DOI : 10.35124/bca.2019.19.2.3409

Biochem. Cell. Arch. Vol. 19, No. 2, pp. 3409-3414, 2019 | www.connectjournals.com/bca | *ISSN 0972-5075*

SYNTHESIS AND CHARACTERIZATION OF GOLD – SILVER AU/AG- CORE-SHELL NANOPARTICLES BY COLD ATMOSPHERIC PRESSURE PLASMA

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(Received 9 May 2019, Revised 16 August 2019, Accepted 27 August 2019)

ABSTRACT : In this study we successfully synthesized core-shell nanoparticles from gold as core and silver as shell (Au @ Ag CSNPs) using atmospheric non-thermal plasma, by reduction the aqueous solution for gold tetrachloride acid (HAuCl4.3H2O) with different concentrations (0.2, 0.5, 1) mM at time (2 minutes) by reduction the aqueous solution silver nitrate AgNO3 at the same different concentrations and the same time. The investigation for nanoparticles was done by UV/VIS spectroscopy, X-ray diffraction (XRD), atomic force microscopy (AFM), and transmission electron microscopy (TEM).

Key words **:** Core-shell nanoparticles, atmospheric pressure plasma, characterization, silver and gold.

INTRODUCTION

Cold Atmospheric Plasma (CAP) is known as non-thermal because in which the electros have temperature much higher than the other heavy particles that are comparable to the room temperature (less than 40 C°) (Hamid H Murbat *et al*, 2014). Cold atmospheric plasma have wide range of applications in industrial and scientific such as medical applications (Adill Ban H *et al*, 2019 and Ansam Q Gadhban *et al*, 2019), biomedical applications (Atta Reyam R *et al*, 2019 and Stoffels E *et al*, 2006), biological sterilization (Kong M G *et al*, 2009), nanoscience (Hamid H *et al*, 2017 and material processing (Cao Z *et al*, 2009). In the last years, a considerable increase in the scientific interest of metallic structures of nanometric size has been observed. Particularly the surface area to volume ratio, have conducted in the rapid development of their synthesis and characterization way this is the special properties of such nanoparticles (NPs) (Sivaraman S K, Santhanam V, 2011 and Gupta S *et al*, 2007). There are different methods to synthesize the metallic NPs are used in many important fields of science, like medicine (Jain P K *et al*, 2008), biotechnology (West J L, Halas N, 2008), biodiagnostics (Rosi N L, Mirkin C A, 2015), and cosmetology (Saha K *et al*, 2011). Researchers have lead that the bimetallic core-shell nanoparticles (CSNPs) have significantly afflicted magnetic (Zeng H *et al*, 2004 and Park H Y *et al*, 2007), optical (Rodriguez-Gonzalez B *et al*, 2005), catalytic (Zhong C J, Maye M M, 2011 and Jiang H L *et al*, 2011), photoluminescence (Valerini D *et al*, 2005), and electronic properties (Malola S and Hakkinen H, 2011), as contrast to their unattached pure metallic forms (Ghosh Chaudhuri R and Paria S, 2011). Besides, it was decided that the special properties of CSNPs could be tailored by varying the ratio between their core and shell, or by altering the type of the applied material (Rodriguez-Gonzalez B *et al*, 2005 and Ghosh Chaudhuri R and Paria S, 2011).

The Au @Ag CSNPs, existence inorganic / inorganic CSNPs and consisting of an Au core and an Ag shell, have been recognized to show many single optical (Guzel R *et al*, 2010 and Feng L L *et al*, 2010), catalytic (Wang A Q *et al*, 2005), oxidative (Lee J *et al*, 2008), and biosensing properties (Samal A K *et al*, 2013), especially due to the properties of both noble metals nanostructures. The special optical properties of Au @ Ag CSNPs are conditional on the arrangement of the metal core and metals shell. In this state, the AuNPs forms the templates for the Ag nanoshell development (Sinha T, 2015). A set of methods, most include sonochemical, laser ablation mediated, and chemical reduction, have been sophisticated for the synthesis of the Au @Ag CSNPs, both in aqueous or non-aqueous media (Peng Z Q *et al*, 2006 and Furusho H *et al*, 2009). These synthesis methods have common disadvantages are their multi-step capacity and the demand of the addition of decrease agents into the reaction mixtures, which can disorganize the formation of the Ag shell onto the Au core (Ghosh Chaudhuri R and Paria S, 2011). Bearing in mind various applications of the bimetallic Au @Ag CSNPs in the biological arrangement,