Nanoplatform for Cancer Therapy

Tech ID: 34360 / UC Case 2018-802-0

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ABSTRACT

Researchers at the University of California, Davis have developed a nanoparticle system combining photothermal therapy and chemotherapy for enhanced cancer treatment.

FULL DESCRIPTION

Amphiphilic hybrid telodendrimers comprised of PEG, cholic acid and indocyanine green derivative (PCI) can self-assemble to form stable micelles, with excellent photothermal properties as well as high loading of cytotoxic agents and immunomodulatory agents. Introduction of a related cysteine containing telodendrimer allows co-assembly with PCI to form a biocompatible and stable disulfide-crosslinked PCI nanoparticle (CPCI-NPs). CPCI-NPs possess fast heating capability and superior photothermal conversion efficiency, when compared to small-molecule photothermal agents or gold nanorods. Combination photothermal-/chemo-therapy with doxorubicin-loaded CPCI-NPs resulted in highly synergistic anti-tumor response in orthotropic OSC-3 oral cancer xenograft model. Similarly, CPCI loaded with imiquimod, an immunostimulant, was found to be highly effective in 4T1 syngeneic murine breast cancer model, particularly when photothermal-/immuno-therapy was given in combination with PD-1 checkpoint blockade antibody. Such triple therapy not only eradicated the light-irradiated primary tumors, but also dramatically inhibited the light-untreated distant tumors via activating the innate and adaptive immune systems in the tumor microenvironment. This versatile photothermal nanoplatform has great potential for clinical translation.

APPLICATIONS

- Cancer therapy, specifically for treating tumors accessible to light irradiation and potentially for systemic treatment when combined with immunotherapy.
- Photothermal ablation of localized tumors.
- Controlled drug delivery systems for chemotherapeutic agents.
- Diagnostic imaging through near-infrared fluorescence capabilities.

FEATURES/BENEFITS

- High photothermal conversion efficiency for effective tumor ablation.
- Stable and controlled drug release mechanism, enhancing chemotherapy efficacy.
- Excellent biocompatibility and low systemic toxicity.
- Enhanced tumor targeting and penetration, maximizing therapeutic outcomes.
- Ability to combine photothermal therapy and chemotherapy, offering a synergistic therapeutic effect.
- Overcomes limitations of poor drug solubility and systemic toxicity in chemotherapy.
- Addresses the challenge of achieving targeted and controlled delivery of therapeutic agents to tumor sites.
- Solves the issue of rapid clearance and low photothermal conversion efficiency seen in other photothermal agents.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,527,880	01/20/2026	2018-802

Additional Patent Pending

INVENTORS

- Lam, Kit S.
- Zhang, Lu

OTHER INFORMATION

KEYWORDS

biocompatibility, cancer therapy, immunotherapy, nanoparticle, near-infrared, photothermal conversion, photothermal therapy (PTT), polyethylene glycol (PEG), synergistic effects, target selectivity

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Biotechnology**
  - Health
  - Other
  - Proteomics
- **Imaging**
  - Medical
  - Molecular
- **Materials & Chemicals**
  - Nanomaterials
  - Polymers
- **Medical**
  - Delivery Systems
  - Disease: Cancer
  - Imaging

- Research Tools
- Therapeutics

- **Nanotechnology**
  - NanoBio
- **Sensors & Instrumentation**
  - Medical

RELATED CASES

2018-802-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Novel Solid Tumor Chemodrug LLS2
- Nuclear Magnetic Resonance System for Determining Oil and Water Compositions in Drilling Mud
- Affinity Peptides for Diagnosis and Treatment of Severe Acute Respiratory Syndrome Coronavirus 2 and Zika Virus Infections
- Nanoparticles for Drug Delivery, Tissue Targeting and Imaging Analysis
- Conjugates That Combine HDAC Inhibitors and Retinoids into Disease Preventatives/Treatments
- A Novel RGD-Containing Cyclic Peptide for use in Cancer Imaging and as a Targeted-Therapy Ligand
- Site-Specific Ligation and Compound Conjugation to Existing Antibodies
- Functional Illumination in Living Cells
- Multifunctional Porphyrin-Based Nanomedicine Platform
- A Two-step Drug Delivery System Based on Click Chemistry
- Transformable Smart Peptides as Cancer Therapeutics
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- Proteoglycan Mimetics For Enhanced Wound Healing Angiogenesis And Vascular Repair
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