Claims

1. A pharmaceutical formulation comprising

(a). at least one analogue and/or derivative of insulin, wherein the analogue of insulin is selected from the group consisting of insulin aspart, insulin lispro, insulin glulisine, and insulin glargine, wherein the derivative of insulin is selected from the group consisting of insulin detemir and insulin degludec, wherein the analogue and/or derivative of insulin is present in a concentration from 10 U/ml to 1000 U/ml; and

(b). Zn(ll), wherein Zn(ll) is present in a concentration from 0.0100 to 0.0600 mg / 100 U of the analogue and/or derivative of insulin; and

(c). optionally protamine;

wherein the pharmaceutical formulation is free of glycerol;

wherein the pharmaceutical formulation further comprises sodium chloride in a concentration from 5.0 to 15 mg/mL; and

wherein the pharmaceutical formulation is an aqueous solution having a pH value in the range from 7.0 to 7.8.

2. The pharmaceutical formulation according to claim 1, wherein sodium chloride is present in a concentration from 5.6 to 6.8 mg/mL.

3. The pharmaceutical formulation as claimed in one or more of claims 1 to 2, wherein protamine is present in a concentration from 0.1 to 0.5 mg/mL.

4. The pharmaceutical formulation as claimed in one or more of claims 1 to 3, wherein the pharmaceutical formulation comprises one or more further active pharmaceutical ingredients.

5. The pharmaceutical formulation according to claim 4, wherein the further active pharmaceutical ingredient is an antidiabetic agent.

6. The pharmaceutical formulation according to claim 4 or 5, wherein the further active pharmaceutical ingredient is an antidiabetic agent selected from the group consisting of:

(a). a GLP-1 receptor agonist;

(b). a dual GLP-1 receptor/glucagon receptor agonist;

(c). human FGF-21;
(d). an FGF-21 analogue;
(e). an FGF-21 derivative;
(f). insulin;
(g). human insulin;
(h). an analogue of insulin; and
(i). a derivative of insulin.

7. The pharmaceutical formulation as claimed in one or more of claims 1 to 6, wherein the pharmaceutical formulation comprises more than one analogue and/or derivative of insulin, wherein one analogue and/or derivative of insulin is a fast acting insulin and one analogue and/or derivative of insulin is a long acting insulin.

8. The pharmaceutical formulation according to claim 7, wherein the fast acting insulin is one or more insulin selected from the group consisting of insulin aspart, insulin lispro and insulin glulisine and wherein the long acting insulin is one or more insulin selected from the group consisting of insulin detemir and insulin degludec.

9. The pharmaceutical formulation as claimed in one or more of claims 1 to 8, wherein the pharmaceutical formulation consists of:
(a). 3.5 mg/mL insulin aspart;
(b). 1.72 mg/mL metacresol;
(c). 1.50 mg/mL phenol;
(d). 0.0196 mg/mL Zn(II);
(e). 6.2 mg/mL sodium chloride;
(f). 1.88 mg/mL Na_2HPO_4 x 7 H_2O;
(g). sodium hydroxide and/or hydrochloric acid to adjust the pH to 7.4; and
(i). water.

10. The pharmaceutical formulation as claimed in one or more of claims 1 to 8, wherein the pharmaceutical formulation consists of:
(a). 3.5 mg/mL insulin aspart;
(b). 1.72 mg/mL metacresol;
(c). 1.50 mg/mL phenol;
(d). 0.0196 mg/mL Zn(II);
(e). 6.2 mg/mL sodium chloride;
(f). 1.88 mg/mL Na_2HPO_4 x 7 H_2O;

(g). from 0.1 mg/mL to 0.5 mg/mL protamine;
(h). sodium hydroxide and/or hydrochloric acid to adjust the pH to a pH in the range from 7.1 to 7.6; and
(i). water.

11. A process for preparing the pharmaceutical formulation according to claim 1, wherein the components are mixed together in the form of a solution or suspension, the pH is adjusted to reach the desired pH and water is added to reach the final volume.

12. A kit comprising one or more separate packages of
(a). the pharmaceutical formulation as claimed in one or more of claims 1 to 10; and
(b). a medical device.

13. A kit comprising one or more separate packages of
(a). the pharmaceutical formulation as claimed in one or more of claims 1 to 10; and
(b). at least one further active pharmaceutical ingredient;
(c). and optionally a medical device.

14. The kit according to claim 12 or 13, wherein the further active pharmaceutical ingredient is an antidiabetic agent.

15. The kit as claimed in one or more of claims 12 to 13, wherein the further active pharmaceutical ingredient is an antidiabetic agent selected from the group consisting of:
(a). a GLP-1 receptor agonist;
(b). a dual GLP-1 receptor/glucagon receptor agonist;
(c). human FGF-21;
(d). a FGF-21 analogue;
(e). a FGF-21 derivative;
(f). insulin;
(g). human insulin;
(h). an analogue of insulin; and
(i). a derivative of insulin.

16. The kit as claimed in one or more of claims 12 to 15, wherein the kit comprises more than one analogue and/or derivative of insulin, wherein one analogue and/or

derivative of insulin is a fast acting insulin and one analogue and/or derivative of insulin is a long acting insulin.

17. The kit according to claim 16, wherein the fast acting insulin is selected from the group consisting of insulin aspart, insulin lispro and insulin glulisine and wherein the long acting insulin is selected from the group consisting of insulin glargin, insulin detemir and insulin degludec.

18. Use of the pharmaceutical formulation as claimed in one or more of claims 1 to 10 for the preparation of a medicament for the treatment of diabetes mellitus.

19. Use of the pharmaceutical formulation as claimed in one or more of claims 1 to 10 for the preparation of a medicament for the treatment of hyperglycemia.

20. Medical device comprising the pharmaceutical formulation as claimed in one or more of claims 1 to 10, wherein said medical device is suitable for administering said pharmaceutical formulation to an animal and/or human.