WHAT IS CLAIMED IS:

1. A fusion protein comprising a GLP-1 polypeptide and an immunoglobulin Fc domain, wherein the GLP-1 polypeptide is covalently linked to the immunoglobulin Fc domain, and the GLP-1 polypeptide is selected from human GLP-1 (7-37), human GLP-1 (7-36), and DPP-IV resistant human GLP-1, and the GLP-1 polypeptide contains one or more amino acid substitutions selected from the group consisting of A8G, G22E, and R36G relative to native human GLP-1; and wherein the immunoglobulin Fc domain comprises or is an IgG2-Fc domain, and the IgG2-Fc domain contains one or more amino acid substitutions selected from the group consisting of C222S, A330S, and P331S.

2. The fusion protein according to claim 1, wherein the GLP-1 polypeptide has a level of hydroxylation at lysine 34 (K34) relative to native human GLP-1.

3. The fusion protein according to claim 1 or 2, wherein the hydroxylation level is between 10% and 100%, for example, greater than or equal to 10%, or greater than or equal to 15%, or greater than or equal to 20%, or greater than or equal to 26%, or greater than or equal to 30%, or greater than or equal to 40%, or greater than or equal to 50%, or greater than or equal to 60%, or greater than or equal to 70%, or greater than or equal to 80%, or greater than or equal to 90%.

4. The fusion protein according to any one of claims 1-3, wherein the GLP-1 polypeptide is substantially unoxidized at tryptophan 31 (W31) relative to native human GLP-1.

5. The fusion protein according to claim 4, wherein oxidation level of the GLP-1 polypeptide at W31 relative to native human GLP-1 is less than 0.5% or undetectable.

6. The fusion protein according to any one of claims 1-5, wherein the GLP-1 polypeptide has at least 90% sequence identity to the amino acid sequences as set forth in SEQ ID NO: 1, SEQ ID NO: 2, or SEQ ID NO: 3, and contains the one or more amino acid substitutions selected from the group consisting of A8G, G22E, and R36G relative to native human GLP-1.

7. The fusion protein according to any one of claims 1-6, wherein the GLP-1 polypeptide contains A8G and G22E substitutions relative to native human GLP-1.

8. The fusion protein according to claim 7, wherein the GLP-1 polypeptide contains A8G, G22E, and R36G substitutions relative to native human GLP-1.

9. The fusion protein according to claim 8, wherein the GLP-1 polypeptide is human GLP-1 (7-37), and contains A8G, G22E, and R36G substitutions relative to native human GLP-1.

10. The fusion protein according to any one of the preceding claims, wherein the amino acid sequence of the GLP-1 polypeptide is as set forth in SEQ ID NO: 3.

11. The fusion protein according to any one of claims 1-10, wherein the IgG2-Fc domain is derived from human IgG2.

12. The fusion protein according to any one of the preceding claims, wherein the IgG2-Fc domain has at least 90% sequence identity to the amino acid sequences as set forth in SEQ ID NO: 5 or SEQ ID NO: 6, and contains the one or more amino acid substitutions selected from the group consisting of C222S, A330S, and P331S.

13. The fusion protein according to any one of the preceding claims, wherein the IgG2-Fc domain has at least 90% sequence identity to the amino acid sequences as set forth in SEQ ID NO: 5 or SEQ ID NO: 6, and contains A330S and P331S substitutions.

14. The fusion protein according to claim 13, wherein the IgG2-Fc domain further contains C222S substitution.

15. The fusion protein according to claim 14, wherein the amino acid sequence of the IgG2-Fc domain is as set forth in SEQ ID NO: 6.

16. The fusion protein according to any one of the preceding claims, wherein the amino acid sequence of the GLP-1 polypeptide is as set forth in SEQ ID NO: 3, and the amino acid sequence of the immunoglobulin Fc domain is as set forth in SEQ ID NO: 6.

17. The fusion protein according to any one of the preceding claims, wherein the GLP-1 polypeptide is located at N-terminus or C-terminus of the immunoglobulin Fc domain.

18. The fusion protein according to any one of the preceding claims, wherein the GLP-1 polypeptide is directly covalently linked to the immunoglobulin Fc domain.

19. The fusion protein according to any one of claims 1-17, wherein the GLP-1 polypeptide and the immunoglobulin Fc domain are covalently linked via a linker.

