Claims

1. A liquid eflapegrastim formulation comprising eflapegrastim and a buffer material, wherein

a concentration of the eflapegrastim is about 11 mg/mL to about 66 mg/mL;

a patient-friendly (PF) index of the liquid formulation, represented by Equation 1, is 10 or less;

[Equation 1]

Patient-friendly (PF) index = Osm (mOsm/kg)/100 + MGF (N)

wherein, in Equation 1, Osm indicates the osmolarity value of the liquid formulation, and MGF indicates a value of maximum gliding force when the liquid formulation is injected with a 29-gauge (29G) syringe at a rate of 2.835 mm/s;

an osmolarity of the liquid formulation is about 100 mOsm/kg to about 800 mOsm/kg;

a maximum gliding force (MGF) of the liquid formulation is 5 N or less when injected with a 29-gauge (29G) syringe at a rate of about 2.835 mm/s, or 7N or less at a rate of about 4.725 mm/s; and

a remaining rate of eflapegrastim after storage at a temperature of 23℃ to 27℃ and a relative humidity of about 55% to 65% is 95% or greater, as measured by reversed phase high-performance liquid chromatography (RP-HPLC) or size-exclusion high-performance liquid chromatography (SE-HPLC).

2. The liquid eflapegrastim formulation of claim 1, wherein the liquid formulation has a conductivity of 15 mS/cm or less.

3. The liquid eflapegrastim formulation of claim 1 or 2, wherein the remaining rate of eflapegrastim is 98% or greater.

4. The liquid eflapegrastim formulation of any one of the preceding claims, wherein the liquid formulation has a viscosity of 4 cP or less at a room temperature of 20℃ to 25℃.

5. The liquid eflapegrastim formulation of any one of the preceding claims, wherein a concentration of the buffer material is about 5 mM to about 100 mM.

6. The liquid eflapegrastim formulation of any one of the preceding claims, wherein the buffer material is citric acid and/or citrate.

7. The liquid eflapegrastim formulation of any one of the preceding claims, further comprising a stabilizing agent.

8. The liquid eflapegrastim formulation of any one of the preceding claims, wherein the stabilizing agent comprises mannitol.

9. The liquid eflapegrastim formulation of claim 8, wherein a concentration of the mannitol is about 1% to about 20%(w/v) of the liquid formulation.

10. The liquid eflapegrastim formulation of any one of the preceding claims, further comprising a surfactant.

11. The liquid eflapegrastim formulation of claim 10, wherein the surfactant is a polysorbate-based non-ionic surfactant.

12. The liquid eflapegrastim formulation of claim 11, wherein the polysorbate-based non-ionic surfactant is selected from the group consisting of Polysorbate 20, Polysorbate 40, Polysorbate 60, and Polysorbate 80.

13. The liquid eflapegrastim formulation of claim 12, wherein a final concentration of the polysorbate-based non-ionic surfactant after the liquid formulation is concentrated is about 0.0001% to about 0.5%(w/v) of the total liquid formulation.

14. The liquid eflapegrastim formulation of any one of the preceding claims, wherein the liquid formulation has a pH of about 4 to about 8.

15. The liquid eflapegrastim formulation of any one of the preceding claims, further comprising a tonicity modifier.

16. The liquid eflapegrastim formulation of claim 15, wherein the tonicity modifier is sodium chloride.

17. The liquid eflapegrastim formulation of claim 15, wherein a concentration of the tonicity modifier is about 5 mM to about 200 mM.

18. The liquid eflapegrastim formulation of any one of the preceding claims, wherein the liquid formulation is pre-treated using a purification column.

19. The liquid eflapegrastim formulation of claim 18, wherein the pre-treated liquid formulation is concentrated after buffer exchange with a buffer which does not contain a polysorbate-based non-ionic surfactant.

20. A liquid eflapegrastim formulation comprising eflapegrastim, a buffer material, and a surfactant, wherein

a concentration of the eflapegrastim is about 11 mg/mL to about 66 mg/mL;

a concentration of the buffer material is about 5 mM to about 100 mM; and

a concentration of the surfactant after the liquid formulation is concentrated is about 0.001% to about 5%(w/v) of the total liquid formulation, and a concentration of the surfactant after the liquid formulation is concentrated is about 0.001% to about 5%(w/v) of the total liquid formulation.

21. The liquid eflapegrastim formulation of claim 20, wherein the surfactant is a polysorbate-based non-ionic surfactant.

22. The liquid eflapegrastim formulation of claim 20, wherein the liquid formulation comprises:

about 11 mg/mL to about 66 mg/mL of the eflapegrastim;

about 5 mM to about 100 mM of citric acid and/or citrate; and

about 0.001% to about 5%(w/v) of a polysorbate-based non-ionic surfactant.

23. The liquid eflapegrastim formulation of claim 21, wherein the polysorbate-based non-ionic surfactant is selected from the group consisting of Polysorbate 20, Polysorbate 40, Polysorbate 60, and Polysorbate 80.

24. The liquid eflapegrastim formulation of claim 21, wherein the liquid formulation comprises:

about 11 mg/mL to about 66 mg/mL of the eflapegrastim;

about 5 mM to about 100 mM of sodium citrate;

about 0.001% to about 0.5%(w/v) of Polysorbate 80;

about 1% to about 20%(w/v) of mannitol; and

about 5 mM to about 200 mM of sodium chloride.

25. The liquid eflapegrastim formulation of claim 20, wherein the osmolarity of the liquid formulation is about 100 mOsm/kg to about 800 mOsm/kg.

26. The liquid eflapegrastim formulation of claim 20, wherein the liquid formulation has a conductivity of 15 mS/cm or less.

27. Use of a liquid eflapegrastim formulation according to any one of claims 1 to 26 in the manufacture of a medicament for treating neutropenia in a patient having compromised white blood cell production.

28. The use of claim 27, wherein the neutropenia is severe chronic neutropenia or febrile neutropenia.

29. The use of any one of claims 27 to 28, wherein the liquid eflapegrastim formulation is to be administered after the patient is treated with adjuvant or neoadjuvant chemotherapy.

30. The use of any one of claims 27 to 29, wherein the liquid eflapegrastim formulation is to be administered between 1 and 5 days after the patient has been treated with adjuvant or neoadjuvant chemotherapy.

31. The use of claim 30, wherein the adjuvant or neoadjuvant chemotherapy is a combination of docetaxel and cyclophosphamide.

32. The use of any one of claims 27 to 31, wherein a second dose of the liquid eflapegrastim formulation is to be administered between 15 and 25 days after a first dose of the liquid eflapegrastim formulation has been administered to the patient.

33. The use of any one of claims 27 to 32, wherein the liquid eflapegrastim formulation comprises a unit dosage form selected from: 25 μg/kg, 50 μg/kg, 100 μg/kg, and 200 μg/kg.

34. The use of any one of claims 27 to 33, wherein the liquid eflapegrastim formulation is in form of 13.2 mg of the liquid eflapegrastim formulation in a 0.6 mL dosage volume.

35. The use of any one of claims 27 to 34, wherein the treatment comprises a second agent.

36. The use of claim 35, wherein the second agent is an anti-cancer agent.

37. The use of any one of claims 27 to 37, wherein the liquid eflapegrastim formulation is to be administered to the patient within about 6 hours, about 5 hours, about 2 hours, about 1 hour of completion of chemotherapy.