450c Phagocytosis of Core-Shell Nanoparticles for Therapeutic Delivery

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A layer-by-layer (LbL) self-assembly technique was used to encapsulate core charged drug nanoparticles 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 cancer. A nanoshell composed of bio-polymers, chitosan, poly-L-lysine, and heparin sulfate, were assembled step wise onto core charged drug nanoparticles. The exterior surface of the nanoshell was functionalized with biocompatible polymer poly(ethylene glycol) (PEG). The novelty in this LbL assembly technique is that the self assembled nanoshell can be modified to facilitate controlled release, biocompatibility and targeting. Drug nanoparticles, within a size range of 314 to 154 nm, of dexamethasone and paclitaxel were fabricated using a modified solvent evaporation technique. Transmission electron microscopy images indicated that the nanoshell was approximately 10 nm, and composed of two polyelectrolyte layers. Characterization of the surface chemistry and charge of the nanoshell utilizing x-ray photoelectron spectroscopy and zeta potential, confirmed the presence of the PEG modified nanoshell. Biocompatibility studies were performed to study the in vitro phagocytosis of the PEG modified drug nanoparticles using a flow cytometric assay. Results from our model drug delivery system, PEG modified fluorescent beads; suggest that a small negative charge and hydrophilicity of the nanoshell result in a decrease in phagocytosis after 24 hours of incubation. The results to date hold promise in using the LbL technique to control the surface chemistry when fabricating a nanoshell for drug delivery applications.