20. The fusion protein according to claim 19, wherein the linker is selected from the group consisting of a cleavable linker, a non-cleavable linker, a flexible linker, a rigid linker, a helical linker, and a non-helical linker.

21. The fusion protein according to claim 20, wherein the linker includes a connecting peptide.

22. The fusion protein according to claim 21, wherein the connecting peptide contains glycine and serine residues.

23. The fusion protein according to claim 22, wherein the connecting peptide comprising glycine and serine residues includes one, two, three, four, or more repeats of SEQ ID NO: 39 (GGGS), SEQ ID NO: 40 (GGGGS), SEQ ID NO: 41 (GGGGGS), or SEQ ID NO: 42 (GGGGGGGS).

24. The fusion protein according to any one of claims 19-23, wherein the linker comprises an amino acid sequence selected from group consisting of SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

25. The fusion protein according to claim 24, wherein the linker comprises the amino acid sequence as set forth in SEQ ID NO: 9.

26. The fusion protein according to any one of claims 19-25, wherein the amino acid sequence of the GLP-1 polypeptide is as set forth in SEQ ID NO: 3, the amino acid sequence of the immunoglobulin Fc domain is as set forth in SEQ ID NO: 6, and the amino acid sequence of the linker is as set forth in SEQ ID NO: 9.

27. The fusion protein according to any one of the preceding claims, wherein the fusion protein has an amino acid sequence as set forth in SEQ ID NO: 7 or an amino acid sequence with at least 80% sequence identity to SEQ ID NO: 7.

28. The fusion protein according to any one of the preceding claims, wherein the IgG2-Fc domain has a level of oxidation at methionine corresponding to methionine residue No. 253 (M253) of SEQ ID NO: 7.

29. The fusion protein according to claim 28, wherein the oxidation level at the M253 residue of SEQ ID NO: 7 is less than or equal to 5%.

30. The fusion protein according to any one of the preceding claims, further comprising a signal peptide.

31. The fusion protein according to claim 30, wherein the signal peptide is the human CD33 signal peptide.

32. The fusion protein according to claim 30 or 31, wherein the signal peptide has an amino acid sequence as set forth in SEQ ID NO: 4 or an amino acid sequence with at least 90% sequence identity to SEQ ID NO: 4.

33. The fusion protein according to any one of claims 30-32, wherein the fusion protein has an amino acid sequence as set forth in SEQ ID NO: 8 or an amino acid sequence with at least 80% sequence identity to SEQ ID NO: 8.

34. The fusion protein according to any one of the preceding claims, wherein the fusion protein has a half-life in a subject's body of at least 1 day, at least 2 days, at least 3 days, at least 4 days, at least 5 days, at least 6 days, at least 7 days, at least 8 days, at least 9 days, at least 10 days, at least 11 days, at least 12 days, at least 13 days, or at least 14 days.

35. A dimer comprising two identical peptide chains connected by a disulfide bond, wherein each peptide chain comprises the fusion protein according to any one of claims 1-34.

36. A nucleic acid molecule comprising a nucleotide sequence encoding the fusion protein according to any one of claims 1-34.

37. The nucleic acid molecule according to claim 36, comprising a nucleotide sequence as set forth in SEQ ID NO: 26 or SEQ ID NO: 27, or a nucleotide sequence with at least 70% sequence identity to SEQ ID NO: 26 or SEQ ID NO: 27.

38. A vector comprising the nucleic acid molecule according to claim 36 or 37.

39. A cell comprising a nucleic acid molecule according to claim 36 or 37, or a vector according to claim 38.

40. The cell according to claim 39, further recombinantly expressing or naturally expressing lysine hydroxylase.

41. The cell according to claim 40, wherein the expression level or activity of lysine hydroxylase expressed in the said cells are higher than the level or activity of lysine hydroxylase in COS-7 cells.

42. The cell according to any one of claims 39-41, wherein the cell is a prokaryotic cell or a eukaryotic cell.

43. The cell according to claim 42, wherein the eukaryotic cell is a mammalian cell.

44. The cell according to claim 43, wherein the mammalian cell is a human cell or Chinese hamster ovary (CHO) cell.

45. The cell according to claim 43, wherein the mammalian cell is human embryonic kidney cells 293 (HEK293), or CHO-K1 cells, or CHO-S cells, or CHO-DG44 cells.

46. A composition comprising the fusion protein according to any one of claims 1-34, or the dimer according to claim 35, or the nucleic acid molecule according to claim 36 or 37, or the vector according to claim 38, or the cell according to any one of claims 39-45.

