



Biosynthesis of gold nanoparticles (AuNPs) by green method and its application in electrochemistry

Maryam Khayatkashani^{1,4}*Omid Sadeghpour², Amir Hossein Jamshidi³, Esmael Nazem⁴

¹ Talae Sabz Tuba Pharmaceutical, Tehran, Iran

² Research Institute for Islamic and Complementary Medicine, School of Iranian Traditional Medicine, Iran
University of Medical Sciences, Tehran, Iran

³ Food and Drug Organization, Food and Drug Laboratories Research

⁴ School of Traditional Medicine, Tehran University of Medical Sciences, Tehran, Iran
Center, Tehran, Iran

ABSTRACT

This study reports a green method for the synthesis of gold nanoparticles (AuNPs) using the aqueous extract of Salix aegyptiaca extract. The effects of gold salt concentration, extract concentration and extract quantity were investigated on nanoparticles synthesis. Novel methods of ideally synthesizing AuNPs are thus thought that are formed at ambient temperatures, neutral pH, low costs and environmentally friendly fashion. AuNPs were characterized with different techniques such as UV-vis spectroscopy, FT-IR spectroscopy, X-ray diffraction, and TEM. FT-IR spectroscopy revealed that gold nanoparticles were functionalized with biomolecules that have primary carbonyl group, -OH groups and other stabilizing functional groups. TEM experiments showed that these nanoparticles are formed with various shapes and X-ray diffraction pattern showed high purity and face centered cubic structure of AuNPs. For electrochemical properties of AuNPs, a modified glassy carbon electrode using AuNPs (AuNPs/GCE) was investigated. The results show that electronic transmission rate between the modified electrode and $[Fe(CN)_6]^{3-/4-}$ increased.

Keywords: *Salix aegyptiaca*; Gold nanoparticles, biosynthesis, Electrochemistry

1. INTRODUCTION

Green processes with the use of economic, efficient and ecofriendly are gaining much importance due to the benefits associated with their use. Several plants have been studied for green synthesis of nanoparticles. The extracts of Rosa damascena [1], Geranium [2], Emblica Officinalis [3] Lemongrass [4], Chenopodium album leaf [5] and etc have shown potential in reducing metals. In the present study, we report the synthesis of AuNPs by the reduction of gold ions using *Salix aegyptiaca* extract.

Salix aegyptiaca (musk willow) is a *Salix* species that is cultivated in the Middle East and concoctions from the bark, leaves, and essence from the flowers are consumed widely as health drinks. the extracts of *Salix aegyptiaca* have potent antioxidant activity. Because many of these antioxidants also have potent anticancer properties, the ethanolic extract from the bark of *Salix aegyptiaca*, with the highest antioxidant and antiproliferative profile, was investigated for its effects on colorectal cancer. Catechol, catechin, and salicin were found to be the main constituents of the extract in addition to smaller amounts of gallic acid, epigallocatechin gallate (EGCG), quercetin, coumaric acid, rutin, syringic acid and vanillin [6].

Catechin is a flavan-3-ol, a type of natural phenol and antioxidant. It is a plant secondary metabolite. Catechin possesses two benzene rings and a dihydropyranheterocycle with a hydroxyl group on carbon 3. Electrochemical experiments show that catechin oxidation mechanism proceeds in sequential steps, related with the catechol and resorcinol groups and the oxidation is pH-dependent. The oxidation of the catechol 3',4'-dihydroxyl