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Biosynthesis of silver nanoparticle by *Erwinia carotovora* for Nanobiosensor fabrication

Dr. E JamunaDOI: <https://doi.org/10.22271/chemi.2021.v9.i2b.11721>**Abstract**

The development of reliable technology for the biosynthesis of silver nano particle using microorganism is an important aspect in the current scenario. The study was conducted at the Department of Agricultural Microbiology, Tamil Nadu Agricultural University. In this study the silver nitrate was used as the substrate for the biosynthesis of silver nanoparticle using *Erwinia carotovora* soft rot inducing pathogen in banana. The test strain was cultivated in nutrient broth for a period of 24 h. Different concentrations of silver nitrate were added to the supernatant of the test culture and 10 mM concentration was found optimum for the biosynthesis of silver nanoparticle. The silver nanoparticle was characterized by UV Visible spectroscopy and scanning electron microscope. The characterization with UV visible spectroscopy was found to be a useful technique for the analysis of nanoparticle, the broad plasmon peak at 390 and 410 nm was observed for the silver nanoparticle synthesized using *Erwinia carotovora*. SEM micrograph recorded a particle size of 50 – 100 nm. The silver nanoparticle synthesized was further utilized for the fabrication of nanobiosensor for the detection of *Erwinia carotovora*.

Keywords: *Erwinia carotovora*, silver Nanaoparticle**Introduction**

Nanotechnology is an emerging field in the area of interdisciplinary research, especially in biotechnology. An important area of research in nanotechnology is the biosynthesis of nanoparticle such as nanosilver. The synthesis of silver nanoparticle extensively studied using chemical and physical methods, but the development of reliable technology to produce nanoparticle is an important aspect of nanotechnology. Biologically synthesised silver nanopartilce provides a wide range of environmentally acceptable methodology at low cost production and with minimum time requirement. It has many applications such as spectrally selective coatings for solar energy absorption and intercalation material for electrical batteries (Joerger *et al.*, 2001) ^[2], as optical receptors (Schultz *et al.*, 2000) ^[5], catalysts in chemical reactions, biolabelling (Hayat, 1989) ^[1] etc. microbial source to produce the silver nanoparticle shows the great interest towards precipitation of nanoparticle due to its metabolic activity. Currently in the field of nanoparticle synthesis and assembly the focus have been turned to the biological systems for inspirations (Simkiss and Wilbur, 1989; Mann, 1996) ^[3, 7]. In the present study, microbial biosynthesis of silver nanoparticle was investigated using *Erwinia carotovora* and the characterisation of the sysnthesised particle was done with UV visible spectrophotometer and scanning electron microscope.

Materials and Methods**Preparation of cell free extract**

The test strain used was *Erwinia carotovora* soft rot causing pathogen in banana. The strain was inoculated in nutrient broth and incubated at 37 °C for 24 hours. After the incubation period the culture was centrifuged at 12000 rpm and their supernatant was used for further experiment.

Biosynthesis of silver nanoparticle

Silver nitrate solution at different concentrations *viz.*, 1mM, 5 mM, 10mM, 15mM and 20mM was used. The silver nitrate solution was added to the reaction vessels containing supernatants (1% v/v). Periodically aliquots of the reaction solution was removed and the absorption was

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measured using UV-Visible spectrophotometer. Further the silver nanoparticle was characterised by scanning electron microscope.

Results and Discussion

The appearance of brown colour evident that the formation of silver nanoparticle in the reaction mixture and the efficient reduction of the silver ions (Sastry *et al.*, 2002) ^[4, 6] (Fig1). The colour of the supernatant changed from pale yellow to brown colour after addition of the silver nitrate solution and there was gradual increase in the colour intensity with increase in the duration. Thus it was evident that the metabolites excreted by the culture exposed to silver could reduce silver ions, clearly indicating that the reduction of the ions occur extracellularly through reducing agents released in to the solution by the culture.

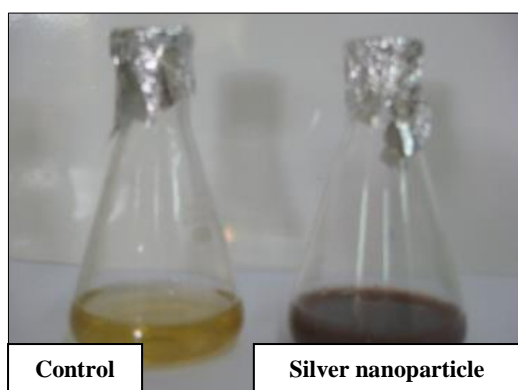


Fig 1: The colour of the supernatant changed from pale yellow to brown colour after addition of the silver nitrate solution and there was gradual increase in the colour intensity with increase in the duration

The reducing agents were believed to be the protein molecules and the enzymes produced by the microorganism. The silver nanoparticles were characterised by UV-Visible spectrophotometer. This technique has proved to be a very useful technique for the analysis of nanoparticle. A strong broad surface plasmon peak at 390 to 410 nm for the nanopartilce synthesised by *Erwinia carotovora* was observed (Fig. 2). Shankar *et al.*, (2003) ^[6] suggested that at 370 nm corresponded to the transverse plasmon vibration in silver nanopartilces whereas peak at 390 nm may be due to longitudinal plasmon peak. A long tailing on the large wavelength side may be due to small amount of aggregation. The spectrum with bands in this range has been associated with the surface plasmon resonance of nano sized metal, confirming the occurrence of silver nanoparticle in the culture solution after exposure to UV light. The SEM photograph of the silver nanopartilces were given in fig.3.

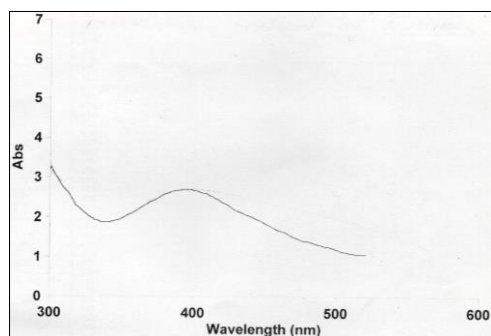


Fig 2: The absorbance spectrum of silver nanoparticle synthesis by *Erwinia carotovora*

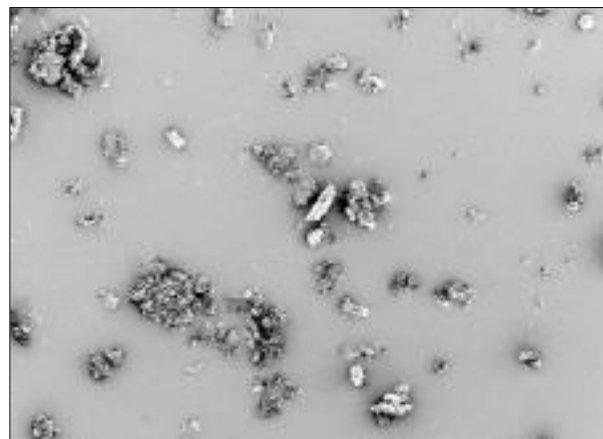


Fig 3: Scanning electron microscope image of silver nanoparticles synthesised by *Erwinia carotovora*

Conclusion

To our knowledge this is the first report for the synthesis of silver nanoparticle using *Erwinia carotovora*. The synthesised nanopartilces were further utilised for the fabrication of nanobiosensor the diagnosis of the pathogen at field condition and thereby preventing the emergence of the disease at later condition.

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