373d Encapsulation of Paclitaxel Nanoparticles in a Bio-Macromoleuclar Nanoshell

Alisar S. Zahr and Michael V. Pishko

Drug delivery systems such as polymer-based nanoparticles are currently being designed to incorporate therapeutic drugs within their matrix. A layer-by-layer (LbL) self-assembly technique was used to encapsulate core charged drug nanoparticles of paclitaxel in a polymeric nanoshell. This approach provides a new strategy in the development of polymeric vehicles in controlling drug release and targeting to diseased tissues and cells specific to a human illness, such as breast cancer. Core paclitaxel nanoparticles were fabricated by a modified solvent-evaporation technique to yield nanoparticles with an average size of 300 nm. A nanoshell composed of multilayered polyelectrolytes, chitosan and heparan sulfate, was assembled step wise onto core charged drug nanoparticles. The presence of each adsorbed layer was confirmed by the determination of the zeta potential. A charge reversal upon subsequent deposition confirmed the successful encapsulation of core paclitaxel nanoparticles. To promote a site-specific delivery, magnetic nanoparticles with an average size of 39 nm, were incorporated within the nanoshell using the LbL assembly technique. X-ray photoelectron spectroscopy and zeta potential were used to verify the incorporation of the magnetic nanoparticles. An in vitro cell death assay was performed by incubating magnetically modified core-shell nanoparticles of paclitaxel with breast cancer cells, MCF-7 for 24 and 48 hours. A magnet was placed below the 6-well plates as to promote a magnetically derived drug delivery system. The work presented here focuses on modifying the properties of the nanoshell encapsulating core drug nanoparticles to achieve a site-specific delivery.