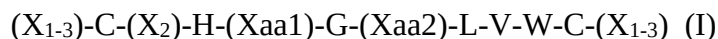


Claims

[Claim 1]

A peptide which comprises an amino acid sequence consisting of 13 to 17 amino acid residues represented by the following formula I and is capable of binding to human IgG and/or rabbit IgG:



wherein each X is independently any amino acid residue other than cysteine,

C is a cysteine residue,

H is a histidine residue,

Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid,

G is a glycine residue,

Xaa2 is a glutamic acid residue or an asparagine residue,

L is a leucine residue,

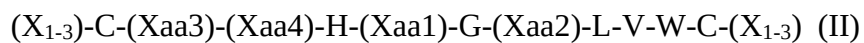
V is a valine residue, and

W is a tryptophan residue.

[Claim 2]

The peptide according to claim 1,

wherein the peptide comprises an amino acid sequence consisting of 13 to 17 amino acid residues represented by the following formula II and is capable of binding to human IgG and/or rabbit IgG:



wherein each X is independently any amino acid residue other than cysteine,

C is a cysteine residue,

H is a histidine residue,

Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid,

G is a glycine residue,

Xaa2 is a glutamic acid residue or an asparagine residue,

L is a leucine residue,

V is a valine residue,

W is a tryptophan residue,

Xaa3 is an alanine residue, a serine residue or a threonine residue, and

Xaa4 is a tyrosine residue or a tryptophan residue.

[Claim 3]

The peptide according to claim 1 or 2, wherein

the peptide comprises an amino acid sequence consisting of 13 to 17 amino acid residues represented by the following formula III and is capable of binding to human IgG and/or rabbit IgG:

(X₁₋₃)-C-A-Y-H-(Xaa1)-G-E-L-V-W-C-(X₁₋₃) (III)

wherein each X is independently any amino acid residue other than cysteine,

C is a cysteine residue,

A is an alanine residue,

Y is a tyrosine residue,

H is a histidine residue,

Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid,

G is a glycine residue,

E is a glutamic acid residue,

L is a leucine residue,

V is a valine residue, and

W is a tryptophan residue.

[Claim 4]

The peptide according to any one of claims 1 to 3, wherein

when the peptide is 17 amino acid residues, amino acid residues from 1st to 3rd and 15th to 17th positions from N terminus are each as follows:

1st amino acid residue = S, G, F or none,

2nd amino acid residue = D, G, A, S, P, homocysteine, or none,

3rd amino acid residue = S, D, T, N, E or R,

15th amino acid residue = S, T or D,

16th amino acid residue = H, G, Y, T, N, D, F, homocysteine, or none, and

17th amino acid residue = Y, F, H, M or none.

[Claim 5]

The peptide according to claim 4, wherein the peptide consists of any of the following amino acid sequences 1) to 15), wherein Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid, and Xaa2 is homocysteine:

- 1) DCAYH(Xaa1)GELVWCT (SEQ ID NO: 1),
- 2) GPDCAYH(Xaa1)GELVWCTFH (SEQ ID NO: 2),
- 3) RCAYH(Xaa1)GELVWCS (SEQ ID NO: 3),
- 4) GPRCAYH(Xaa1)GELVWCSFH (SEQ ID NO: 4),
- 5) SPDCAYH(Xaa1)GELVWCTFH (SEQ ID NO: 5),
- 6) GDDCAYH(Xaa1)GELVWCTFH (SEQ ID NO: 6),
- 7) GPSCAYH(Xaa1)GELVWCTFH (SEQ ID NO: 7),
- 8) GPDCAYH(Xaa1)GELVWCSFH (SEQ ID NO: 8),
- 9) GPDCAYH(Xaa1)GELVWCTHH (SEQ ID NO: 9),
- 10) GPDCAYH(Xaa1)GELVWCTFY (SEQ ID NO: 10),
- 11) SPDCAYH(Xaa1)GELVWCTFY (SEQ ID NO: 11),
- 12) SDDCAYH(Xaa1)GELVWCTFY (SEQ ID NO: 12),
- 13) RGNCAHYH(Xaa1)GQLVWCTYH (SEQ ID NO: 13),
- 14) G(Xaa2)DCAYH(Xaa1)GELVWCT(Xaa2)H (SEQ ID NO: 36), and
- 15) RRGPDCAHYH(Xaa1)GELVWCTFH (SEQ ID NO: 37).

