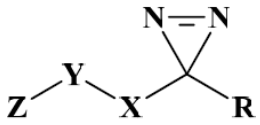
CLAIMS

What is claimed is:

1. A biocompatible polymer comprising a single strand of repeating units and up to 5,000 photoreactive groups covalently attached to said strand, wherein said polymer is comprised in a poly(lactide-co-glycolide) (PLGA) film, wherein the PLGA film is covered with said polymer, wherein said polymer has a molecular weight of up to 3 million Daltons, and wherein said photoreactive groups are derivatives of diazirine, wherein the polymer is a polyamide.

2. The polymer according to claim 1, wherein said diazirine derivative is a compound of the following formula:



wherein

R is

a hydrogen;

C_1-C_8 straight-chain or branched alkyl group, C_2-C_8 straight-chain or branched alkenyl or alkynyl group, or phenyl group substituted at any ring position with one or more the same or different C_1-C_8 straight-chain or branched alkyl group, phenyl or heterocyclic ring, which may be optionally substituted with one or more the same or

different C_1-C_8 straight-chain or branched alkyl group, C_1-C_8 alkoxy group, C_1-C_8 alkoxycarbonyl group, carboxyl group, hydroxyl group, nitro group, halogen atom or amino group optionally mono or di-substituted with the same or different C_1-C_8 straight-chain or branched alkyl group;

methyl group substituted with 1-3 halogen atoms;

amino group optionally mono or di-substituted with the same or different C_1-C_8 straight-chain or branched alkyl group;

thiol or thioether group having the same or different C_1-C_8 straight-chain or branched alkyl group;

sulfone or sulfate group having the same or different C_1-C_8 straight-chain or branched alkyl group;

nitro, cyano, halogen, hydroxy, carboxylic acid or sulfonic acid group; or

alkoxy or alkoxycarbonyl group having the same or different C_1-C_8 straight-chain or branched alkyl group;

X is a bond or 5-7 membered saturated cyclic or heterocyclic, aromatic or heteroaromatic ring unsubstituted or mono-, di- or tri- substituted with:

C_1-C_8 straight-chain or branched alkyl group, C_2-C_8 straight-chain or branched alkenyl or alkynyl group, or phenyl group substituted at any ring position with one or more the same or different C_1-C_8 straight-chain or branched alkyl group, phenyl or heterocyclic ring, which may be optionally substituted with one or more the same or different C_1-C_8 straight-chain or branched alkyl group, C_1-C_8 alkoxy group, C_1-C_8 alkoxycarbonyl group, carboxyl group, hydroxyl group, nitro group, halogen atom or amino group optionally mono or di-substituted with the same or different C_1-C_8 straight-chain or branched alkyl group;

methyl group substituted with 1-3 halogen atoms;

amino group optionally mono or di-substituted with the same or different C_1-C_8 straight-chain or branched alkyl group;

thiol or thioether group having the same or different C_1-C_8 straight-chain or branched alkyl group;

sulfone or sulfate group having the same or different C_1-C_8 straight-chain or branched alkyl group;

nitro, cyano, halogen, hydroxy, carboxylic acid or sulfonic acid group; or

alkoxy or alkoxycarbonyl group having the same or different C_1-C_8 straight-chain or branched alkyl group;

Y is a bond or saturated and unsaturated C_1-C_{500} straight-chain or branched alkyl, alkenyl or alkynyl group, wherein said chain may optionally incorporate at least one hetero atom, and may also comprise at least one substituent;

Z is any suitable functional group, such as halogen, amino, cyano, hydroxy, aldehyde, alkoxycarbonyl, *N*-amide, *N*-hydroxysuccinimide ester, maleimide or thiol.

3. The polymer according to claim 4, wherein said diazirine derivative is selected from the group consisting of:

3-phenyl-3-trifluoromethyl-3*H*-diazirine,

3-[3-(bromoacetylamino)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-(bromoacetylamino)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-methoxy, 5-(bromoacetylamino)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-cyano, 5-(bromoacetylamino)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-sulfo, 5-(bromoacetylamino)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[3-(bromomethyl)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-(bromomethyl)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-methoxy, 5-(bromomethyl)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-cyano, 5-(bromomethyl)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-sulfo, 5-(bromomethyl)phenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[3-aminophenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-aminophenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-methoxy, 5-aminophenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-cyano, 5-aminophenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[2-sulfo, 5-aminophenyl]-3-trifluoromethyl-3*H*-diazirine,

3-stilbenyl-3-trifluoromethyl-3*H*-diazirine,

3-[4-(*N*,*N*'-dimethylamino)stilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-methoxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-hydroxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-aminostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-chlorostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-bromostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-nitrostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-cyanostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-carbomethoxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[4-carboxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[3,5-dimethoxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[3,5-dinitrostilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-[3,5-dihydroxystilbenyl]-3-trifluoromethyl-3*H*-diazirine,

3-naphthyl-3-trifluoromethyl-3*H*-diazirine,

3-pyridinyl-3-trifluoromethyl-3*H*-diazirine,

3-anthryl-3-trifluoromethyl-3*H*-diazirine, and

3-pyrenyl-3-trifluoromethyl-3*H*-diazirine.

