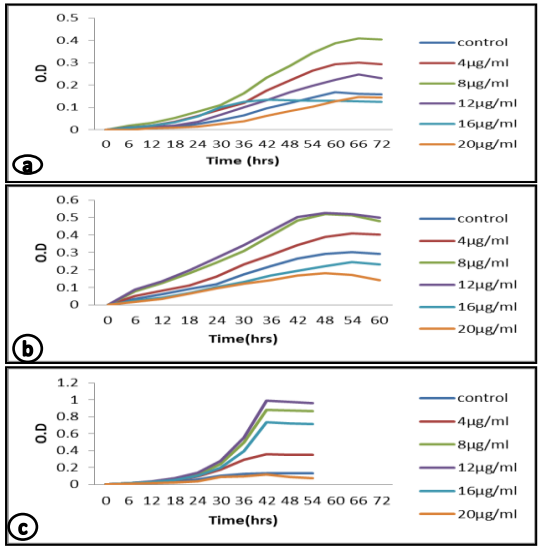

Fig 2. The graphs show effect of silver nanoparticle on PGPR growth: a – *Rhizobium species*,: b – *Burkholderia dolosa*: *c- Rhizobium aegyptiacum*

Conclusion

Silver nanoparticle was succesfully synthesized from bacteria and characterized. Furthermore findings show that synthesized silver nanoparticles help in growth promotion of plant growth promoting bacteria at optimum concentration.

References:

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