[Claim 6]

The peptide according to claim 1 or 2,

wherein the peptide comprises an amino acid sequence consisting of 13 amino acid residues represented by the following formula IV and is capable of binding to human IgG and/or rabbit IgG:

D-C-(Xaa3)-(Xaa4)-H-(Xaa1)-G-(Xaa2)-L-V-W-C-T (IV)

wherein

D is an aspartic acid residue,

C is a cysteine residue,

H is a histidine residue,

Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid,

G is a glycine residue,

Xaa2 is a glutamic acid residue or an asparagine residue,

L is a leucine residue,

V is a valine residue,

W is a tryptophan residue,

T is a threonine residue,

Xaa3 is an alanine residue or a threonine residue, and

Xaa4 is a tyrosine residue or a tryptophan residue.

[Claim 7]

The peptide according to claim 6, wherein the peptide consists of any of the following amino acid sequences 1) to 4), wherein Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid:

1) DCTYH(Xaa1)GNLVWCT (SEQ ID NO: 14),

2) DCAYH(Xaa1)GNLVWCT (SEQ ID NO: 15),

3) DCTYH(Xaa1)GELVWCT (SEQ ID NO: 16), and

4) DCAWH(Xaa1)GELVWCT (SEQ ID NO: 17).

[Claim 8]

A peptide which comprises an amino acid sequence consisting of 13 amino acid residues represented by the following formula V and is capable of binding to human IgG and/or rabbit IgG:

D-C-(Xaa2)-(Xaa3)-(Xaa4)-(Xaa1)-G-(Xaa5)-L-(Xaa6)-W-C-T (V)

wherein

D is an aspartic acid residue,

C is a cysteine residue,

G is a glycine residue,

L is a leucine residue,

W is a tryptophan residue,

T is a threonine residue,

Xaa1 is a lysine residue, a cysteine residue, an aspartic acid residue, a glutamic acid residue, 2-aminosuberic acid, or diaminopropionic acid,

Xaa2 is an alanine residue, a serine residue or a threonine residue,

Xaa3 is a tryptophan residue or a tyrosine residue,

Xaa4 is a histidine residue, an arginine residue, a serine residue or a threonine residue,

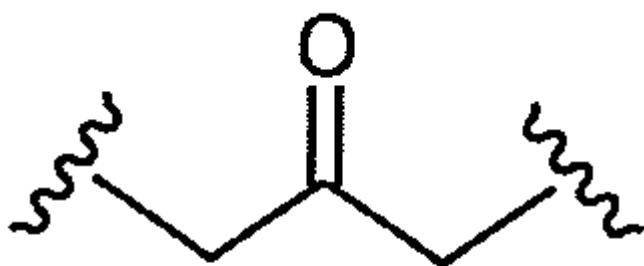
Xaa5 is a glutamic acid residue, an asparagine residue, an arginine residue, or an aspartic acid residue, and

Xaa6 is an isoleucine residue or a valine residue.

[Claim 9]

The peptide according to any one of claims 1 to 8, wherein the peptide has a disulfide bond formed between the two cysteine (C) residues on the outer sides, or sulfide groups in the two cysteine residues on the outer sides of the peptide are linked via a linker represented by the following formula:

[Formula 1]



[Claim 10]

The peptide according to any one of claims 1 to 9, wherein the peptide is labeled with a labeling agent.

[Claim 11]

The peptide according to any one of claims 1 to 10, wherein the peptide is bound with a drug.

[Claim 12]

The peptide according to any one of claims 1 to 11, wherein Xaa1 is a lysine residue.

[Claim 13]

The peptide according to any one of claims 1 to 12, wherein Xaa1 is modified with a cross-linking agent.

