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 ~~OF THE INVENTION~~

The following ~~invention~~ disclosure relates to ~~is~~ 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 composition comprising:

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. 0.1% to 99.8% by weight water.

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

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

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

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 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 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 ~~invention~~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~~invention~~, the one or more than one polyanionic polymer includes at least one cross-linkable polyanionic polymer. In another embodiment of the present disclosure~~invention~~, 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~~invention~~, 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~~invention~~, 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

blood clotting; and 3) a cross-linking mist that cross-links the gel in the wound while disinfecting the surrounding area.

In one embodiment of the present disclosure~~invention~~, the one or more than one polyanionic polymer comprises alginates or hyaluronates. In one embodiment of the present disclosure~~invention~~, the one or more than one polycationic polymer comprises chitosan. In one embodiment of the present disclosure~~invention~~, the cross-linking mist may be aqueous calcium chloride.

One or more methods of using the medical gel of the present disclosure~~invention~~ are also disclosed, including rapidly achieving hemostasis without the need to apply pressure, and providing a biocompatible wound healing matrix.

Various embodiments of the present disclosure~~invention~~ allow the formulation to be adjusted and implemented for varying the desired viscosity and pre-determined characteristic functions. In one ~~aspect~~embodiment, the ratio of the polycationic polymer to the polyanionic polymer may be improved, having varying degrees of efficiency in wound healing. In another embodiment~~aspect~~, therapeutics can be added to integrate drug formulations for drug delivery options. Further, other features may encompass controlling temperature(s) and/or pressure(s) during the preparation of the medical gel, during application of the gel, and implementing a control for the elasticity or rigidity of the solidified matrix. The matrix formulation, both liquid and solidified structures, may also be dependent on anatomical and physiological measurements and conditions.

Various embodiments of the ~~invention~~ present disclosure allow the composition to be adjusted and implemented at a first tissue site or a second tissue site, and such modification deemed obvious may be integrated and combined in varying quantities to provide for a structural matrix of any size, shape, and configuration.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of an embodiment of the present invention.

FIG. 2 is a microscopic depiction of how the present invention interacts with blood and itself.

FIGS. 3A to 3I show various polymeric subunits that can be used to make up the polycationic or polyanionic polymers.

FIG. 4 shows the benefits of the present invention as compared to existing technology.

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

9. A biocompatible polymeric composition as in Claim 3, wherein at least one cross-linkable polyanionic polymer is cross-linked to at least one polycationic polymer through hydrogen bonding.

10. A biocompatible polymeric composition as in Claim 3, wherein at least one cross-linkable polyanionic polymer is cross-linked to 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. A method of forming a protective coat over a polymeric composition of Claim 1 in situ, comprising the addition of a solution comprising:

    a. about 0.1% to about 30% by weight of a di- or higher valent cation;
    b. 0% to about 90% by weight of a hydrophobic polymer; and
    c. about 5% to about 99.9% by weight of a 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. A method of Claim 12, wherein said solvent is selected from the group consisting of: water, amyl acetate, acetone, methyl ethyl ketone, isopropanol, and tetrahydrofuran.

15. A method of Claim 12, 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. Use of the biocompatible polymeric composition of claim 1 for the manufacture of a medicament for the treatment of ~~A method of treating~~ a wound ~~comprising directly applying to a wound a biocompatible polymeric composition of Claim 1~~.

17. Use ~~A method~~ of Claim 16, 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. Use of the biocompatible polymeric composition of claim 1 for the manufacture of a medicament for ~~A method of~~ achieving rapid hemostasis without the need to apply pressure to a wound ~~comprising directly applying to a wound a biocompatible polymeric composition of Claim 1~~.