[CLAIMS]

[Claim 1]

A liquid formulation of a long-acting conjugate, wherein the liquid formulation comprises:

18 nmol/mL to 920 nmol/mL of a long-acting conjugate of Chemical Formula 1 below;

a buffering agent in an amount for maintaining the pH of the liquid formulation in the range of 5.0 to 6.5; and

0.5% (w/v) to 9% (w/v) of a sugar alcohol, saccharide, or a combination thereof:

[Chemical Formula 1]

$Q – L_a – Z$

In Chemical Formula 1 above,

Q is a peptide of General Formula 1 below;

L is a linker containing an ethylene glycol repeating unit;

a is 0 or a natural number, with the proviso that when a is 2 or more, each L is independent of each other;

Z is an immunoglobulin Fc fragment; and

– represents a covalent bond:

[General Formula 1]

Xaa1–Aib–Xaa3–Gly–Thr–Phe–Thr–Ser–Asp–Xaa10–Ser–Xaa12–Xaa13–Xaa14–Xaa15–Glu–Xaa17–Xaa18–Xaa19–Lys–Xaa21–Phe–Val–Xaa24–Trp–Leu–Leu–Xaa28–Xaa29–Xaa30–R1 (General Formula 1, SEQ ID NO: 47)

in General Formula 1 above,

a lactam ring is formed between the underlined glutamic acid (Glu) at position 16 and the underlined lysine (Lys) residue at position 20 from the N-terminus, wherein

Xaa1 is histidine, 4-imidazoacetyl (CA), or tyrosine;

Xaa3 is glutamic acid or glutamine;

Xaa10 is tyrosine or cysteine;

Xaa12 is lysine or isoleucine;

Xaa13 is tyrosine, alanine, or cysteine;

Xaa14 is leucine or methionine;

Xaa15 is cysteine or aspartic acid;

Xaa17 is arginine, isoleucine, cysteine, or lysine;

Xaa18 is alanine, arginine, or histidine;

Xaa19 is alanine, glutamine, or cysteine;

Xaa21 is glutamic acid, or aspartic acid;

Xaa24 is glutamine, asparagine, or aspartic acid;

Xaa28 is alanine, asparagine, or aspartic acid;

Xaa29 is cysteine, glycine, glutamine, threonine, glutamic acid, or histidine;

Xaa30 is cysteine, glycine, lysine, or histidine, or is absent; and

R1 is cysteine, m–Ser–Ser–Gly–Ala–Pro–Pro–Pro–Ser–n (SEQ ID NO: 48), or m–Ser–Ser–Gly–Gln–Pro–Pro–Pro–Ser–n (SEQ ID NO: 49), or is absent,

wherein:

m is Cys, or Pro; and

n is Cys, or Gly, or is absent.

[Claim 2]

The liquid formulation of claim 1, wherein the peptide is any one amino acid sequence selected from SEQ ID NOS: 1 to 46.

[Claim 3]

The liquid formulation of claim 1, wherein the peptide is any one amino acid sequence selected from SEQ ID NOS: 1, 2, 9, 19, 21 to 27, 30 to 32, or 40 to 46.

[Claim 4]

The liquid formulation of claim 1, wherein the peptide is any one amino acid sequence selected from SEQ ID NO: 9, 30 to 32, or 42 to 46.

[Claim 5]

The liquid formulation of claim 1, wherein the peptide is SEQ ID NO: 9.

[Claim 6]

The liquid formulation of claim 1, wherein R1 is cysteine, Cys–Ser–Ser–Gly–Gln–Pro–Pro–Pro–Ser (SEQ ID NO: 50), Pro–Ser–Ser–Gly–Ala–Pro–Pro–Pro–Ser (SEQ ID NO: 51), Pro–Ser–Ser–Gly–Ala–Pro–Pro–Pro–Ser–Gly (SEQ ID NO: 52), Pro–Ser–Ser–Gly–Gln–Pro–Pro–Pro–Ser (SEQ ID NO: 53), or Pro–Ser–Ser–Gly–

Gln–Pro–Pro–Pro–Ser–Cys (SEQ ID NO: 54), or is absent.

[Claim 7]

The liquid formulation of claim 1, wherein Q is amidated at the C-terminus thereof.

[Claim 8]

The liquid formulation of claim 1, wherein Q is linked via a sulfur atom of cysteine.

[Claim 9]

The liquid formulation of claim 1, wherein the immunoglobulin Fc fragment is derived from IgG4.

[Claim 10]

The liquid formulation of claim 1, wherein Z is a structure in which two polypeptide chains are linked by a disulfide bond, and are linked only through a nitrogen atom in one of the two chains.

[Claim 11]

The liquid formulation of any one of claims 1 to 10, wherein Z is a homodimer of the amino acid sequence of SEQ ID NO: 76.

[Claim 12]

The liquid formulation of claim 11, wherein Z is linked through a nitrogen atom of proline at the N-terminus thereof.

[Claim 13]

The liquid formulation of claim 1, wherein the immunoglobulin Fc fragment and Q are non-glycosylated.

[Claim 14]

The liquid formulation of claim 1, wherein L is polyethylene glycol.

