wounds. Such acute wounds that could be treated include burns, abrasions, dry skin, post-op surgical incisions, cuts, puncture wounds, blisters, insect bites, and other severe tissue injury. Chronic wound treatment might encompass slow to heal wounds including pressure ulcers, venous ulcers, diabetic foot ulcers, decubitus ulcers, and non-healing tissue injuries.

Overall, a composition is desired that will be easily applied, forming a matrix conducive to the healing of a tissue, and having anti-microbial properties. The composition may be biocompatible or quickly reacted to avoid possibilities of cytotoxicity. Further, the composition will stimulate and maximize wound healing while providing a controlled method for providing thin and thick layers of a solidified wound dressing, as desired.

Indirect effects may include reduced need for medical procedures such as debridement, decreased hospitalization time, reduced postoperative recovery times, shortened return interval to daily functions and work, and reduced overall treatment costs. Desirably, these improvements to wound healing, including application and method of use, will be valuable in treating and repairing various tissue(s).

SUMMARY

The following disclosure relates to a biocompatible polymeric composition that is a gelatinous wound healing and hemostatic matrix able to be formed and solidified both internally and externally.

In a first aspect, there is provided a biocompatible polymeric gel composition ~~comprising~~consisting of:

a. about 0.1% to about 95% by weight of one or more than one polyanionic polymer;

b. about 0.1% to about 90% by weight of one or more than one polycationic polymer; and

c. about 0.1% to 99.8% by weight ~~water~~solvent.

In a second aspect, there is provided a method of forming a protective coat over a biocompatible polymeric gel composition of the first aspect in situ, ~~comprising the addition of~~wherein said protective coat comprises a solution comprising:

a. about 0.1% to about 30% by weight of a di- or higher valent cation; and

b. ~~0% to about 90% by weight of a hydrophobic polymer; and~~about 5% to about 99.9% by weight of a solution solvent.

~~c. about 5% to about 99.9% by weight of a solvent~~

In a third aspect, there is provided a use of a disclosed biocompatible polymeric gel composition for the manufacture of a medicament for the treatment of a wound.

In a fourth aspect, there is provided a use of a disclosed biocompatible polymeric gel composition for the manufacture of a medicament for achieving rapid hemostasis without the need to apply pressure to a wound.

~~In a fifth aspect, there is provided a biocompatible polymeric composition comprising:~~

~~a. about 1% to about 20% by weight of sodium alginate;~~

~~b. about 1% to about 5% by weight of sodium hyaluronate;~~

~~c. about 2% to about 20% by weight of chitosan chloride; and~~

~~d. 55% to 96% by weight of a 5% aqueous solution of ethanol in water.~~

~~In a sixth aspect, there is provided a method of forming a protective coat over a polymeric composition of the fifth aspect in situ, comprising the addition of a solution comprising:~~

~~a. about 0.1% to about 1% by weight of calcium chloride;~~

~~b. about 1% to about 5% by weight of nitrocellulose; and~~

~~c. about 94% to about 98.9% by weight of amyl acetate.~~

In one embodiment of the present disclosure, the biocompatible polymeric composition comprises 1) one or more than one polyanionic polymer and 2) one or more than one polycationic polymer. In one embodiment of the present disclosure, the one or more than one polyanionic polymer includes at least one cross-linkable polyanionic polymer. In another embodiment of the present disclosure, the one or more than one polyanionic polymer includes at least one cross-linkable polyanionic polymer and at least one non-cross-linkable polyanionic polymer.

In one embodiment of the present disclosure, the biocompatible polymeric composition comprises a mixture of 1) one or more than one polyanionic polymer able to be formed on the surface of a wound and 2) one or more than one polycationic polymer that assists in the solidification process as well as speeds up blood clotting. In another embodiment of the present disclosure, the biocompatible polymeric composition comprises a mixture of 1) one or more than one polyanionic polymer able to be formed on the surface of a wound; 2) one or more than one polycationic polymer that assists in the solidification process as well as speeds up

What is claimed:

1. A biocompatible polymeric gel composition ~~comprising~~consisting of:
   a. about 0.1% to about 95% by weight of one or more than one polyanionic polymer;
   b. about 0.1% to about 90% by weight of one or more than one polycationic polymer; and
   c. about 0.1% to 99.8% by weight ~~water~~solvent.

2. A biocompatible polymeric gel composition of Claim 1 wherein the one or more than one polyanionic polymer comprises at least one cross-linkable polyanionic polymer.

~~3. A biocompatible polymeric composition of Claim 2 wherein the one or more than one polyanionic polymer further comprises at least one non-cross-linkable polyanionic polymer.~~

43. A biocompatible polymeric gel composition of Claim ~~3~~2, wherein at least one cross-linkable polyanionic polymer is selected from the group consisting of: a polystyrene sulfonate, a polyacrylate, a polymethacrylate, a polyvinyl sulphate, a polyphosphate, Iota carrageenan, Kappa carrageenan, gellan gum, carboxyl methyl cellulose, carboxyl methyl agarose, carboxyl methyl dextran, carboxyl methyl chitin, carboxyl methyl chitosan, a polymer modified with a carboxyl methyl group, an alginate, a polymer containing a plurality of carboxylate groups, and xanthan gum.

54. A biocompatible polymeric gel composition of any one of Claims 2 or 34, wherein one or more than one cross-linkable polyanionic polymer is selected from the group consisting of: sodium polystyrene sulfonate, sodium polyacrylate, sodium polymethacrylate, sodium polyvinyl sulphate, sodium polyphosphate, and sodium alginate.

