(non-patent document 2). However, it has been reported that when T cells are freeze-preserved, the expression of PD-1 (immune checkpoint molecule) on T cell membranes is markedly decreased (non-patent document 3). Thus, there is a demand for the development of a method for non-frozen preservation of T cells.

Prior Art Documents

Patent Documents

[0006]

Patent Document 1: WO2017/077964

Patent Document 2: PCT/JP2018/034667

Patent Document 3: WO2017/073656

Patent Document 4: Japanese unexamined Patent Application Publication No. 2018-153196

[0007]

Non-patent Document 1: Takayama et. al., 2008, Blood, 111: 5298-5306

Non-patent Document 2: Tyler et. al., 2013, Blood, 121: 308-317

Non-patent Document 3: Campbell et. al., 2009, Clin vaccine immunol, 16: 1648-53

Summary

Object to be Solved by the Disclosure

[0008]

An object of the present disclosure is to describe a novel preservation solution that is superior in preservation stability to a conventional preservation

solution and can preserve mammalian cells over a long period of time.

Means to Solve the Object

[0009]

The present inventors have conducted diligent studies to attain the aforementioned object and consequently completed the present disclosure by finding that (1) when platelets are preserved under shaking in an isotonic solution supplemented with ascorbic acid (hereinafter, also referred to as "vitamin C" or "VC"), the deterioration of the platelets is suppressed as compared with a conventional platelet preservation solution, (2) when niacin (hereinafter, also referred to as "vitamin B3" or "VB3") is added in combination with VC to the isotonic solution, the deterioration of the platelets is more efficiently suppressed, (3) the isotonic solution supplemented with VC and VB3 is also effective for the non-frozen preservation of other mammalian cells such as mesenchymal stem cells, megakaryocytes, and T cells, and (4) such a cell preservation effect brought about by VC and VB3 is inhibited by riboflavin (vitamin B2; hereinafter, also referred to as "VB2").

[0010]

Specifically, the present disclosure describes: (1) a preservation solution for a mammalian cell, comprising niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant; (2) the preservation solution according to the aforementioned (1), wherein the

antioxidant is ascorbic acid or a derivative thereof or a salt of ascorbic acid or the derivative; (3) the preservation solution according to the aforementioned (1) or (2), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 1 to 10000 mg/L; (4) the preservation solution according to the aforementioned (1) or (2), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 30 to 3000 mg/L; (5) the preservation solution according to the aforementioned (1) or (2), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 120 to 1200 mg/L; (6) the preservation solution according to any one of the aforementioned (2) to (5), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 1 to 10000 mg/L; (7) the preservation solution according to any one of the aforementioned (2) to (5), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 30 to 6000 mg/L; (8) the preservation solution according to any one of the aforementioned (2) to (5), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 300 to 3000 mg/L; (9) the preservation solution according to any one of the aforementioned (1) to (8), wherein the preservation solution is for preserving a mammalian cell at 0 to 40°C; and (10) the preservation solution according to any one of the aforementioned (1) to (9), wherein the preservation

solution does not comprise vitamin B2 or a derivative thereof or a salt of vitamin B2 or the derivative.

[0011]

The present disclosure also describes: (11) the preservation solution according to any one of the aforementioned (1) to (10), wherein the mammalian cell is a platelet or a megakaryocyte; (12) the preservation solution according to the aforementioned (11), wherein the platelet is a purified platelet obtained by a method comprising the following (A) and (B): (A) a condensation step of condensing a culture product of megakaryocytes; and (B) a centrifugation step of centrifuging a platelet from the obtained condensed product; (13) the preservation solution according to the aforementioned (11) or (12), wherein the preservation solution further comprises albumin; (14) the preservation solution according to the aforementioned (13), wherein a concentration of albumin is 1.25 to 10% (w/v); (15) the preservation solution according to the aforementioned (13) or (14), wherein the preservation solution further comprises sugar; (16) the preservation solution according to the aforementioned (15), wherein the sugar is glucose; and (17) the preservation solution according to any one of the aforementioned (11) to (16) , wherein the preservation solution is for preserving a platelet or a megakaryocyte for 5 to 10 days.

[0012]

The present disclosure further describes: (18) the preservation solution according to any one of the aforementioned (1) to (10), wherein the mammalian cell is

a stem cell or an immunocyte; (19) the preservation solution according to the aforementioned (18), wherein the stem cells is a mesenchymal stem cell; (20) the preservation solution according to the aforementioned (18), wherein the immunocyte is a T cell; (21) the preservation solution according to any one of the aforementioned (18) to (20), wherein niacin or the derivative thereof or the salt of niacin or the derivative, and the antioxidant are contained in an isotonic solution; (22) the preservation solution according to the aforementioned (21), wherein the isotonic solution is a lactated Ringer's solution; (23) the preservation solution according to the aforementioned (21) or (22), wherein the preservation solution further comprises trehalose; (24) the preservation solution according to any one of the aforementioned (21) to (23), wherein the preservation solution further comprises dextran; (25) the preservation solution according to any one of the aforementioned (18) to (24), wherein the preservation solution is for preserving a stem cell for 1 to 63 days; and (26) a powder formulation for preparing a preservation solution according to any one of the aforementioned (1) to (25), comprising niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant.