[Claim 15]

The liquid formulation of claim 1, wherein the formula weight of the ethylene glycol repeating unit moiety in L is in the range of 1 kDa to 100 kDa.

[Claim 16]

The liquid formulation of claim 1, wherein the buffering agent is selected from the group consisting of citric acid and a salt thereof, acetic acid and a salt thereof, histidine and a salt thereof, phosphoric acid and a salt thereof, and a combination thereof.

[Claim 17]

The liquid formulation of claim 14, wherein the buffering agent is acetic acid and a salt thereof.

[Claim 18]

The liquid formulation of claim 1, wherein the pH of the liquid formulation is 5.0 to 5.5.

[Claim 19]

The liquid formulation of claim 1, wherein the pH of the liquid formulation is 5.1 to 6.0.

[Claim 20]

The liquid formulation of claim 19, wherein the pH of the liquid formulation is 5.1 to 5.5.

[Claim 21]

The liquid formulation of claim 1, wherein the concentration of the buffering agent is 5 mM to 100 mM for maintaining the pH of the liquid formulation in the range of 5.0 to 6.5.

[Claim 22]

The liquid formulation of claim 1, wherein the saccharide is glucose, fructose, galactose, lactose, maltose, sucrose, or a combination thereof.

[Claim 23]

The liquid formulation of claim 22, wherein the saccharide is sucrose.

[Claim 24]

The liquid formulation of claim 1, wherein the sugar alcohol is one or more selected from the group consisting of mannitol and sorbitol.

[Claim 25]

The liquid formulation of claim 1, wherein the liquid formulation further comprises one or more components selected from the group consisting of a nonionic surfactant and an amino acid.

[Claim 26]

The liquid formulation of claim 25, further comprising an isotonic agent.

[Claim 27]

The liquid formulation of claim 25, wherein the nonionic surfactant is contained at a concentration of 0.01% (w/v) to 0.1% (w/v) in the liquid formulation.

[Claim 28]

The liquid formulation of claim 25, wherein the nonionic surfactant is poloxamer, polysorbate, or a combination thereof.

[Claim 29]

The liquid formulation of claim 28, wherein the nonionic surfactant is selected from the group consisting of poloxamer 188, polysorbate 20, polysorbate 40, polysorbate 60, polysorbate 80, and a combination thereof.

[Claim 30]

The liquid formulation of claim 25, wherein the amino acid further comprises a stabilizer selected from the group consisting of arginine, glycine, methionine, and a combination thereof.

[Claim 31]

The liquid formulation of any one of claims 1 to 330 wherein the liquid formulation comprises:

90 nmol/mL to 552 nmol/mL of a peptide conjugate of Chemical Formula 1;

5 mM to 25 mM of a buffering agent selected from citric acid and a salt thereof, acetic acid and a salt thereof, histidine and a salt thereof, phosphoric acid and a salt thereof, and a combination thereof so that the pH of the liquid formulation is 5.0 to 6.5;

1% (w/v) to 9% (w/v) of a sugar alcohol, saccharide, or a combination thereof;

0.01% (w/v) to 0.1% (w/v) of a nonionic surfactant selected from poloxamer, polysorbate, or a combination thereof; and

0.01 mg/mL to 1 mg/mL of a stabilizer selected from the group consisting of arginine, glycine, methionine, and combinations thereof.

[Claim 32]

The liquid formulation of any one of claims 1 to 30, wherein the liquid formulation comprises:

90 nmol/mL to 552 nmol/mL of a peptide conjugate of Chemical Formula 1;

5 mM to 25 mM of a buffering agent selected from citric acid and a salt thereof, acetic acid and a salt thereof, histidine and a salt thereof, phosphoric acid and a salt thereof, and a combination thereof so that the pH of the liquid formulation is 5.0 to 5.5;

4% (w/v) to 9% (w/v) of a saccharide;

0.01% (w/v) to 0.1% (w/v) of a nonionic surfactant selected from poloxamer, polysorbate, or a combination thereof; and

0.01 mg/mL to 1 mg/mL of a stabilizer selected from the group consisting of arginine, glycine, methionine, and combinations thereof.

[Claim 33]

The liquid formulation of any one of claims 1 to 25, wherein the liquid formulation comprises:

90 nmol/mL to 552 nmol/mL of a peptide conjugate of Chemical Formula 1;

5 mM to 25 mM of a buffering agent selected from citric acid and a salt thereof, acetic acid and a salt thereof, histidine and a salt thereof, phosphoric acid and a salt thereof, and a combination thereof so that the pH of the liquid formulation

is 5.0 to 5.5; and

4% (w/v) to 9% (w/v) of a saccharide.

[Claim 34]

The liquid formulation of claim 33, further comprising 0.01 mg/mL to 1 mg/mL of a stabilizer selected from the group consisting of arginine, glycine, methionine, and a combination thereof.

[Claim 35]

The liquid formulation of claim 33, further comprising 0.01% (w/v) to 0.1% (w/v) of a nonionic surfactant selected from poloxamer, polysorbate, or a combination thereof.

[Claim 36]

The liquid formulation of claim 34, further comprising 0.01% (w/v) to 0.1% (w/v) of a nonionic surfactant selected from poloxamer, polysorbate, or a combination thereof.