Compositions Of Polyion Complex Polypeptide Hydrogels

Tech ID: 29013 / UC Case 2018-142-0

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OTHER INFORMATION

KEYWORDS

Hydrogel, polypeptide hydrogels, diblock copolypeptide hydrogel, polyion complex, tissue engineering, bioengineering, nanomaterial, polymer

CATEGORIZED AS

- **Materials & Chemicals**
  - Biological
  - Nanomaterials
  - Polymers
- **Medical**
  - Other
- **Nanotechnology**
  - NanoBio

RELATED CASES

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SUMMARY

UCLA researchers in the Department of Bioengineering have developed a new class of cell-compatible copolypeptide hydrogels that possess chain conformation directed polyion complex (PIC) supramolecular architectures.

BACKGROUND

Hydrogels are three-dimensional polymer networks that are capable of absorbing large amounts of water or biological fluids. Hydrogels can be classified in several ways depending on the constituents that form the polymeric network (neutral vs. ionic, natural vs. synthetic), mechanical and structural characteristics (i.e. degree of cross-linking, gel integrity), and method of cross-linking (chemical cross-linking vs. physical cross-linking). Protein and peptide based hydrogels are used for many applications, ranging from personal care products, food and cosmetic thickeners to support matrices for drug delivery and tissue replacement.

INNOVATION

Researchers at UCLA have developed synthetic diblock copolypeptide hydrogels (DCHs) that incorporate oppositely charged ionic segments to form β-sheet structured, polyion complex (PIC) hydrogel assemblies when mixed in aqueous media. The observed chain conformation directed assembly was found to enable efficient hydrogel formation, and provided distinct and useful properties to these hydrogels, including self-healing after deformation, microporous architecture, and stability against dilution in aqueous media. The unique feature of using ordered chain conformations in PIC assemblies can be explored to create new supramolecular materials. In addition, while the stiffness of most hydrogels is mainly adjusted either by polymer concentration or crosslink density, DCH stiffness can also be tuned by these parameters, or by altering amino acid composition, hydrophilic to hydrophobic ratio, molecular weight, or block architecture of the copolymers. The ability to control nanoscale and bulk properties by molecular design, combined with DCH injectability and abundant sites for functionalization makes DCH innovative candidates for use as biomaterials.

APPLICATIONS

- Thickeners/structuring agents in personal care products
- Controlled delivery of drugs and cells into tissues
- Tissue repair and engineering 3D printing of hydrogel networks

ADVANTAGES

- Allows adjustment of gel stiffness independently of polymer concentration or crosslink density
- Forms hydrogels at low concentration in water (<10 wt%)
- Nontoxic and biodegradable
- Their amphiphilic nature allows them to serve as effective carriers for deliver of both hydrophilic and hydrophobic molecules
- Great injectability allows for minimal invasive delivery

RELATED MATERIALS

- Yintao Sun, Alexander L. Wollenberg, Timothy Mark O'Shea, Yanxiang Cui, Z. Hong Zhou, Michael V. Sofroniew, and Timothy J. Deming. Conformation-directed formation of self-healing diblock copolypeptide hydrogels via polyion complexation (2017). Journal of the American Chemical Society Article 2017, 139, 15114–15121. DOI: 10.1021/jacs.7b08190

PATENT STATUS

Country	Type	Number	Dated	Case
Germany	Issued Patent	60 2018 063 372.3	12/27/2023	2018-142
European Patent Office	Issued Patent	3687578	12/27/2023	2018-142
Spain	Issued Patent	3687578	12/27/2023	2018-142
Italy	Issued Patent	502024000014302	12/27/2023	2018-142
Sweden	Issued Patent	3687578	12/27/2023	2018-142
United States Of America	Published Application	20200246503	08/06/2020	2018-142

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Preparation Of Functionalized Polypeptides, Peptides, And Proteins By Alkylation Of Thioether Groups
- Use Of Non-Ionic Copolypeptide Hydrogels For Cell Suspension And Cell And Molecule Delivery
- Preparation Of Functional Homocysteine Residues In Polypeptides And Peptides
- Chemoselective Side-Chain Modifications Of Methionine-Containing Elastin-Like Polypeptides

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