[0013]

Furthermore, the present disclosure describes: (27) a method for preserving a mammalian cell, comprising a step of preserving the mammalian cell in a liquid comprising niacin or a derivative thereof or a salt of

niacin or the derivative, and an antioxidant; (28) the method for preserving a mammalian cell according to the aforementioned (27), wherein the antioxidant is ascorbic acid or a derivative thereof or a salt of ascorbic acid or the derivative; (29) the method for preserving a mammalian cell according to the aforementioned (27) or (28), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 1 to 10000 mg/L; (30) the method for preserving a mammalian cell according to the aforementioned (27) or (28), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 30 to 3000 mg/L; (31) the method for preserving a mammalian cell according to the aforementioned (27) or (28), wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 120 to 1200 mg/L; (32) the method for preserving a mammalian cell according to any one of the aforementioned (28) to (31), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 1 to 10000 mg/L; (33) the method for preserving a mammalian cell according to any one of the aforementioned (28) to (31), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 30 to 6000 mg/L; (34) the method for preserving a mammalian cell according to any one of the aforementioned (28) to (31), wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 300 to 3000 mg/L; (35) the method for preserving a mammalian

cell according to any one of the aforementioned (27) to (34), wherein the mammalian cell is preserved at 0 to 40°C; and (36) the method for preserving a mammalian cell according to any one of the aforementioned (27) to (35), wherein the liquid does not comprise vitamin B2 or a derivative thereof or a salt of vitamin B2 or the derivative.

[0014]

Moreover, the present disclosure describes: (37) the method for preserving a mammalian cell according to any one of the aforementioned (27) to (36), wherein the mammalian cell is a platelet or a megakaryocyte; (38) the method for preserving a mammalian cell according to the aforementioned (37), wherein the platelet is a purified platelet obtained by a method comprising the following (A) and (B): (A) a condensation step of condensing a culture product of megakaryocytes; and (B) a centrifugation step of centrifuging a platelet from the obtained enrichment product; (39) the method for preserving a mammalian cell according to the aforementioned (37) or (38), wherein the liquid further comprises albumin; (40) the method for preserving a mammalian cell according to the aforementioned (39), wherein a concentration of albumin is 1.25 to 10% (w/v); (41) the method for preserving a mammalian cell according to the aforementioned (39) or (40), wherein the liquid further comprises sugar; (42) the method for preserving a mammalian cell according to the aforementioned (41), wherein the sugar is glucose; (43) the method for preserving a mammalian cell according to any one of the

aforementioned (37) to (42), wherein the platelet or the megakaryocyte is preserved for 5 to 10 days; (44) the method for preserving a mammalian cell according to any one of the aforementioned (27) to (36), wherein the mammalian cell is a stem cell or an immunocyte; (45) the method for preserving a mammalian cell according to the aforementioned (44), wherein the stem cell is a mesenchymal stem cell; (46) the method for preserving a mammalian cell according to the aforementioned (44), wherein the immunocyte is a T cell; (47) the method for preserving a mammalian cell according to any one of the aforementioned (44) to (46), wherein the liquid is an isotonic solution; (48) the method for preserving a mammalian cell according to the aforementioned (47), wherein the isotonic solution is a lactated Ringer's solution; (49) the method for preserving a mammalian cell according to the aforementioned (47) or (48), wherein the liquid further comprises trehalose; (50) the method for preserving a mammalian cell according to any one of the aforementioned (47) to (49), wherein the liquid further comprises dextran; and (51) the method for preserving a mammalian cell according to any one of the aforementioned (44) to (50), wherein the stem cells are preserved for 1 to 63 days. Other examples of the present disclosure can be i) niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant for use in the preservation of mammalian cells, and ii) use of niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant for

use in preparing a preservation solution for mammalian cells.

[0014a] In one aspect, the disclosure describes the use of a preservation solution comprising niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant for preserving a mammalian cell.

CLAIMS

1. Use of a preservation solution comprising niacin or a derivative thereof or a salt of niacin or the derivative, and an antioxidant for preserving a mammalian cell.

2. The use according to claim 1, wherein the antioxidant is ascorbic acid or a derivative thereof or a salt of ascorbic acid or the derivative.

3. The use according to claim 1 or 2, wherein a concentration of niacin or the derivative thereof or the salt of niacin or the derivative is 1 to 10000 mg/L.

4. The use according to claim 2 or 3, wherein a concentration of ascorbic acid or the derivative thereof or the salt of ascorbic acid or the derivative is 1 to 10000 mg/L.

5. The use according to any one of claims 1 to 4, for preserving a mammalian cell at 0 to 40°C.

6. The use according to any one of claims 1 to 5, wherein the preservation solution does not comprise vitamin B2 or a derivative thereof or a salt of vitamin B2 or the derivative.

7. The use according to any one of claims 1 to 6, wherein the mammalian cell is a platelet or a megakaryocyte.

8. The use according to claim 7, wherein the platelet is a purified platelet obtained by a method comprising the following (A) and (B):
(A) a condensation step of condensing a culture product of megakaryocytes; and
(B) a centrifugation step of centrifuging a platelet from the obtained condensed product.

9. The use according to claim 7 or 8, wherein the preservation solution further comprises albumin.

10. The use according to claim 9, wherein a concentration of albumin is 1.25 to 10% (w/v).

11. The use according to any one of claims 7 to 10, wherein the preservation solution further comprises sugar.

12. The use according to claim 11, wherein the sugar is glucose.

13. The use according to any one of claims 7 to 12, for preserving a platelet or a megakaryocyte for 5 to 10 days.

14. The use according to any one of claims 1 to 6, wherein the mammalian cell is a stem cell or an immunocyte, and
wherein niacin or the derivative thereof or the salt of niacin or the derivative, and the antioxidant are contained in an isotonic solution, the isotonic solution further comprising trehalose.

15. The use according to claim 14, wherein the stem cell is a mesenchymal stem cell.

16. The use according to claim 14, wherein the immunocyte is a T cell.

17. The use according to any one of claims 14 to 16, wherein the isotonic solution is a lactated Ringer's solution.

18. The use according to any one of claims 14 to 17, wherein the isotonic solution further comprises dextran.

19. The use according to any one of claims 14 to 18, for preserving a stem cell for 1 to 63 days.