

Intracellular Biosynthesis Of Au And Ag Nanoparticles Using Ethanolic Extract Of *Brassica Oleracea* L. And Studies On Their Physicochemical And Biological Properties

Palaniselvam Kuppusamy¹, Solachuddin J.A. Ichwan², Narasimha Reddy Parine³, Mashitah M. Yusoff¹, Gaanty Pragas Maniam¹, Natanamurugaraj Govindan¹

¹Biomaterial and Biosensor Laboratory, Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak 26300 Gambang, Kuantan, Pahang, Malaysia

²Kulliyah of Dentistry, International Islamic University Malaysia, Bandar Indera Mahkota 25200, Kuantan, Pahang, Malaysia

³Genome Research Chair, Department of Biochemistry, College of Science, King Saud University, Riyadh 12372, Saudi Arabia

ABSTRACT

In this present study, we reported broccoli (*Brassica oleracea* L.) as a potential candidate for the synthesis of gold and silver nanoparticles (NPs) in green chemistry method. The synthesized metal nanoparticles are evaluated their antimicrobial efficacy against different human pathogenic organisms. The physico-chemical properties of gold nanoparticles were analyzed using different analytical techniques such as a UV–Vis spectrophotometer, Field Emission Scanning Electron Microscopy, energy dispersive X-ray spectroscopy, X-ray diffraction and a Fourier Transform Infrared spectrophotometer. In addition, gold and silver NP antimicrobial efficacy was checked by disc diffusion assay. UV–Vis color intensity of the nanoparticles was shown at 540 and 450 nm for gold and silver nanoparticles respectively. Higher magnification of the Field Emission Scanning Electron Microscopy image shows the variable morphology of the gold nanoparticles such as spherical, rod and triangular shapes and silver nanoparticles were seen in spherical shapes. The average spherical size of the particles was observed in 24–38 nm for gold and 30–45 nm for silver NPs. X-ray diffraction pattern confirmed the presence of gold nanoparticles and silver nanoparticles which were crystalline in nature. Additionally, the functional metabolites were identified by the Fourier Transform Infrared spectroscopy. IR spectra revealed phenols, alcohols, aldehydes (sugar moieties), vitamins and proteins are present in the broccoli extract which are accountable to synthesize the nanoparticles. The synthesized gold and silver NPs inhibited the growth of the tested bacterial and fungal pathogens at the concentration of 50 µg/mL respectively. In addition, broccoli mediated gold and silver nanoparticles have shown potent antimicrobial activity against human pathogens.

KEYWORDS: Biosynthesis; Broccoli extract; Gold; Silver nanoparticles; Antimicrobial

DOI: [10.1016/j.jes.2014.06.050](https://doi.org/10.1016/j.jes.2014.06.050)