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RESEARCH ARTICLE

Biogenesis of Gold Nanoparticles Using Plant Powders and Assessment of In Vitro Cytotoxicity in 3T3-L1 Cell Line

Duraisamy Kalpana · P. B. Tirupathi Pichiah · Arunachalam Sankarganesh · Whoa Shig Park · Seok Myon Lee · Rizwan Wahab · Youn Soo Cha · Yang Soo Lee

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Abstract Gold nanoparticles were used in various biological applications for their structural and functional properties. For the application of gold nanoparticles in biological applications, the cytotoxicity of gold nanoparticles should be validated. Gold nanoparticles were biosynthesized using the three plant powders obtained from leaves of *Torreya nucifera*, *Cinnamomum japonicum*, and *Nerium indicum*. UV–vis spectroscopic analysis ensured the formation of gold nanoparticles and Bio-TEM analysis revealed the size and spherical shape of gold nanoparticles. XRD pattern with the reflection planes (111), (200), (220), and (311) confirmed the face cubic centered structure of biosynthesized gold nanoparticles. Aromatic compounds and proteins were found to be responsible for the bioreduction of gold salt to gold nanoparticles and stabilization of synthesized gold nanoparticles from the FTIR analysis. The synthesized nanoparticles were tested for in vitro cytotoxicity using 3T3-L1 cell lines. The nanoparticles, synthesized using ecofriendly plant powders exhibited low level of cytotoxicity even at higher concentrations of 10 μg/ml. This validates that the synthesized molecules are not toxic and they can be analyzed for various biomedical applications.

Keywords Gold nanoparticles · XRD · FTIR · Cytotoxicity · 3T3-L1 cell line

D. Kalpana · Y. S. Lee (✉)
Department of Forest Science and Technology, Institute of Agricultural Science and Technology, Chonbuk National University, Jeonju, South Korea
e-mail: ysoolee@chonbuk.ac.kr

P. B. T. Pichiah · Y. S. Cha
Department of Food Science and Human Nutrition, Chonbuk National University, Jeonju, South Korea

A. Sankarganesh
Department of Pediatrics, Medical School, Chonbuk National University, Jeonju, South Korea

W. S. Park · S. M. Lee
Jeonnam Forest Resource Research Institute, Naju 520833, South Korea

R. Wahab
College of Science, Department of Zoology, King Saud University, Riyadh, Saudi Arabia

Introduction

Nanotechnology, one of the technological innovations of twenty-first century is developing rapidly throughout the world. The nanomaterials have been used as fluorescent biological labels [1, 2], in drug delivery [3], detection of proteins [4], tissue engineering [5], separation, and purification of biological molecules and cells [6–10]. Gold nanoparticles are as well used in the biomedical applications such as regulation of intracellular gene [11], electrochemical biosensor for detection of DNA sequence [12], chemotherapeutic agents [13], drug delivery [14, 15], other applications like detection of gene mutation [16] and identification of bacteria from clinical specimens [17]. The surface plasmon absorption property along with the technique of conjugation of gold nanoparticles with DNA can be applied in various biomolecular applications like labeling, detection, transfer of drugs, and even the genetic materials. By optimizing spectroscopic, fluorescence, luminescence, and electrochemical characteristics of the gold nanoparticles with biological molecules such as DNA sugars, many sensors are designed [18].

Spherical nanoparticles are generally produced in a controlled manner by simple reduction of metal salt solutions by using reducing agents. Spheres are considered as the lowest energy shapes and the spherical gold nanoparticles are commonly prepared by one of these methods; Turkevich method, where citrate is used to reduce gold chloride in boiling water