PRESERVING PROTEIN FUNCTION VIA STATISTICALLY RANDOM HETEROPOLYMERS

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,258,612	03/25/2025	2017-052
China	Issued Patent	CN 111601596 B	06/02/2023	2017-052
United States Of America	Issued Patent	11,629,372	04/18/2023	2017-052

Additional Patent Pending

BRIEF DESCRIPTION

Protein-based materials have the potential to change the current paradigm of materials science. However, it still remains a challenge to preserve protein hierarchical structure and function while making them readily processable. Protein structure is inherently fluid, and it is this property that contributes to their fragility outside of their native environment.

Through the use of rationally designed statistically random heteropolymers, it is possible to stabilize proteins at each hierarchical level and process them in organic solvents, a common need for materials fabrication. The chemical and architectural complexities of statistically random heteropolymers provide a modular platform for tunable protein-polymer-solvent interactions. This provides opportunities not offered by small molecule surfactants or amphiphilic block copolymers. Through evaluation of horseradish peroxidase and green fluorescent protein structure, we show that statistically random heteropolymers can stabilize enzymes. Allowing for activity retention when stored in organic solvent, over 80% activity was observed after 24 hours. Furthermore, horseradish peroxidase and chymotrypsin proteins, when encapsulated in statistically random heteropolymers, are still accessible to their substrates while remaining inaccessible to the denaturing organic solvent. Statistically random heteropolymers have potential in creating stimuli-reponsive materials and nanoreactors composed of proteins and synthetic materials.

SUGGESTED USES

Water detoxification.

Active membranes.

Protein therapeutic patches.

Controlled delivery of protein in vivo.

Catalysis of chemicals (biomass into biofuels) with reusable scaffolds.

Storage of proteins, such as insulin, at room temperature.

Incorporation of light harvesting proteins into devices.

Incorporation of carbon capturing proteins into devices.

Decorating liposomes and mammalian/bacterial cells with ligands.

Smart coatings with stimuli-responsiveness.

CONTACT

Laleh Shayesteh
lalehs@berkeley.edu
tel: 510-642-4537.

INVENTORS

» Xu, Ting

OTHER INFORMATION

KEYWORDS

Proteins, Random heteropolymers, Hybrid materials, Biomaterials, Energy, Nanomaterials

CATEGORIZED AS

» **Biotechnology**
» Industrial/ Energy
» **Energy**
» Bioenergy
» **Engineering**
» Engineering
» **Materials & Chemicals**
» Biological
» Nanomaterials
» **Medical**
» Delivery Systems
» Other
» Research Tools
» **Nanotechnology**
» Materials
» NanoBio

ADVANTAGES

Statistically random heteropolymers assist in the encapsulation, solubilization, and stabilization of a variety of proteins in organic solvents. The instability, insolubility, and inability to retain protein function in organic media no longer hold, allowing protein-based materials with increased performance to be generated. Although AOT small molecule surfactants and amphiphilic block copolymers such PS-b-PEO do demonstrate the ability to make proteins more processable, their lack of preserving protein function limits their viability. SRHPs have the potential to pave the path towards improved technologies, such as water detoxification and chemical catalysis, and shows promise as a modular and general approach towards protein-based material fabrication.

RELATED MATERIALS

- » Other
- » Tools and Devices
- » **Security and Defense**
- » Other
- » Screening/Imaging
- » **Sensors & Instrumentation**
- » Biosensors
- » Environmental Sensors
- » Medical
- » Other
- » Physical Measurement
- » Scientific/Research

RELATED CASES

2017-052-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Bioactive Plastics With Programmable Degradation And Microplastic Elimination
- ▶ Synergistic Enzyme Mixtures to Realize Near-Complete Depolymerization in Blends
- ▶ Population-Based Heteropolymer Design To Mimic Protein Mixtures In Biological Fluids

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University of California, Berkeley Office of Technology Licensing
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