SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0012]

An object of the present ~~invention~~disclosure is to provide a highly efficient separation material for recovering white blood cells or mononuclear cells from a biological fluid containing blood cell components with high efficiency, without causing a pressure elevation, and to provide cell separation methods using the separation material.

SOLUTION TO PROBLEM

[0013]

The present inventors intensively studied for separation materials and cell separation methods that are able to efficiently separate white blood cells or mononuclear cells from a biological fluid, and are less likely to cause a pressure elevation, and consequently found that the use of a specific separation material enables white blood cells and mononuclear cells to be efficiently separated. Thus, the present ~~invention~~disclosure was completed.

[0014]

Specifically, the present ~~invention~~disclosure relates to a separation material for separating white blood cells or mononuclear cells from a biological fluid, the separation material including a nonwoven fabric having an average fiber diameter of at least 2.0 μm but not more than 6.0 μm, and an air permeability coefficient M of at least 6.2 but not more than 35. Preferably, the nonwoven fabric is made of at least one selected from the group consisting of polyolefins, polyamides and polyesters. Preferably, the biological fluid is at least one selected from the group consisting of peripheral blood, umbilical cord blood, bone marrow, menstrual blood, and tissue extracts.

[0015]

The present ~~invention~~disclosure also relates to a cell separation container that includes a container provided with an inlet and an outlet for a biological fluid, wherein the above-described separation material is packed in the container. In the cell separation container, the separation material is preferably packed in the form of a single layer or a laminate of layers oriented in a direction of flow of the biological fluid, and it is also preferably packed in a state of being compressed in a direction of flow of the biological fluid. Preferably, the cell separation container is in the form of a column.

[0016]

The present ~~invention~~disclosure further relates to a cell separation method, including a step of contacting a biological fluid with the above-described separation material to separate white blood cells or mononuclear cells.

[0017]

The present ~~invention~~disclosure further relates to a method for separating white blood cells or mononuclear cells, which includes: a first step of contacting a biological fluid with the above-described cell separation container to capture white blood cells or mononuclear cells on the separation material; and a second step of recovering the white blood cells or mononuclear cells from the separation material using a detachment solution. In this cell separation method, preferably, the first step includes introducing the biological fluid through the inlet of the cell separation container and discharging the biological fluid through the outlet, and the second step includes introducing the detachment solution through the outlet of the cell separation container and recovering the white blood cells or mononuclear cells through the inlet. Preferably, the method further includes, after the first step and before the second step, a step of introducing physiological saline or a buffer through the inlet to remove contaminant components in the cell separation container. Preferably, the method further includes, before the first step,

a step of contacting physiological saline or a buffer with the separation material. Preferably, the method further includes, before the first step, a step of fixing the inlet for a biological fluid of the cell separation container below the outlet for a biological fluid of the cell separation container. Preferably, the separation material substantially captures white blood cells and platelets, and substantially does not capture red blood cells. Preferably, the separated white blood cells or mononuclear cells include hematopoietic stem cells and/or mesenchymal stem cells.

[0018]

Furthermore, the present ~~invention~~disclosure relates to a cryopreservation method that includes placing cells obtained by any of the cell separation methods in a liquid nitrogen environment. Preferably, the liquid nitrogen environment is at -196°C to -30°C. In the cryopreservation method, at least one cryoprotective agent selected from the group consisting of dimethyl sulfoxide, dextran, albumin, and hydroxyethyl starch is preferably used. Preferably, 80% or more of cryopreserved stem cells are viable.

[0019]

Moreover, the present ~~invention~~disclosure relates to white blood cells, mononuclear cells or stem cells, obtained by any of the cell separation methods. Preferably, the stem cells include cells selected from the group consisting of: CD34+ cells; CD133+ cells; CD34- and CD133+ cells; CD34+ and CD133+ cells; CD34+ and CD133- cells; CD45-, CD44+, CD73+, and CD90+ cells; CD45-, CD235a-, CD33-, and CD7- cells; CD45+, CD133+, and CD117+ cells; CD45+, CD133-, and CD117+ cells; CD45+, CD133+, and CD164+ cells; CD45+, CD133-, and CD164+ cells; and CD45- and CD309+ cells. Preferably, the white blood cells include: CD45+ and CD164+ cells; or CD45+ and CD117+ cells.

ADVANTAGEOUS EFFECTS OF INVENTION

[0020]