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Keratin hydrogels for intravenous embolization

A rapid onset, non-toxic, hybrid hydrogel network for the safe and rapid embolization of blood vessels.

IP Status:US Patent Pending; Application No. 18/291,525.

Applications

- In-situ formation of embolic agents
- Drug delivery

Key Benefits & Differentiators

- **Non-toxic:** Hydrogel is made from two non-toxic aqueous solutions
- **Fast and tunable gelation time:** Gelation is tunable and occurs rapidly in the range from 1 second to 1 minute
- **Mild reaction conditions:** There are no harmful byproducts and the reaction does not require a catalyst
- **Administered through microcatheter:** Low viscosity of the precursors allows administration via microcatheter, which is important for precise embolization

Technology Overview

Therapeutic embolization procedures are used to treat a wide variety of medical conditions including aneurysms, tumors, and hemorrhages. Liquid embolic agents are often favored over solid embolic agents as they offer more complete filling of irregularly shaped blood vessels. However, current commercially available liquid embolic agents suffer drawbacks including difficult administration, off-target embolization, and the required use of toxic organic solvents for delivery. In addition, current techniques release toxic byproducts during the formation of the embolic agent in the blood vessel. Consequently, there is a need to develop liquid embolic agents that are safe, cost-effective, and functional.

Researchers at the University of Minnesota have developed a novel liquid embolic agent that rapidly forms a hydrogel network upon the mixing of two aqueous polymer solutions. The hydrogel consists of a polymer and keratein, which is extracted from human hair. Due to its availability, biocompatibility, and low cost, it is an attractive non-toxic component of hydrogels for long-term embolization. The precursors of this hydrogel are aqueous and have a low viscosity, which allows for them to be administered via microcatheter for precise placement. The gelation time and hydrogel properties are readily tuned by changing reaction conditions, allowing them to be tuned for the desired application.

Phase of Development

TRL: 3-4
Proof of concept - hydrogel formation has been observed. Animal studies are in progress.

Desired Partnerships

Technology ID
2021-012

Category
Engineering & Physical Sciences/Chemicals
Life Sciences/Biomaterials
Life Sciences/Human Health

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Researchers

- **Jafar Golzarian, MD** Professor Emeritus, Department of Radiology