[Claim 14]

The peptide according to claim 13, wherein the cross-linking agent is selected from the group consisting of DSG (disuccinimidyl glutarate), DSS (disuccinimidyl suberate), DMA (dimethyl adipimidate dihydrochloride), DMP (dimethyl pimelimidate dihydrochloride), DMS (dimethyl suberimidate dihydrochloride), DTBP (dimethyl 3,3'-dithiobispropionimidate dihydrochloride), and DSP (dithiobis(succinimidyl propionate)).

[Claim 15]

The peptide according to claim 14, wherein the cross-linking agent is DSG (disuccinimidyl glutarate) or DSS (disuccinimidyl suberate).

[Claim 16]

A conjugate of the peptide according to any one of claims 13 to 15 and IgG, wherein the conjugate is formed through the cross-linking reaction of the peptide modified with the cross-linking agent with the IgG.

[Claim 17]

A method for producing a conjugate of the peptide according to any one of claims 13 to 15 and IgG, comprising the step of mixing the peptide with IgG to cause the cross-linking reaction of the peptide modified with the cross-linking agent with the IgG.

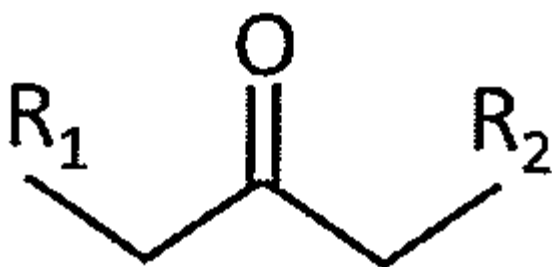
[Claim 18]

A pharmaceutical composition comprising the peptide according to any one of claims 1 to 15 or the conjugate according to claim 16.

[Claim 19]

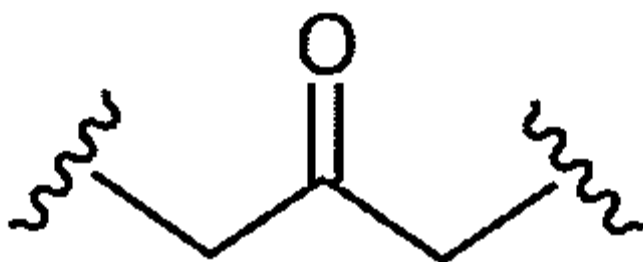
A method for producing a peptide having two or more cysteine residues linked via a linker, comprising the step of mixing a peptide containing two or more cysteine residues with a compound represented by the following formula:

[Formula 2]



wherein R₁ and R₂ are each independently any halogen atom to obtain a peptide in which sulfide groups in the two or more cysteine residues are linked via a linker represented by the following formula:

[Formula 3]



[Claim 20]

The method according to claim 19, wherein R₁ and R₂ in the compound are the same and are Cl, Br, or I.

[Claim 21]

The method according to claim 19 or 20, wherein the peptide is the peptide according to any one of claims 1 to 8 and 10 to 15.

[Claim 22]

The conjugate according to claim 16, wherein Xaa1 of the peptide is a lysine residue, a cysteine residue, or diaminopropionic acid.

[Claim 23]

The conjugate according to claim 16 or 22, wherein the peptide is labeled with a chelate complex of a radioisotope metal ion.

[Claim 24]

The conjugate according to claim 23, wherein the chelate complex is a chelate complex of DOTA.

[Claim 25]

The conjugate according to claim 23 or 24, wherein the peptide is labeled by a radioisotope formed through the reaction between an azide group and dibenzocyclooctyne.

[Claim 26]

The conjugate according to any one of claims 16 and 22 to 25, wherein the IgG is an anti-HER2 human IgG antibody.

[Claim 27]

The conjugate according to any one of claims 16 and 22 to 26, wherein the conjugate has a cross-linking structure formed between the Xaa1 residue of the peptide and IgG Fc.

[Claim 28]

The conjugate according to any one of claims 16 and claims 22 to 27, wherein the conjugate has a cross-linking structure formed between the Xaa1 residue of the peptide and Lys248 or Lys246 of the IgG Fc.