

Synthesis, Characterisation and DFT Studies of Stigmasterol Mediated Silver Nanoparticles and Their Anticancer Activity

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Abstract The present investigation reports the facile, reproducible and eco-friendly biological synthesis of nano silver using *Ficus Hispida* leaf extract (FHLE) as a reductant. The properties of the synthesized silver nanoparticles (Ag-NP's) is characterized by scanning electron microscopy, energy dispersive X-ray spectroscopy, transmission electron microscopy (TEM), UV-visible spectroscopy, Fourier transform infrared spectroscopy and X-ray diffraction studies. The synthesized Ag-NPs are found to have spherical shape with average particle size in the range of 50–100 nm. The XRD studies and selected area electron diffraction pattern of TEM images confirm the face centered cubic structure of biosynthesised silver nanoparticles. The DFT studies reveal that the stigmasterol present in FHLE is responsible for leaf extract to behave as a reducing agent for reduction of Ag⁺ ions into Ag⁰. The antitumor studies against DLA cell lines of the biosynthesized Ag-NPs is found to have 100% inhibition with concentration of 200 µg/ml of Ag-NP's.

Keywords Silver nanoparticles · *Ficus Hispida* · DFT studies · Cytotoxicity activity

1 Introduction

Metal nanoparticles finds highlighted applications on the various fields of medicinal research because metal nanoparticles show unique and comparably better physical, chemical and biological properties than their macroscopic counterparts due to high surface to volume ratio. The widely used metal nanoparticles in medicinal research are those derived from the valuable metals such as silver [1], gold [2] and platinum [3]. The different morphological feature of metal nanoparticles finds applications in the various fields such as environmental chemistry, material science, diagnosis and treatment of diseases [4–6]. Several methods have been employed for synthesising of silver nanoparticle [7]. Maribel et al. reported the synthesis of silver nanoparticles by reduction in solutions [8]. Decomposition of silver compounds by heat [9] is reported by Navaladian et al., Sreeram et al. worked on the microwave assisted synthesis [10], laser mediated synthesis [11], and biological reduction methods [12]. Synthesis of silver nanoparticles from plant species is widely accepted because of its cost effective, environmentally friendly and plants are widely distributed with a range of metabolites. As compared to the available methods, the biosynthesis application would provide better advancement due to its low cost, eco-friendly, low environmental impact and single step synthesis without involving any hazardous solvents. *Ficus Hispida* (FH) belongs to the family of Moraceae and it is commonly known as a devil fig, hairy fig etc. In Tamil the plant is known as peyatti. FH is a moderate size tree known for its edible fruits and folklore value. Traditionally, the different parts of the plant are known to have medicinal activity and widely used for treatment of various diseases like ulcers, psoriasis, anaemia, diabetes, convulsion, hepatitis, dysentery etc. FH is found to possess bioactive groups like alkaloids, sterols, phenols, flavonoids.

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