4. A bioadhesive composition comprising the polymer of claim 1 and suitable solvents, surfactants, stabilizers, fillers and other additives.

5. The composition according to claim 4, wherein said additives are anti-inflammatory drugs, anti-proteases, antibiotics, and/or anti-restenosis compounds.

6. The composition according to claim 4, wherein said composition is in a form of hydrogel, biocompatible film, patch or bondage.

7. The composition according to claim 4 further comprising aligned nanofibers of biodegradable polymer.

8. The composition according to claim 7, wherein said polymer is collagen or gelatin.

9. The composition according to claim 4, wherein said composition is UV transparent.

10. The composition according to claim 9 having transparency less than 1 optical density unit per 1 centimeter.

11. The composition according to claim 4 comprising metallic particles of size less than 50 micron.

12. The composition according to claim 11, wherein said particles comprises rare earth elements, such as lanthanide group elements, including but not limited to scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium.

13. The composition according to claim 11, wherein said metal particles are coated with anionic or cationic coating.

14. The composition according to claim 13, wherein said coating comprises fatty acids, silica, polyethylene glycol, pluronics, poloxamers, polydopamine, polylysine or any suitable peptide.

15. The composition according to claim 11 further comprising aligned nanofibers of biodegradable polymer.

16. The composition according to claim 15, wherein said polymer is collagen or gelatin.

17. The composition according to claim 11, wherein said composition is NIR transparent.

18. The composition according to claim 17 having transparency less than 1 optical density unit per 1 centimeter.

19. The composition according to claim 4 further comprising any alginate-based polymer, such as alginate-pyrrole or alginate-biotin, thus providing additional properties to the biomaterial, such as increased affinity and conductivity.

20. Use of the bioadhesive composition comprising the polymer of claim 1 and suitable solvents, surfactants, stabilizers, fillers and other additives in the manufacture of a composition for the treatment, in surgery, of a condition such as gastrointestinal surgery towards cancer removal, anastomoses procedures (including end-to-end anastomoses), such as blood vessel anastomoses wherein two tubes or lumens must be joined, tissue fixation, suture sealing and replacement, treatment of lung punctures, body lumen punctures or leaks, cerebrospinal fluid membrane damages, obesity treatments, and bowel obstructions, fixing flat electrodes to heart tissue during open heart, and surgery patches containing drugs such as in gastrointestinal system.

21. Use of the bioadhesive composition comprising the polymer of claim 1 and suitable solvents, surfactants, stabilizers, fillers and other additives in the manufacture of a composition for treating post-surgery gastrointestinal anastomoses, such as end-to-end anastomoses, blood vessel anastomoses wherein two tubes or lumens must be joined, fixed tissues, sealing and replacing sutures, lung punctures, body lumen punctures or leaks, cerebrospinal fluid membrane damages, obesity and bowel obstructions.

22. Use of the bioadhesive composition comprising the polymer of claim 1 and suitable solvents, surfactants, stabilizers, fillers and other additives for the preparation of a formulation for fixing flat electrodes to heart tissue during open heart surgery, and for surgery patches containing drugs.

23. A method for the preparation of the polymer of claim 1, comprising the steps of:

(a) Preparing a solution of said biocompatible polymer having concentration of 0.1 to 100 mg/ml at pH 7.2;

(b) Dissolving said diazirine compound in a suitable organic within the concentration range of 0.01 to 100 mM;

(c) Mixing and reacting the solution of said biocompatible polymer prepared in a) with the solution of the diazirine derivative prepared in b), in order to covalently attach the diazirine groups to the polymer strand;

(d) Purifying said polymer modified in c) on a Sephadex G-25 column or using other conventional purification and separation techniques in order to remove the unbound diazirine derivative molecules.

24. The method according to claim 23, wherein the solvent is DMSO.

25. The method according to claim 23, wherein concentration of the diazirine compound is between 0.01 mM and 100 mM.

26. Use of the composition of claim 4 in the manufacture of a medicament for tissue fixation, wherein the medicament is to be administered by:

(a) Applying the medicament to a tissue to be fixed; and

(b) Irradiation of the applied tissue area with UV light.

27. Use of the composition of claim 11 in the manufacture of a medicament for tissue fixation, wherein the medicament is to be administered by:

(a) Applying the medicament to a tissue to be fixed; and

(b) Irradiation of the applied tissue area with NIR light.

28. The use according to claim 26, wherein the applied tissue area is to be irradiated with UV light wavelength between 320 nm to 390 nm, and wherein the time of irradiation is to be less than 20 minutes.

29. The use according to claim 27, wherein the applied tissue area is to be irradiated with NIR light wavelength between 800 nm to 1000 nm, and wherein the time of irradiation is to be less than 20 minutes.

30. The polymer according to claim 1, wherein the polyamide is poly-L-lysine.