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Liposomal Encapsulation of Silver Nanoparticle for Improved Delivery and Enhanced Anticancer Properties

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Abstract : Silver nanoparticles (AgNP) are one of the most widely investigated metallic nanoparticles due to their promising antibacterial activities. In recent years, AgNP research has shifted beyond antimicrobial use to potential applications in the medical arena. This shift coupled with the extensive commercial applications of AgNP will further increase human exposure, and the subsequent risk of adverse effects that may result from repeated exposures and inefficient delivery meaning research into improved AgNP delivery is of paramount importance. In this study, AgNP were encapsulated in a natural bio-surfactant, dipalmitoylphosphatyidyl choline (DPPC), in an attempt to enhance the intracellular delivery and simultaneously mediate the associated cytotoxicity of the AgNP. It was noted that as a result of the encapsulation, liposomal-AgNP (Lipo-AgNP) at 0.625 µg/ml induced significant cell death in THP1 cell lines a notably lower dose than that of the uncoated AgNP induced cytotoxicity. The induced cytotoxicity was shown to result in an increased level of DNA fragmentation resulting in a cell cycle interruption at the S phase of the cell cycle. It was shown that the predominate form of cell death upon exposure to both uncoated and Lipo-AgNP was apoptosis, however, a ROS-independent activation of the executioner caspases 3/7 occurred when exposed to the Lipo-AgNP. These findings showed that encapsulation of AgNP enhances AgNP cytotoxicity and mediates an ROS-independent induction of apoptosis.

Keywords : silver nanoparticles, AgNP, cytotoxicity, encapsulation, liposome
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