Hydrogels for use as vitreous body substitutes

Technology Offer

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Category

Therapy
Ophthamology
Ophthalmic drug delivery
Artificial vitreous body

Keywords

Vitrectomy
Hydrogel
Retinal disease

Development stage

Preclinical

Seeking

Licensing/collaboration

IP status

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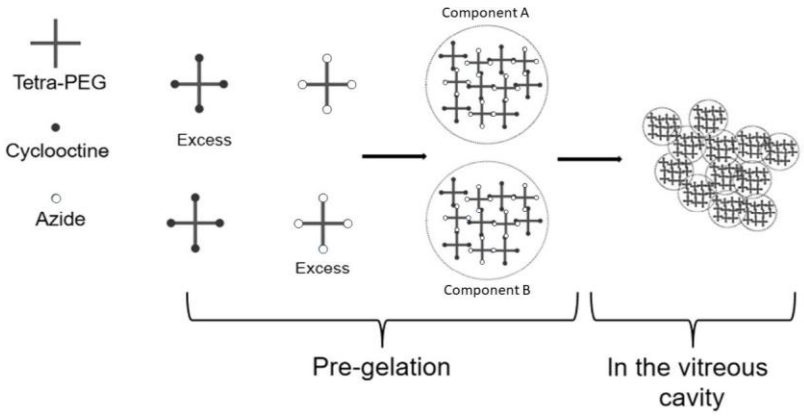

Figure 1: preparation of a hydrogel

Background

The vitreous body is a complex structure. Developing a synthetic replacement that mimics its functions has proven challenging. In case of diseases or traumata the natural vitreous humour needs to be partially or fully substituted by artificial replacements.

Prior art vitreous body substitutes such as gases or silicone oil, which are used, for example, after a retinal detachment, show serious limitations. They both limit the patient's vision after the operation.

Recently hydrogels with fast-transition from sol- to gel-state were examined as artificial vitreous body. Although some hydrogels can be introduced into the body via injection of a polymer solution followed by in situ polymer crosslinking, conventional hydrogels often swell, which compromises their morphological and mechanical compatibility in vivo. Existing fast-forming hydrogels turned out to be cytotoxic and are therefore not suitable for medical uses as artificial vitreous bodies.

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Technology

The technology relates to a product comprising two components as a combined preparation for simultaneous or sequential use as an artificial vitreous body. The first component comprises tetra-PEG-cyclooctyne and tetra-PEG-azide, wherein tetra-PEG-cyclooctyne is present in molar excess as compared to tetra-PEG-azide. The second component comprises tetra-PEG-azide and tetra-PEG-cyclooctyne, wherein tetra-PEG-azide is present in molar excess as compared to tetra-PEG-cyclooctyne.

It has been found that these two components are non-cytotoxic and form a non-cytotoxic hydrogel upon mixing of each other. Therefore, they can be used as an artificial vitreous body. This differentiates the present components from prior art hydrogel-forming components which may react to proteins and other biological substances in the target tissue, thereby being toxic and/or leading to unwanted side-reactions.

The hydrogel may be formed outside the eye shortly (< 15 minutes) prior to injection, during or after injection into the eye just by mixing the two components together.

Figure 1 depicts the preparation of the hydrogel from tetra-PEG-monomers with respectively azide and cyclooctyne active groups. The first and second component differ from each other in that tetra-PEG-cyclooctyne is present in molar excess as compared to tetra-PEG-azide in the first component, while tetra-PEG-azide is present in molar excess as compared to tetra-PEG-cyclooctyne in the second component.

Benefits

- Long term stability
- No cytotoxicity,
- Fast hydrogel formation after mixing; hydrogel formation within the eye mixing possible prior to, during or after injection into the eye

Applications

- Artificial vitreous body
- Retinal detachment

Publications

- WO2025215027 Hydrogels for use as vitreous body substitute

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