47. The composition according to claim 46, wherein in the fusion protein, greater than or equal to 10%, or greater than or equal to 15%, or at least greater than or equal to 20%, or greater than or equal to 26%, or greater than or equal to 30%, or greater than or equal to 40%, or greater than or equal to 50%, or greater than or equal to 60%, or greater than or equal to 70%, or greater than or equal to 80%, or greater than or equal to 90% of the GLP-1 polypeptide in the fusion protein is hydroxylated at position K34 relative to native human GLP-1.

48. A method for constructing a cell according to any one of claims 39-45, comprising:

a) introducing a nucleic acid molecule encoding the fusion protein into a vector to construct an expression vector;
b) introducing the expression vector into a cell that recombinantly expresses or naturally expresses lysine hydroxylase to obtain a recombinant cell; preferably, the lysine hydroxylase level or activity expressed by the recombinant cell is higher than the level or activity of lysine hydroxylase expressed by COS-7 cells; more preferably, the cell is a CHO cell, particularly CHO-K1 cells; more preferably, the vector is a pKN012 vector.

49. A method for constructing a recombinant cell, comprising:
a) inserting the nucleotide sequence as set forth in SEQ ID NO: 26 into the NcoI and HindIII sites of a pKN012 vector to generate a pKN012-GLP1-IgG2/Fc expression vector;
b) introducing the pKN012-GLP1-IgG2/Fc expression vector into a CHO-K1 cell to obtain the recombinant cell.

50. A method for producing a fusion protein, comprising the step of using the cell according to any of claims 39-45 or the cell obtained by the construction method according to claim 48 or 49 to produce the fusion protein.

51. The method according to claim 50, further comprising the step of detecting the hydroxylation level of the fusion protein at position K34 relative to native human GLP-1.

52. A method for detecting the quality of a fusion protein, wherein the fusion protein comprises a GLP-1 polypeptide and an immunoglobulin IgG2-Fc domain, the method comprises the following step: detecting the hydroxylation level of the fusion protein at position K34 relative to native human GLP-1.

53. The method according to claim 52, wherein the GLP-1 polypeptide is selected from human GLP-1 (7-37), human GLP-1 (7-36), and DPP-IV resistant human GLP-1, and the GLP-1 polypeptide contains one or more amino acid substitutions selected from the following group consisting of A8G, G22E, and R36G relative to native human GLP-1; and/or the IgG2-Fc domain contains one or more amino acid substitutions selected from the group consisting of C222S, A330S, and P331S.

54. The method according to claim 52 or 53, wherein when the hydroxylation level of the fusion protein at position K34 relative to native human GLP-1 is between 10% and 100% (e.g., greater than or equal to 10%, or greater than or equal to 15%, or greater than or equal to 20%, or greater than or equal to 26%, or greater than or equal to 30%, or greater than or equal to 40%, or greater than or equal to 50%, or greater than or equal to 60%, or greater than or equal to 70%, or greater than or equal to 80%, or greater than or equal to 90%), the quality of the fusion protein is confirmed as qualified.

55. Use of the fusion protein according to any one of claims 1-34, or the dimer according to claim 35, or the nucleic acid molecule according to claim 36 or 37, or the vector according to claim 38, or the cell according to any one of claims 39-45, or the composition according to claim 46 or 47, in the manufacture of a medicament for the treatment or prevention of diseases.

56. The use according to claim 55, wherein the disease is selected from the group consisting of metabolic diseases associated with glucose or lipid metabolism disorders, complications of metabolic diseases, and neurological disorders.

57. The use according to claim 56, wherein the metabolic diseases associated with glucose or lipid metabolism disorders are selected from the group consisting of diabetes, non-

alcoholic steatohepatitis (NASH), non-alcoholic fatty liver disease (NAFLD), obesity, and metabolic syndrome.

58. The use according to claim 56 or 57, wherein the metabolic disease associated with glucose or lipid metabolism disorders is diabetes (e.g., type 2 diabetes).

59. The use according to claim 56, wherein the complications of metabolic diseases include cardiovascular complications, renal complications, or hepatic complications caused by metabolic diseases.

60. The use according to claim 56, wherein the neurological disorder is a neurodegenerative disease.

61. The use according to claim 60, wherein the neurodegenerative disease is selected from the group consisting of Alzheimer's disease, motor neuron disease, Huntington's disease, and Parkinson's disease.

