Targeted Core-Shell Nanoassembly Composed of a Mesoporous Silica Core, Liposome Shell, and GE11 Peptide as a Drug Delivery Nanocarrier

Grant, Kailyn (School: Bob Jones High School)

Non-small cell lung cancer (NSCLC) is presently one of the leading causes of cancer deaths in the United States. Common chemotherapy drugs for advanced NSCLC have had low response rates. They exert high cytotoxicity, leading to apoptosis. Anthracycline drugs, like doxorubicin, also have low response rates to chemotherapy due to their cytotoxicity. As with many chemotherapy drugs, they can diffuse freely through cells. This also leads to an inability to achieve adequate therapeutic concentrations of the drug at the tumor site. An approach to improving therapeutic efficacy is localized dose intensification. The rationale is that this method enhances the delivery of effective therapy while minimizing cytotoxic effects. One drug delivery method involves encapsulating drugs into nano-sized carriers. For this project, a drug delivery nanocarrier consisting of mesoporous silica nanoparticles (MSNs) loaded with Doxorubicin Hydrochloride (Dox-HCl) encapsulated in a liposome shell was designed to prevent premature drug release into healthy cells. The Dox@MSNs were tagged with GE-11 targeting peptides that recognize tumor cells that over-express epidermal growth factor receptors. Functional group characterization technique Fourier transform infrared spectroscopy and surface charge characterization by zeta potential were used to confirm successful drug loading into the MSNs. The release profile of Dox-HCl from Dox@MSN@GE-11 was obtained by ultraviolet-visible spectroscopy. Results and conclusions indicate that this nanoassembly offers an efficient delivery approach for highly toxic, small-molecule chemotherapeutic drugs to reach solid tumors like NSCLC with higher efficacy and lower toxicity.

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