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Protein-Based Nanoparticles Prepared by Radiation-Induced Cross-Linking

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The powerful of ionizing radiation of electron beam or gamma sources to crosslink polymers has been largely demonstrated. Preparation of crosslinked hydrogels for wound dressing by this technique has important advantage to other chemical process. In addition, ionizing radiation technology has the ability to generate intermolecular or intramolecular crosslinking.
Conversely, for several decades have been demonstrated that irradiation of protein solutions generates mainly degradation products. Only protein solutions in frozen state can be sterilized by gamma rays avoiding protein degradation.
Low amounts of polar solvents can be added to protein solutions without produce denaturation. By Dynamic Light Scattering (DLS) it is possible to follow the protein aggregation process in solution; however this effect is reversible.
In this work, novel methods of Albumin NPs (Alb NPs) and core/shell gold/Albumin NPs (Au/Alb NPs) preparations are shown by radiation induced crosslinking.
Albumin dissolved in ethanol/water solutions were irradiated with ionizing radiation sources (gamma rays or electron beam). In both cases NPs were obtained after irradiation with at least 2 kGys [1,2]. NP size can be modulated with the ethanol concentration. In the same way, core/shell Au/Alb NPs has been prepared by a similar technique. In this case a multilayer of crosslinked Albumin coated the Au NPs.
NPs were characterized by different techniques such as DLS, UV-visible and infrared spectroscopy, transmission electron microscopy and atomic force microscopy. NPs sizes were in the range of 20-40 nm for Alb NPs and 60-80 nm for Au/Alb NPs. In the last case, TEM images showed that the NPs have spherical shape and the presence of a low-density halo around the metal core confirms the presence of Albumin. Using an antigen-antibody recognition analysis was able to demonstrate the biospecificity of the NPs surfaces.

References

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Country/Organization invited to participate

Argentina

Primary author: Mr GRASSELLI, Mariano (Universidad Nacional de Quilmes - IMBICE (CONICET), Argentina)

Co-authors: Ms FLORES, Constanza Y. (Laboratorio de Materiales Biotecnológicos (UNQ-IMBICE-CONICET), Argentina); Ms ACHILLI, Estefania (Universidad Nacional de Quilmes - IMBICE (CONICET), Argentina); Ms SIRI,

Macarena (Laboratorio de Biomembranas (UNQ-IMBICE-CONICET), Argentina); Prof. ALONSO, Silvia del Valle (Laboratorio de Biomembranas (UNQ-IMBICE-CONICET), Argentina)

Presenter: Mr GRASSELLI, Mariano (Universidad Nacional de Quilmes - IMBICE (CONICET), Argentina)

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