# Claims

1. A hydrophilic amorphous ionic liquid formulation for biological tissue treatment, comprising the following components:

a) an ionic liquid containing a cation and an anion, the cation comprising a nitrogen-containing heterocyclic ring substituted with one or more aminoalkyl groups, and the nitrogen-containing heterocyclic ring being a five-membered or six-membered nitrogen-containing heterocyclic monocyclic ring, and the anion comprising a compound containing carboxyl group;

b) an auxiliary agent for adjusting properties of component a), comprising one or more of antipyrine and nicotinamide;

c) water; and

d) a reducing agent capable of being stably present in the ionic liquid formulation;

wherein based on the total volume of the ionic liquid formulation, the mass-volume ratio concentration of component a) is from 35 w/v% to 95 w/v%, the mass-volume ratio concentration of component b) is from 4 w/v% to 50 w/v%, the mass-volume ratio concentration of component c) is from 5 w/v% to 45 w/v%, and the mass-volume ratio concentration of component d) is from 0.1 w/v% to 2.0 w/v%.

2. The ionic liquid formulation according to claim 1, wherein a molar ratio of the cation to the anion in component a) is close to or equal to the reciprocal of a charge ratio thereof, such that the cation and the anion are sufficiently ionized and have substantially identical charge.

3. The ionic liquid formulation according to claim 1, wherein the one or more aminoalkyl groups are each independently amino$C_{1-8}$alkyl or amino$C_{3-6}$cycloalkyl.

4. The ionic liquid formulation according to claim 1, wherein the one or more aminoalkyl groups are each independently amino$C_{1-6}$alkyl.

5. The ionic liquid formulation according to claim 1 or 2, wherein the cation comprises an N-(amino$C_{1-6}$alkyl)-five-membered or six-membered nitrogen-containing heterocyclic monocyclic ring.

6. The ionic liquid formulation according to claim 1 or 2, wherein the cation comprises 1-(3-aminopropyl)-imidazole.

7. The ionic liquid formulation according to claim 1 or 2, wherein the anion comprises an aliphatic or aromatic monocarboxylic acid, dicarboxylic acid, or tricarboxylic acid.

8. The ionic liquid formulation according to claim 1 or 2, wherein the anion comprises benzoic acid or benzenedicarboxylic acid.

9. The ionic liquid formulation according to claim 1 or 2, wherein the anion comprises phthalic acid.

10. The ionic liquid formulation according to claim 1 or 2, wherein component c) is deoxygenated ultrapure water.

11. The ionic liquid formulation according to claim 1 or 2, wherein the reducing agent of component d) is potassium pyrosulfite.

12. The ionic liquid formulation according to claim 1 or 2, wherein based on the total volume of the ionic liquid formulation, the mass-volume ratio concentration of component a) is from 75 w/v% to 90 w/v%, the mass-volume ratio concentration of component b) is from 6 w/v% to 23 w/v%, the mass-volume ratio concentration of component c) is from 10 w/v% to 40 w/v%, and the mass-volume ratio concentration of component d) is from 0.1 w/v% to 1.0 w/v%.

13. The ionic liquid formulation according to claim 1 or 2, wherein the cation comprises 1-(3-aminopropyl)-imidazole, the anion comprises phthalic acid, the component b) comprises antipyrine and nicotinamide, and the reducing agent of component d) is potassium pyrosulfite; and

the ionic liquid formulation comprises water having a mass-volume ratio concentration of 10 w/v% to 40 w/v%, 1-(3-aminopropyl)-imidazole having a mass-volume ratio concentration of 40 w/v% to 60 w/v%, potassium pyrosulfite having a mass-volume ratio concentration of 0.2 w/v% to 0.8 w/v%, phthalic acid having a mass-volume ratio concentration of 35 w/v% to 65 w/v%, antipyrine having a mass-volume ratio concentration of 8 w/v% or less, and nicotinamide having a mass-volume ratio concentration of 5 w/v% to 15 w/v%.

14. The ionic liquid formulation according to claim 13, comprising water having a mass-volume ratio concentration of 26 w/v%, 1-(3-aminopropyl)-imidazole having a mass-volume ratio concentration of 56 w/v%, potassium pyrosulfite having a mass-volume ratio concentration of 0.5 w/v%, phthalic acid having a mass-volume ratio concentration of 40 w/v%, antipyrine having a mass-volume ratio concentration of 5 w/v%, and nicotinamide having a mass-volume ratio concentration of 10 w/v%.

15. The ionic liquid formulation according to claim 1 or 2, wherein the refractive index of the ionic liquid formulation is 1.50 or more.

16. The ionic liquid formulation according to claim 15, wherein the refractive index of the ionic liquid formulation is 1.50 to 1.55.

17. The ionic liquid formulation according to claim 15, wherein the refractive index of the ionic liquid formulation is 1.51 to 1.54.

18. The ionic liquid formulation according to claim 1 or 2, wherein the b) auxiliary agent further comprises one or more of nicotinic acid and 1,4-diazabicyclo[2.2.2]octane.

19. A method for preparing the ionic liquid formulation according to any one of claims 1 to 18, comprising:

formulating the components a)-d) into a formulation in a container, and

filling the container with an inert gas for inert protection, and sealing the container.

20. Use of the ionic liquid formulation according to any one of claims 1 to 18 in biological tissue treatment, wherein the biological tissue treatment comprises one or more of tissue clearing, cryopreservation of a tissue by vitrification, low-temperature fluorescence enhancement, ice-free cryosectioning, cryosectioning of an expanded tissue, and super-resolution imaging.