

15

solution (200 μ l). The albumin adhered to the catheter non-specifically. The catheter was then dried at room temperature and subsequently immersed in 50 μ g of DMSO solution containing the hydroxysuccinimide ester of PEG-bissuccinate of Example 1 to cross-link the albumin on the catheter. The catheter was then washed in saline and is ready for MR imaging.

14. Hydrogel Matrix for Cell Support

Living cells may be loaded into the hydrogel compositions and propagated to produce therapeutic agents. Such cells would have low or non-existent toxicity. For example, cells with the capacity to secrete therapeutic agents, e.g., insulin or other hormones, enzymes, or proteins, can be loaded into a hydrogel and implanted into a patient. If an appropriate label is also loaded into this hydrogel, an MR image will indicate cell density and activity, and/or the presence or concentration of the therapeutic agents, in the hydrogel.

To prepare such a hydrogel composition, the desired cells are dispersed, e.g., by vortexing, in a sterile solution of 10% serum, e.g., fetal calf, bovine, or human, in Dulbecco's modified Eagle medium at a pH of 7.9. At this stage, suitable therapeutic drugs and/or diagnostic labels as described above may be added. The number of cells loaded into the hydrogel is selected to achieve a specific dosage of the therapeutic agent secreted by the cells per day. For example, if the cells are secreting insulin, the standard dosage is about 10 to 80 I.U./day. This mixture is cross-linked by adding a cross-linking agent, e.g., the bis(N-hydroxy-succinimidyl)polyethylene glycol disuccinate described in Example 1, which is dissolved in DMSO. The cell loaded hydrogel is kept in tissue culture medium for a time sufficient to remove any DMSO or other contaminants, e.g., 12 to 24 hours, before implantation into a patient.

Other Embodiments

It is to be understood that while the invention has been described in conjunction with the preferred embodiments thereof, that the foregoing description is intended to illustrate and not limit the scope of the invention, which is defined by the scope of the appended claims. Other aspects, advantages, and modifications within the scope of the invention will be apparent to those skilled in the art to which the invention pertains.

What is claimed is:

1. A biocompatible, biodegradable, hydrogel comprising a backbone bonded to a cross-linking agent, wherein said cross-linking agent is a bis-hydroxysuccinimide ester of polyalkylene glycol ("PAG") diacid, bis-hydroxysulfosuccinimide ester of PAG diacid, bis-imidate of PAG diacid, bis-imidazolide of PAG diacid, bis-imidazolide of PAG, bis-halide of PAG, bis-chloranhydride of PAG diacid, bis (n-amino alkyl) of PAG, bis (polyoxyalkylene-bis, or bis benzoxazolide of PAG.

16

2. The hydrogel of claim 1, further comprising a reporter group loaded into said hydrogel.

3. The hydrogel of claim 2, wherein said reporter group comprises a diagnostic label.

4. The hydrogel of claim 3, wherein said label is detectable by X-ray or magnetic resonance imaging.

5. The hydrogel of claim 4, wherein said X-ray detectable label is an iodine containing compound.

6. The hydrogel of claim 4, wherein said magnetic resonance imaging detectable label is a gadolinium containing compound.

7. The hydrogel of claim 6, wherein said label is gadolinium-diethylenetriamine-pentaacetic acid.

8. The hydrogel of claim 2, wherein said reporter group is entrapped in said hydrogel.

9. The hydrogel of claim 1, wherein said backbone comprises a proteinaceous macromolecule.

10. The hydrogel of claim 9, wherein said backbone comprises from 5 to 50 percent protein by weight of an initial proteinaceous solution.

11. The hydrogel of claim 10, wherein said backbone comprises from 20 to 50 percent protein by weight of said initial solution.

12. The hydrogel of claim 1, herein said backbone is a plasma protein, glycoprotein, polyamino acid homopolymer, polysaccharide derivative, glycosaminoglycan, polyethylenamine, or polyethylene glycol derivative.

13. The hydrogel of claim 12, wherein said backbone is albumin, polymannuronic acid, or polygalacturonic acid.

14. The hydrogel of claim 12, wherein said polysaccharide derivative is a dextran or starch derivative.

15. The hydrogel of claim 1, wherein said backbone is a recombinant protein.

16. The hydrogel of claim 1, wherein said cross-linking agent is a bis-hydroxysuccinimide ester of polyethylene glycol ("PEG") diacid, bis-hydroxysulfosuccinimide ester of PEG diacid, bis-imidate of PEG diacid, bis-imidazolide of PEG diacid, bis-imidazolide of PEG, bis-halide of PEG, bis-chloranhydride of PEG diacid, bis (n-amino alkyl) of PEG, bis (polyoxyethylene-bis), or bis benzoxazolide of PEG.

17. A therapeutic composition comprising

a biocompatible, biodegradable hydrogel comprising a backbone bonded to a cross-linking agent, wherein said cross-linking agent is a bis-hydroxysuccinimide ester of polyalkylene glycol ("PAG") diacid, bis-hydroxysulfosuccinimide ester of PAG diacid, bis-imidate of PAG diacid, bis-imidazolide of PAG diacid, bis-imidazolide of PAG, bis-halide of PAG, bis-chloranhydride of PAG diacid, bis (n-amino alkyl) of PAG, bis (polyoxyalkylene-bis), or bis benzoxazolide of PAG,

a diagnostic label, and

a therapeutic drug, wherein said diagnostic label and said therapeutic drug are both loaded into said hydrogel.

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