Claims

1. A pharmaceutical aqueous solution comprising:
(a) a complex formed by
(ai) the radionuclide ^{177}Lu (Lutetium-177), and
(aii) a somatostatin receptor binding peptide linked to the chelating agent DOTA; and
(b) at least two different stabilizers against radiolytic degradation comprising
(bi) gentisic acid or a salt thereof; and
(bii) ascorbic acid or a salt thereof;
wherein said radionuclide is present in a concentration that it provides a volumetric radioactivity of from 250 to 500 MBq/mL;
said stabilizers are present in a total concentration of from 1.0 to 5.0 mg/mL; and the pharmaceutical aqueous solution has less than 1% ethanol, and the radiochemical purity (determined by HPLC) of the solution is maintained at ≥95% for at least 72 h when stored at 25° C.

2. The pharmaceutical aqueous solution according to claim 1, wherein
(bi) gentisic acid is present in a concentration of from 0.5 to 2 mg/mL; and
(bii) ascorbic acid is present in a concentration of from 2.0 to 5.0 mg/mL.

3. The pharmaceutical aqueous solution according to claim 2, wherein gentisic acid is present in a concentration of from 0.5 to 1 mg/mL.

4. The pharmaceutical aqueous solution according to claim 2, further comprising:
(c) diethylentriaminepentaacetic acid (DTPA) or a salt thereof in a concentration of from 0.01 to 0.10 mg/mL.

5. The pharmaceutical aqueous solution according to claim 4, further comprising:
(d) an acetate buffer composed of:
(di) acetic acid in a concentration of from 0.3 to 0.7 mg/mL; and
(dii) sodium acetate in a concentration from 0.4 to 0.9 mg/mL.

6. The pharmaceutical aqueous solution according to claim 5, wherein said acetate buffer provides for a pH of from 4.5 to 6.0.

7. The pharmaceutical aqueous solution according to claim 5, wherein said acetate buffer provides a pH of from 5.0 to 5.5.

8. The pharmaceutical aqueous solution according to claim 1, wherein at least one of the stabilizers is present during the complex formation of components (ai) and (aii) and at least one of the stabilizers is added after the complex formation of components (ai) and (aii).

9. The pharmaceutical aqueous solution according to claim 1, wherein at least gentisic acid is present during the complex formation of components (ai) and (aii) and at least ascorbic acid is added after the complex formation of components (ai) and (aii).

10. The pharmaceutical aqueous solution according to claim 1, wherein the only stabilizer present during the complex formation of components (ai) and (aii) is gentisic acid and the only stabilizer added after the complex formation of components (ai) and (aii) is ascorbic acid.

11. The pharmaceutical aqueous solution according to claim 8, wherein that/those stabilizer/stabilizers which is/are present during the complex formation of components (ai) and (aii) is/are present during the complex formulation in a total concentration of from 15 to 50 mg/mL.

12. The pharmaceutical aqueous solution according to claim 8, wherein that/those stabilizer/stabilizers which is/are present during the complex formation of components (ai) and (aii) is/are present during the complex formulation in a total concentration of from 20 to 40 mg/mL.

13. The pharmaceutical aqueous solution according to claim 11, wherein the only stabilizer present during the complex formation of components (ai) and (aii) is gentisic acid and is present during the complex formation in a concentration of from 20 to 40 mg/mL.

14. The pharmaceutical aqueous solution according to claim 10, wherein the only stabilizer present during the complex formation of components (ai) and (aii) is gentisic acid and is present during the complex formation in a concentration of from 25 to 35 mg/mL.

15. The pharmaceutical aqueous solution according to claim 1, which has a shelf life of at least 72 h when stored at ≤25° C.

16. The pharmaceutical aqueous solution according to claim 1, which is a single dose that allows delivery of 7.4 GBq ±10% of radioactivity at injection time.

17. The pharmaceutical aqueous solution according to claim 1, wherein said solution is produced at a batch size of at least 20 GBq, at least 50 GBq, or at least 70 GBq.

18. The pharmaceutical aqueous solution according to claim 16, which is provided in a volume of 20.5 to 25.0 mL.

19. The pharmaceutical aqueous solution according to claim 1, wherein the somatostatin receptor binding peptide linked to the chelating agent DOTA is DOTA-TATE (oxodotreotide) or DOTA-TOC (edotreotide).

20. A pharmaceutical aqueous solution comprising:
(a) a complex formed by
(ai) the radionuclide ^{177}Lu (Lutetium-177) in a concentration that it provides a volumetric radioactivity of from 250 to 500 MBq/mL, and
(aii) DOTA-TATE or DOTA-TOC;
(b) the stabilizers against radiolytic degradation comprising
(bi) gentisic acid in a concentration of from 0.5 to 1 mg/mL and
(bii) ascorbic acid in a concentration of from 2.0 to 5.0 mg/mL;
(c) diethylentriaminepentaacetic acid (DTPA) or a salt thereof in a concentration of from 0.01 to 0.10 mg/mL; and
(d) an acetate buffer composed of:
(di) acetic acid in a concentration of from 0.3 to 0.7 mg/mL; and
(dii) sodium acetate in a concentration from 0.4 to 0.9 mg/mL; wherein the pharmaceutical aqueous solution has less than 1% ethanol, and the radiochemical purity (determined by HPLC) of the solution is maintained at ≥95% for at least 72 h when stored at 25° C.

21. The pharmaceutical aqueous solution according to claim 20, which is a single dose that allows delivery of 7.4 GBq ±10% of radioactivity at injection time.

22. The pharmaceutical aqueous solution according to claim 20, wherein said complex is formed by the radionuclide ^{177}Lu and DOTA-TATE.

23. The pharmaceutical aqueous solution according to claim 20, wherein said complex is formed by the radionuclide ^{177}Lu and DOTA-TOC.

24. The pharmaceutical aqueous solution according to claim 20, wherein said component (b) consists essentially of two stabilizers:
(bi) gentisic acid or a salt thereof as a first stabilizer; and
(bii) ascorbic acid or a salt thereof as a second stabilizer.

25. The pharmaceutical aqueous solution according to claim 20, wherein said complex is formed by the radionuclide ^{177}Lu and DOTA-TATE with a volumetric radioactivity of about 370 MBq/mL, and said component (b) comprises gentisic acid in a concentration of about 0.63 mg/mL and ascorbic acid in a concentration of about 2.80 mg/mL.