Claims

1. A self-cleaving fusion protein comprising:

(i) a target protein;

(ii) a peptide represented by Formula I below;

(iii) a domain of Sortase A having cleaving function;

(iv) a tag, wherein (i) to (iv) are sequentially positioned from an amino terminal to a carboxyl terminal of the fusion protein,

[Formula I]

L-P-X-T-G,

L represents Leucine, P represents Proline, X represents an any amino acid, T represents Threonine, G represents Glycine, and

a peptide linker between (ii) a peptide represented by Formula I and (iii) a domain of Sortase A having cleaving function, the linker is represented by Sc(SG4)l(GGSSRSS)GdSe, in which S represents Serine, G represents Glycine, R represents Arginine, c represents 0 to 5, d represents 0 to 5, e represents 0 to 5, and l represents 0 to 10.

2. The self-cleaving fusion protein according to claim 1, wherein X in Formula I is glutamic acid.

3. The self-cleaving fusion protein according to claim 1, wherein the peptide linker consists of 19 to 40 amino

acids.

4. The self-cleaving fusion protein according to claim 1, wherein the peptide linker consists of 19 to 25 amino acids.

5. The self-cleaving fusion protein according to claim 1, wherein the peptide linker comprises an amino acid sequence represented by SEQ ID NO: 7.

6. The self-cleaving fusion protein according to claim 1, wherein the Sortase A is derived from Staphylococcus aureus (S.aureus).

7. The self-cleaving fusion protein according to claim 1, wherein the domain of Sortase A having cleaving function comprises an amino acid sequence represented by SEQ ID NO: 8.

8. The self-cleaving fusion protein according to claim 1, wherein the tag is selected from the group consisting of a poly-histidine tag, a glutathione-S-transferase tag, a Hemagglutinin tag, a FLAG tag, a Myc tag, a maltose binding protein tag, a chitin binding protein tag, and a fluorescent tag.

9. The self-cleaving fusion protein according to claim

8, wherein the tag is a poly-histidine tag.

10. The self-cleaving fusion protein according to claim 9, wherein the poly-histidine tag comprises sequential 6 to 12 histidines.

11. The self-cleaving fusion protein according to claim 1, wherein the target protein is selected from the group consisting of polymer proteins, glycoproteins, cytokines, growth factor, blood preparations, vaccines, hormones, enzymes and antibodies.

12. The self-cleaving fusion protein according to claim 1, wherein the target protein is a portion or whole of a light chain or a heavy chain of an antibody.

13. The self-cleaving fusion protein according to claim 12, wherein the target protein is a light chain variable region (VL) or a heavy chain variable region (VH) of an antibody.

14. The self-cleaving fusion protein according to claim 1, wherein the fusion protein comprises an amino acid sequence represented by SEQ ID NO: 17 or 18.

15. A nucleic acid encoding the self-cleaving fusion protein according to any one of claims 1 to 14.

16. An expression vector comprising the nucleic acid of claim 15.

17. A host cell transformed with the expression vector of claim 16.

18. The host cell according to claim 17, wherein the host cell is prokaryotic or eukaryotic cell.

19. The host cell according to claim 18, wherein the host cell is Escherichia coli.

20. The host cell according to claim 19, wherein Escherichia coli is Origami2(DE3) or BL21(DE3).

21. A method for purifying a target protein comprising: (1) culturing cells of claim 17 to obtain cell lysates; and (2) purifying the target protein from the cell lysates.

22. The method for purifying a target protein of claim 21, wherein the step (2) comprising:

(a) injecting the cell lysates into a column bound to a tag in a fusion protein;

(b) washing the column;

(c) equilibrating the column by using a cleavage buffer including at least one selected from the group

consisting of calcium and triglycine to perform a cleaving reaction; and

(d) obtaining the cleavage-buffer from the column to obtain the target protein from which the tag is removed.

23. The method for purifying a target protein of claim 22, wherein the cleavage-buffer in the step (c) comprises at least triglycine.

24. The method for purifying a target protein of claim 22, wherein the cleavage-buffer in the step (c) comprises 0.1 to 10 mM of calcium and 0.1 to 10 mM of triglycine.

25. The method for purifying a target protein of claim 24, wherein the cleavage-buffer in the step (c) comprises 0.2 to 5 mM of calcium and 0.2 to 5 mM of triglycine.

26. A method of preparing a therapeutic antibody-drug conjugate comprising:

(1) reacting the self-cleaving fusion protein of claim 1 with triglycine-drug (GGG-drug) in a cleavage buffer including calcium to conjugate the triglycine-drug (GGG-drug)to a target protein;

(2) obtaining the cleavage buffer and recovering a conjugate of the target protein in which a tag is removed with triglycine-drug.

27. The method of preparing a therapeutic antibody-drug conjugate of claim 26, wherein the cleavage-buffer in the step (1) comprises 0.1 to 10 mM of calcium.

28. The method of preparing a therapeutic antibody-drug conjugate of claim 26, wherein the step (1) comprises 500μM to 1mM of triglycine-drug (GGG-drug).

29. The method of preparing a therapeutic antibody-drug conjugate of claim 26, wherein the step (1) comprises reacting the self-cleaving fusion protein of claim 1 with triglycine-drug (GGG-drug) for 3 to 16 hours.

30. The method of preparing a therapeutic antibody-drug conjugate of claim 26, wherein the target protein is an antibody to against a tumor surface antigen.