Metabolite-Responsive Hybrid Biomaterials

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Materials & Chemicals**
  » Biological
  » Polymers
» **Medical**
  » Delivery Systems
  » Disease: Cancer

RELATED CASES

2019-076-0

BRIEF DESCRIPTION

Researchers have developed a “smart” biomaterial for drug delivery systems capable of responding to signature cancer metabolite concentrations in tumor environments. This response triggers the release of encapsulated drugs at a specific tumor target.

SUGGESTED USES

Targeted drug delivery for oncology and other diseases

FEATURES/BENEFITS

·Unique and high specificity with regards to drug delivery targets in tumor environments

·Combine material with other delivery or treatment systems to increase efficacy

·Enzyme sensor has high thermostability, making it suitable for relatively harsh synthetic methods and storage

TECHNOLOGY DESCRIPTION

Most polymer drug delivery systems release drugs in response to pH or temperature changes in the body during a disease state. Differences in these conditions between healthy and diseased environments are sometimes not large or unique enough to identify, leading to varying efficacy and accuracy of drug delivery systems. Some systems also use external triggers such as ultrasound, light, and/or magnetic force to aid in the release of drugs. However, these triggers require special conditions that may not be easy to implement in vivo. These limitations lead to reduced target (tumor) specificity.

In diseases, such as cancer, cells utilize different metabolic pathways in order to proliferate within the body. The shift to an alternative metabolic pathway leads to the production of alternate metabolite by-products. In this case, cancer cells exhibit the Warburg Effect, a shift to the glycolysis pathway and subsequent accumulation of lactate in the tumor environment. Researchers at UCI have developed a protein-polymer hybrid biomaterial that leverages this unique cancer effect to target tumors. This material uses a thermophilic mutant lactate dehydrogenase (LDH) from Bacillus stearothermophilus to sense and bind to lactate but not catalyze it. LDH and its inhibitor are incorporated into hydrogel nanoparticles through non-covalent reversible cross-links. For drug delivery, drugs can be encapsulated in the hydrogel. When the hybrid material is administered in a tumor environment, the accumulated lactate will compete with the inhibitor, decreasing the cross-links and inducing a mechanical change (swelling) of the hydrogel; consequently, this change triggers the release of encapsulated drugs.

STATE OF DEVELOPMENT

Successful synthesis of generation 1 protein-polymer hydrogel nanoparticles. Material characterization and preliminary in vitro data collection is ongoing. Drug encapsulation and release experiments are in progress.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,547,674	01/10/2023	2019-076

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Protein Nanoparticles For Cancer Immunotherapy

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