Novel Hydrogels for Encapsulation, Vascularization, and Transplantation of Cells

Protein and cell therapies are limited by delivery methods

Protein and cell therapies represent promising strategies for various regenerative medicine therapies. However, these therapies are significantly limited by delivery methods, particularly in terms of protein stability and dosing kinetics as well as cell survival, engraftment, and function. Hydrogels represent versatile and robust delivery vehicles for proteins and cells due to their high water content that aids protein biological activity, high cytocompatibility, and minimal adverse host reactions. However, current hydrogel technologies degrade too slowly for many applications.

Novel hydrogels aid in tunable degradation kinetics

Georgia Tech scientists engineered a hydrolytically degradable poly(ethylene glycol) (PEG) hydrogel technology for numerous *in vitro* and *in vivo* applications. The PEG macromer uses ester linkages embedded in the PEG backbone (4-arm PEG-ester-maleimide), which can be combined at various ratios with non-degradable macromers to enable tunable degradation kinetics. The hydrogel material enables tight control over gel degradation and therapeutic release kinetics. This technology overcomes limitations of widely use hydrogels crosslinked with protease-degradable linkers that exhibit slow and site-dependent degradation rates.

Applications for this technology include controlled release and delivery of drugs or proteins as well as cell encapsulation. In addition, it can be used as a delivery vehicle and adhesive for cells in transplantation settings, as current data promotes human stem cell viability and engraftment *in vivo*.

Summary Bullets

- This hydrolytically degradable poly(ethylene glycol) (PEG) hydrogel leverages ester linkages combined at various ratios with non-degradable macromers to enable tunable degradation kinetics.
- Potential applications include controlled release and delivery of drugs or proteins as well as cell encapsulation. It can also be used as a delivery vehicle and adhesive for cells in transplantation settings.
- These innovative hydrogels allow for rapid hydrolytic cleavage *in vivo* but remain stable *in vitro* for weeks at neural pH 7 to support regenerative medicine techniques.

Solution Advantages

- **Improved viability:** Promotes cell vascularization, encapsulation, and transplantation
- **Customizable:** Offers tunable degradation kinetics *in vitro* and *in vivo* in a wide variety of animal models and transplant sites
- **Supports regenerative medicine:** Allows for rapid hydrolytic cleavage in the *in vivo* environment but remains stable *in vitro* for weeks at neutral pH 7

Potential Commercial Applications

- Tissue engineering
- Drug delivery
- Regenerative medical therapies
- Research tool for biotechnology applications

Inventors

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IP Status

Patent application has been filed : US63/390503

Publications

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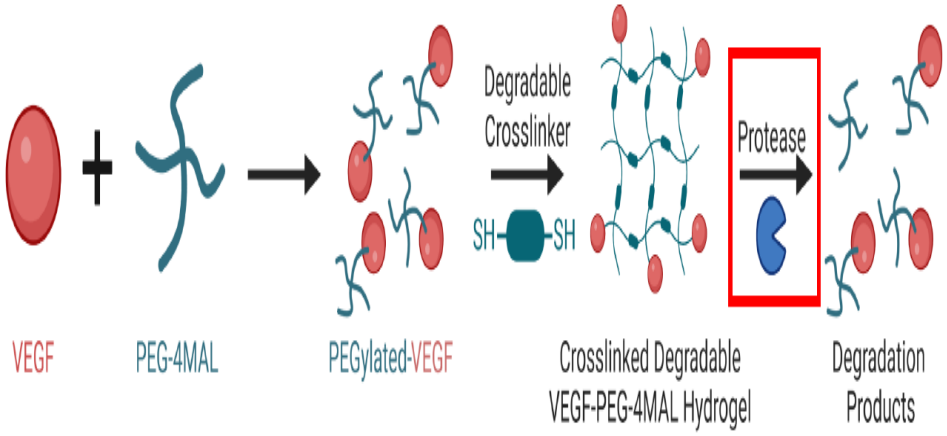
Images



Example hydrogel delivery system employing PEG-VPM hydrogels

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