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BIOSYNTHESIS OF SILVER NANOPARTICLES USING MINTS LEAF EXTRACT AND EVALUATION OF THEIR ANTIMICROBIAL ACTIVITY

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ABSTRACT : The aim of this study is to synthesize an easy, non-toxic and eco-friendly method. Silver nanoparticles which were synthesized by leaf extract of mint were characterized by UV-Visible Spectroscopy which appears UV-Visible spectrum of demonstrated a peak 448 nm corresponding to surface Plasmon resonance of silver nanoparticles, Fourier Transform Infrared Spectroscopy (FTIR); functional groups involved in the silver nanoparticles synthesis were identified, the presence of silver nanoparticles was confirmed by X-ray diffraction (XRD) and Atomic Force Microscope (AFM) analysis clearly illustrated that the shape of silver nanoparticles was spherical and the size of the silver nanoparticles has been measured as 55- 85 nm. Evaluation of its antimicrobial activity, the resulted showed that efficiency inhibitory activity against bacteria and fungi, silver nanoparticle showed a greater effect on *Staphylococcus aureus* at a concentration of 150 µg/ml which reached in diameter of the inhibition zone 18.5 mm. whereas in fungi, *Candida utilis*at a concentration of 150 µg/ml, which reached in diameter of the inhibition zone 18mm.

Key words : Silver nanoparticles, antimicrobial, mints, AFM, XRD.

INTRODUCTION

Nanotechnology is the concept that research and development on new material in size between 1-100 nm, this technology is capable of providing different novel applications that range fromfood processing and agricultural production to sophisticated medicinal techniques (Bawa *et al*, 2016). Nanoparticles have been used as therapeutic agent, imaging diagnosis and delivery vehicles for drugs and genes. It can interact with biological systems as the molecular level and allow targeted delivery and passage through biological barriers (Sahoo *et al*, 2017). In recent years, synthesis of metal nanoparticles has been demonstrated by many physical and chemical means, but the importance of biological synthesis is being emphasized globally at present because chemical methods are toxic, expensive, non eco-friendlyand have low productivity (Shah *et al*, 2015). Biological methods involve the synthesis of silver nanoparticles using extracts from organisms as reductant and capping agents (Li *et al*, 2007). There are some examples of synthesizing nanomaterials using plants, including the use of live alfalfa to synthesize gold and silver nanoparticles, and *Acorous calamus* rhizome extract to synthesize silver nanoparticles, the rhizome has a rich profile of bioactive compounds including alkaloids, flavonoids, triterpenes and phenolic compounds (Gardea-Torresdey *et al*, 2003; Nakkala *et al*, 2014).In addition to silica nanoparticles were synthesizedby extract of *Thuja orientalis* leaf (AL-Azawi *et al*, 2019). Silver nanoparticles are one of the fastest growing product categories due to wide range of applications (Marambio-Jones and Hoek, 2010).*Mentha longifolia* L. is genus (Lamiaceae) comprises more than25 species. The cultivation of mint is principally in temperate regions of Europe and Asia but also in South Africa, Australia and the United States. *Mentha* species is an important aromatic plantwith economical benefits in food, medicine and cosmeticsas well as antiseptic, anticarcinogenic,expectorant, calming, diuretic effects,and effects against common cold, indigestion, nausea,and sore throat(Russo *et al*, 2015; Sevindik *et al*,2017, Babaeian *et al*, 2017). Mentha is known to produce a wide range of natural terpenoids named menthol ($C_{10}H_{20}O$) found in the essential oils of the mints family (*Mentha* spp.). Flavonoid, terpenoid and alkaloids compounds present in the extract were claimed to be responsible for reduction and stabilization of nanoparticles (Fatiha *et al*, 2015; Santhoshkumar *et al*, 2017; Huang *et al*, 2007). The mechanism of the bactericidal effect of silver nanoparticles may attach to the surface of the cell membrane disturbing permeability and respiration functions of the cell, antibacterial properties of silver particles are size dependent with smaller particles exhibiting a greater effect