~~6. A biocompatible polymeric composition as in Claim 3, wherein at least one non-cross-linkable polyanionic polymer is selected from the group consisting of: a hyaluronate, a polynucleotide, a polypeptide chain having an average residue isoelectric point below 7, a glucosaminoglycan, and a proteoglycan.~~

~~7. A biocompatible polymeric composition as in Claim 6, wherein at least one non-cross-linkable polyanionic polymer is selected from the group consisting of: sodium hyaluronate or RNA.~~

85. A biocompatible polymeric gel composition as in any one of Claims 1 to ~~43~~, wherein the one or more than one polycationic polymer is selected from the group consisting of: chitosan, chitin, diethylaminoethyl-dextran, diethylaminoethyl-cellulose, diethylaminoethyl-agarose, diethylaminoethyl-alginate, a polymer modified with a diethylaminoethyl group, a

polymer containing a plurality of protonated amino groups, and a polypeptide having an average residue isoelectric point above 7.

~~9~~6. A biocompatible polymeric gel composition as in Claims 2 to ~~5~~3, wherein said at least one cross-linkable polyanionic polymer is cross-linked to said at least one polycationic polymer through hydrogen bonding.

~~10~~7. A biocompatible polymeric gel composition as in Claims 2 to ~~6~~3, wherein said at least one cross-linkable polyanionic polymer is cross-linked to said at least one polycationic polymer through covalent linkages.

~~11. A biocompatible polymeric composition as in Claim 3 further comprising a therapeutic agent selected from the group consisting of: antimicrobial agents, antibiotics, hormones, proteins, and iodine.~~

~~12~~8. A method of forming a protective coat over a biocompatible polymeric gel composition of any one of Claims 1 to 7 in situ, ~~comprising the addition of~~wherein said protective coat comprises a solution comprising:

a. about 0.1% to about 30% by weight of a di- or higher valent cation; and

b. ~~0% to about 90% by weight of a hydrophobic polymer; and~~

~~c. about 5% to about 99.9% by weight of a solvent~~about 5% to about 99.9% by weight of a solution solvent.

~~13. A method of Claim 12, wherein said hydrophobic polymer is selected from the group consisting of: a polyurethane, nitrocellulose, a cyanoacrylate, a styrene, a polytetrafluoroethane, and a silicone.~~

~~14~~9. A method of Claim ~~12~~8, wherein said solution solvent is selected from the group consisting of: water, ethanol, amyl acetate, acetone, methyl ethyl ketone, isopropanol, and tetrahydrofuran.

~~15~~10. A method of any one of Claims ~~12~~8 to 9, wherein said di- or higher valent cation is selected from the group consisting of salts of: Ca2+, Fe2+, Fe3+, Ag2+, Ag3+, Au2+, Au3+, Mg2+, Cu2+, Cu3+, and Zn2+.

~~16~~11. Use of the biocompatible polymeric gel composition of any one of claims 1 to 7 for the manufacture of a medicament for the treatment of a wound.

~~17~~12. Use of Claim ~~16~~11, wherein said wound is selected from the group consisting of: an external laceration, an abrasion, a burn, an ocular laceration, damage to a parenchymal organ, an internal laceration, a laceration in the gastrointestinal tract, superficial cuts and scrapes, internal bleeding, an arterial bleed, a venous bleed, dental or oral bleeds and incisions.

~~18~~13. Use of the biocompatible polymeric gel composition of any one of claims 1 to 7 for the manufacture of a medicament for achieving rapid hemostasis without the need to apply pressure to a wound.

~~19~~14. A biocompatible polymeric gel composition ~~comprising~~of any one of Claims 1 to 7, wherein:

a. said one or more than one polyanionic polymer is about 1% to about 20% by weight of sodium alginate;

~~b. about 1% to about 5% by weight of sodium hyaluronate;~~

~~e~~b. said one or more than one polycationic polymer about 2% to about 20% by weight of chitosan chloride; and

~~d~~c. said solvent is about 55% to about 96% by weight of a 5% aqueous solution of ethanol in water.

~~20~~15. A method of forming a protective coat over a biocompatible polymeric gel composition of any one of Claims ~~19~~ 8 to 10 in situ, ~~comprising the addition of a solution comprising~~wherein:

a. said di- or higher valent cation is about 0.1% to about 1% by weight of calcium chloride; and

~~b. about 1% to about 5% by weight of nitrocellulose; and~~

~~e~~b. said solution solvent is about 94% to about 98.9% by weight of amyl acetate.

~~21~~16. A biocompatible polymeric gel composition as in any one of Claims 1 to 7, wherein said solvent is selected from the group consisting of: water, ethanol, amyl acetate, acetone, methyl ethyl ketone, isopropanol, and tetrahydrofuran.

17. A biocompatible polymeric gel composition of Claim 1, wherein

a. said one or more than one polyanionic polymer is about 0.1% to about 5% by weight of sodium alginate;

b. said one or more than one cationic polymer is about 2% to about 25% by weight of chitosan; and

c. the balance of a solvent.

18. A biocompatible polymeric gel composition of Claim 17, wherein

a. said one or more than one polyanionic polymer is about 2% to about 5% by weight of sodium alginate;

b. said one or more than one cationic polymer is about 5% to about 20% by weight of chitosan; and

c. the balance of a solvent.

19. A biocompatible polymeric gel composition of Claim 17, wherein

a. said one or more than one polyanionic polymer is about 0.1% to about 4% by weight of sodium alginate;

b. said one or more than one cationic polymer is about 2% to about 25% by weight of chitosan; and

c. the balance of a solvent.

20. A biocompatible polymeric gel composition of Claim 1, wherein

a. said one or more than one polyanionic polymer is about 3.6% by weight of sodium alginate;

b. said one or more than one cationic polymer is about 7% by weight of chitosan; and

c. the balance of a solvent.

21. A biocompatible polymeric gel composition of claim 20, wherein said solvent is water.