

Article

The Fabrication of Gold–Silver Bimetallic Colloids by Microplasma: A Worthwhile Strategy for Counteracting the Surface Activity of Avian Influenza Virus

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Abstract: In the present project, fructose-stabilized gold, silver and gold–silver bimetallic colloids have been synthesized by the electrochemical reduction of $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ (Au precursor) and AgNO_3 (Ag precursor), employing the atmospheric pressure microplasma technique. X-Ray Diffraction patterns of gold–silver bimetallic particles exhibit (111), (200) and (220) planes identical to gold and silver NPs depicting FCC structures. The decrease in the peak intensities of Au–Ag (111) and Au–Ag (200) as compared to those of Au (111) and (200) is due to the formation of Au–Ag alloys. The FE-SEM image of gold–silver bimetallic NPs has revealed an adequate change in morphology as compared to the morphology of gold NPs and silver NPs. The majority of the gold–silver bimetallic NPs are spherical and are uniformly dispersed. The EDS spectra of (Au–Ag) confirm the presence of metallic gold and silver. The appearance of a single Surface Plasmon Resonance (SPR) peak in the UV–VIS absorption spectra of gold–silver colloids and its position in between the SPR peaks of the UV–VIS absorption spectra of gold and silver colloids justify the formation of gold–silver bimetallic alloy particles. In DLS measurements, the size distribution of gold–silver bimetallic colloids carries a narrow range 55 to 117 nm as compared to the size distribution of gold and silver colloids. The compatibility of the sizes of these colloids and the influenza virus belonging to the Orthomyxoviruses family (size range 80–300 nm with different morphologies) are assumed to stand responsible for an effective bio-conjunction with Influenza viruses. Au–Ag bimetallic nanostructures have synergistically improved their antiviral activity against H9N2 influenza virus as compared to monometallic AuNPs and AgNPs. Thus, the Au–Ag nanostructured alliance has been proven to be more effective and is capable of manifesting high antiviral efficacy.

Keywords: microplasma fabrication; bimetallic colloids; nanostructures; analytical techniques; antiviral activity; synergy

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1. Introduction

The influenza virus is a consistent global fear and threat with the potential to cause pandemics worldwide in humans and animals [1]. The Avian Influenza Virus H9N2 belonging to the orthomyxoviridae family was initially isolated from China poultry farms. It had resulted in large-scale economic losses due to the decreased egg production and the increased mortality of chicks in the past [2]. The H9N2 virus has also been a source of sporadic infections in humans in Asia since 1998 [3]. The concerns about its pandemic

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