(SD2022-180) Method of viral nanoparticle functionalization for therapy and imaging applications

Tech ID: 32778 / UC Case 2021-Z08-1

BACKGROUND

Plant viral nanoparticles (plant VNPs) are promising biogenetic nanosystems for the delivery of therapeutic, immunotherapeutic, and diagnostic agents. The production of plant VNPs is simple and highly scalable through molecular farming in plants. Some of the important advances in VNP nanotechnology include genetic modification, disassembly/reassembly, and bioconjugation. Although effective, these methods often involve complex and time-consuming multi-step protocols.

TECHNOLOGY DESCRIPTION

Engineers from UC San Diego have developed a simple and versatile supramolecular coating strategy for designing functional plant VNPs via metal–phenolic networks (MPNs). Specifically, this method gives plant viruses [e.g., tobacco mosaic virus (TMV), cowpea mosaic virus, and potato virus X] additional functionalities including photothermal transduction, photoacoustic imaging, and fluorescent labeling via different components in MPN coating [i.e., complexes of tannic acid (TA), metal ions (e.g., Fe3+, Zr4+, or Gd3+), or fluorescent dyes (e.g., rhodamine 6G and thiazole orange)]. For example, using TMV as a viral substrate by choosing Zr4+–TA and rhodamine 6G, fluorescence is observed peaking at 555 nm; by choosing Fe3+–TA coating, the photothermal conversion efficiency was increased from 0.8 to 33.2%, and the photoacoustic performance was significantly improved with a limit of detection of 17.7 μg mL–1. We further confirmed that TMV@Fe3+–TA nanohybrids show good cytocompatibility and excellent cell-killing performance in photothermal therapy with 808 nm irradiation. These findings not only prove the practical benefits of this supramolecular coating for designing multifunctional and biocompatible plant VNPs but also bode well for using such materials in a variety of plant virus-based theranostic applications.

APPLICATIONS

ADVANTAGES

CONTACT
University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

OTHER INFORMATION

KEYWORDS
metal-phenolic network, plant virus nanoparticles, photothermal therapy, photoacoustic imaging, fluorescent imaging, theranostics

CATEGORIZED AS
- **Imaging**
  - Medical
  - Other
- **Materials & Chemicals**
  - Agricultural
  - Nanomaterials
- **Nanotechnology**
  - NanoBio
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RELATED CASES
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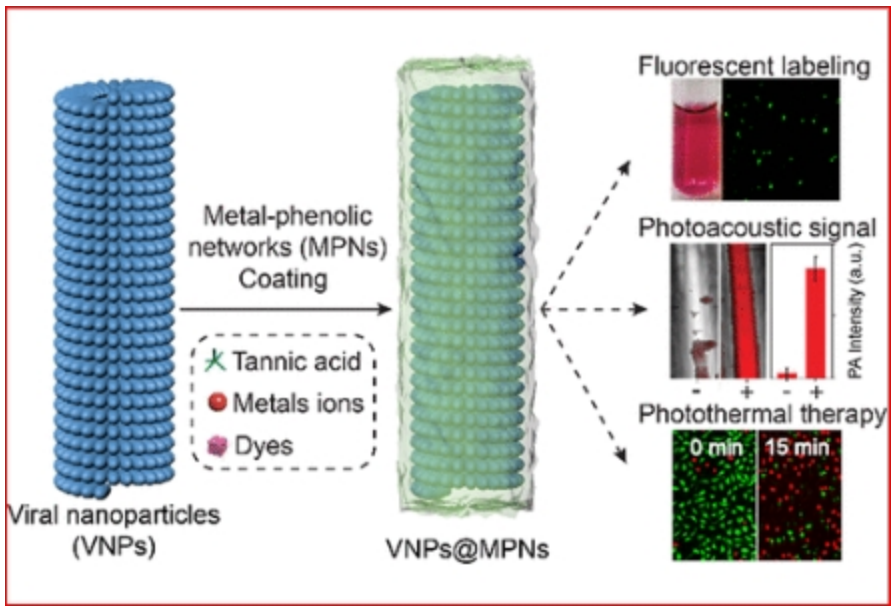

STATE OF DEVELOPMENT

INTELLECTUAL PROPERTY INFO

This patent-pending invention is available for commercial development. Contact UCSD for licensing terms.

RELATED MATERIALS

▶ Zhuohong Wu, Jiajing Zhou, Christian Isalomboto Nkanga, Zhicheng Jin, Tengyu He, Raina M. Borum, Wonjun Yim, Jingcheng Zhou, Yong Cheng, Ming Xu, Nicole F. Steinmetz, and Jesse V. Jokerst. One-Step Supramolecular Multifunctional Coating on Plant Virus Nanoparticles for Bioimaging and Therapeutic Applications. ACS Applied Materials & Interfaces 2022 14 (11), 13692-13702 - 03/08/2022

University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345