Ternary Biomolecular Nanoparticles for Delivery and Targeting of Anti-Cancer Drugs

Published date: March 21, 2011

Technology description

Technical Summary

Traditional chemotherapy involves cytotoxic agents acting on both cancerous and benign cells. The lack of tissue specificity results in untoward side effects due to the effect of drug on non-cancerous cells. Increased dosing regimens are required to compensate for drug which does not reach the cancerous tissue site. The combination of elevated dosing levels and toxic side effects lead to dose-limiting toxicity and poor patient compliance, which can compromise the effectiveness of chemotherapy. To alleviate these issues, a design for delivering chemotherapeutic agents specifically to cancer cells over benign cells is desired.

For this purpose, Emory inventors have developed a ternary complex comprised of a self-assembling heparin-based nanoparticle, targeting ligand, and a chemotherapeutic or imaging agent. In an example system, a heparin nanoparticle encapsulating conjugated folic acid and Taxol was synthesized and testedin vitroandin vivo. The folic acid targeting agent ensures cellular uptake specifically by cancer cells, which over-express FR, via receptor-mediated endocytosis. These functionalized nanoparticles can also enter tumor cells through the enhanced permeability and retention effect (EPR) characteristic of the leaky vasculature of cancerous tissues.

The Taxol-heparin-folic acid conjugate is more potent than Taxol alone against KB cancer cells in vitro .

The Taxol-heparin-folic acid conjugate is more effective at reducing tumor volume and maintaining mouse body weight in vivo .

Other nanoparticle carriers and chemotherapeutics have been successfully reduced to practice, indicative of the tunable nature of this invention forÂ desired characteristics and intracellular effect.

The drug delivery market is expected to grow by an average of 10% per year reaching $132 billion by 2012.

Application area

A nanoparticle with a heparin backbone conjugated with a drug or imaging agent and a targeting agent. Useful for selective drug delivery to cancer cells.

Advantages

Stable nanoparticles functionalized with chemotherapeutic agents capable of targeting tumor cells expressing the folate receptor (FR) and other markers.
Nanoparticle-chemotherapeutic-folic acid conjugates exhibit increased cytoxicity over chemotherapeutic alone and concurrently show greater selectivity for malignant cells versus normal cells.

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