Proceedings of the 6th World Congress on New Technologies (NewTech'20)
~~Prague, Czech Republic~~ Virtual Conference – August, 2020
Paper No. ICNFA 120
DOI: 10.11159/icnfa20.120

Bio-functionalized (Ag-Ser) Nanoparticle Synthesis and Characterization for Biomedical Platforms

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Extended Abstract

Several nanoparticle synthesis, characterization and functionalization methods are derived by self-assembly of peptides on Ag surface have been used for biomedical applications from drug delivery to biosensor systems [1]. Nanoparticle interaction with biological matrix is greatly affected by the morphology of the particle, surface chemistry, functionalization, and electronic and physicochemical properties. Understanding of biointerface science for nanoparticle and bio-matrix interaction mainly depends on particle size and surface characteristics [2].

Herein, a bio-functionalized nanoparticle synthesis route is designed and accomplished for biomedical applications. Sericin extracted from *Bombyx mori* silk cocoon is used for successfully controlled nucleation and further protection of silver nanoparticles. In the presence of sericin, silver amine complex $[Ag(NH_3)_2]$ + is reduced by sugar thus, stable silver particles are formed and maintain long term functionality such as 4 months at least. Newly synthesized nanoparticles are characterized by using various methods such as UV-visible spectroscopy, dynamic light scattering (DLS), transmission electron microscopy (TEM), and gel electrophoresis. Assembled nanoparticles, spherical in nature, have very narrow ($\sigma=\pm5$) size in distribution and peak at 20 nm. The stability of particles has crucial importance to display functionality in a biological environment. Therefore, measuring absorbance with UV-vis spectroscopy assesses the stability of nanoparticles at various pH and NaCl concentrations to understand agglomeration kinetics of Ag-Ser NPs. Furthermore, critical agglomeration concentration is determined by agarose gel electrophoresis. Subsequently, surface charge of bio-functionalized Ag-Ser NPs is measured by Zeta-potential analyzer. The stabilization mechanism of bio-functionalized Ag-Ser NPs is analyzed by Raman spectroscopy to elucidate the main function of sericin on the synthesis process and molecular weight of extracted sericin is determined by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE).

In order to understand biological efficiency of bio-functionalized Ag-Ser NP on pathogenic microorganisms, the minimum inhibitory concentration assay is carried out and the results indicates that around 3.38 μg/ml of sericin-silver nanoparticle effectively inhibits the growth of *Escherichia coli, Staphylococcus aureus, Pseudomonas aureginosa, Candida albicans*. Comprehensively, the sericin-modified chemical reduction of silver nanoparticles offers easy, non-toxic nanoparticle synthesis with a short reaction time. With this method, the applicability of silver nanoparticles with high stability widens in many biotechnological research fields such as medical, electronics and photonics [3].

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