62. Use of the fusion protein of any of claims 1-34, or the dimer of claim 35, or the polynucleotide of claim 36 or 37, or the vector of claim 38, or the cell of claims 39-45, or the composition of claims 46 or 47, and additional therapeutic agents, in the preparation of medicaments for treating or preventing diseases.

63. The use according to claim 62, wherein the disease is selected from the group consisting of: metabolic diseases related to disorders of glucose metabolism and/or lipid metabolism, complications of metabolic diseases, central metabolic diseases such as neurological diseases and other metabolic-related diseases.

64. The use according to claim 63, wherein the metabolic disease related to disorders of glucose metabolism and/or lipid metabolism is selected from the group consisting of: diabetes, non-alcoholic fatty liver disease (NAFLD), non-alcoholic steatohepatitis (NASH), obesity and metabolic syndrome.

65. The use according to claim 63 or 64, wherein the metabolic disease associated with disorders of glucose metabolism and/or lipid metabolism is diabetes (e.g., type 2 diabetes).

66. The use according to claim 63, wherein the complications of the metabolic diseases include cardiovascular complications (such as heart failure), renal complications (such as diabetic nephropathy and chronic kidney disease) caused by metabolic diseases, or hepatic complications (such as fatty liver disease, including NAFLD and NASH).

67. The use according to claim 63, wherein the neurological disease is a neurodegenerative disease.

68. The use according to claim 67, wherein the neurodegenerative disease is selected from the group consisting of Alzheimer's disease, motor neuron disease, Huntington's disease, and Parkinson's disease.

69. The use according to any one of claims 62-68, wherein the additional therapeutic agent is selected from the group consisting of insulin, metformin, sulfonylureas (e.g., glimepiride, glyburide, gliclazide, gliquidone), alpha-glucosidase inhibitors (e.g., acarbose), and gamma-aminobutyric acid.

70. The use according to claim 69, wherein the additional therapeutic agent is metformin.

71. The use according to claim 69, wherein the additional therapeutic agent is gamma-aminobutyric acid.

72. Use of a fusion protein comprising the amino acid sequence shown in SEQ ID NO: 7 and metformin in the preparation of a medicament for the treatment of diabetes.

73. The use according to claim 72, wherein the diabetes is type 2 diabetes.

74. The use according to claim 72 or 73, wherein the amino acid sequence of the fusion protein is shown in SEQ ID NO: 7.

75. Use of a fusion protein comprising the amino acid sequence shown in SEQ ID NO: 7 and gamma-aminobutyric acid in the preparation of a medicament for the treatment of neurodegenerative diseases.

76. The use according to claim 75, wherein the neurodegenerative disease is selected from the group consisting of Alzheimer's disease, motor neuron disease, Huntington's disease and Parkinson's disease.

77. The use according to claim 75 or 76, wherein the amino acid sequence of the fusion protein is shown in SEQ ID NO: 7.

78. A pharmaceutical combination comprising the fusion protein according to any of claims 1-34, or the dimer described in claim 35, or the polynucleotide described in claims 36 or 37, or the vector of claim 38, or the cell of claims 39 -45, or the composition of claim 46 or 47, and an additional therapeutic agent.

79. The pharmaceutical combination according to claim 78, wherein the additional therapeutic agent is a drug for treating diabetes, or a drug for treating neurodegenerative diseases.

80. The pharmaceutical combination of claim 79, wherein the additional therapeutic agent is selected from the group consisting of insulin, metformin, sulfonylureas (e.g., glimepiride, glyburide, gliclazide, glaquidone), alpha-glucosidase inhibitors (e.g., acarbose), and gamma-aminobutyric acid.

81. The pharmaceutical combination of claim 80, wherein the additional therapeutic agent is metformin.

82. The pharmaceutical combination of claim 80, wherein the additional therapeutic agent is gamma-aminobutyric acid.

83. The fusion protein of any of claims 1-34, or the dimer of claim 35, or the polynucleotide of claim 36 or 37, or the vector of claim 38, or the cell of claims 39-45, or the composition of claims 46 or 47, and the fusion protein of any of claims 1-34, or the dimer of claim 35, or the polynucleotide of claim 36 or 37, or the vector of claim 38, or the cell of claims 39-45, or the composition of claims 46 or 47, and additional therapeutic agents, for use in therapy.