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Green Synthesis of Metallic Nanoparticles using Aqueous Plant Extract and their Antibacterial Activity

S. Saranya[1*], A. Eswari[2], E. Gayathri[2], S. Eswari[3] and K. Vijayarani[1]

[1]Department of Animal Biotechnology, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai-600007, India
[2]Department of Biotechnology, St. Joseph's College of Engineering, Chennai-600119, India
[3]Department of Veterinary Physiology, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai-600007, India
**Corresponding author email id: s.saranyabiotec@gmail.com*

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A B S T R A C T

Plant extracts from *Musa ornate* and *Zea mays* were used for the green synthesis of Copper (Cu) and Zinc oxide (ZnO) nanoparticles (NPs) from copper chloride and zinc sulphate solution respectively. Green synthesized metallic nanoparticles were characterized by UV–visible spectrophotometer, X-ray diffractometer (XRD), Fourier Transform Infra-Red spectrophotometer (FTIR), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM) and Zeta potential particle size analyser. Optimum parameters such as precursor salt solution concentration, pH, ratio between reducing agent and precursor salt solution and reaction time, the formation and stability of the reduced metal nanoparticles in the colloidal solution were monitored by UV–visible spectrophotometer analysis. The mean particle diameter of nanoparticles were calculated from the XRD pattern according to the line width of the plane, refraction peak using the Scherrer's equation. FTIR results suggested that possible biomolecules for the reduction of metallic nanoparticles. SEM and TEM analysis showed the formation of well dispersed metallic nanoparticles and the synthesized metallic nanoparticles were in nano scale range. Antimicrobial activities of the metallic nanoparticles were performed by well diffusion method against *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus agalactiae* and *Salmonella enterica*. Metallic Cu and ZnO NPs synthesized had antimicrobial activity against pathogenic bacteria and highest antimicrobial activity was found with Cu NPs synthesized using *Musa ornate* flower sheath against *Staphylococcus agalactiae*.

Introduction

Nanotechnology is an emerging area of science and synthesis of nanoparticles (NPs) has been the most important step in the field of nanotechnology (Albrecht *et al.,* 2006). In the field of biology, nanoparticles have a variety of applications as vaccine/drug delivery systems, minerals, antibacterials, etc. A wide range of chemical and physical methods are being used for the synthesis of nanoparticles. Nevertheless, these methods have few constraints like the use of toxic solvents, high energy consumption, hazardous by products, etc. Biological synthesis of NPs has been found to be more advantageous than physio-chemical synthesis since biological synthesis is cost effective, environment