Claims

1. A cell centrifugation apparatus, comprising a centrifuge chamber and at least one liquid pushing plates;

the centrifuge chamber has a rotation axis, and is used for connecting with a rotation drive mechanism, and the centrifuge chamber rotates around its rotation axis under drive of the rotation drive mechanism for centrifuging a blood sample contained in the centrifuge chamber;

the at least one liquid pushing plates is arranged in the centrifuge chamber; when the centrifuge chamber rotates, each liquid pushing plate is used to push the blood sample to rotate synchronously along a same rotation direction as the centrifuge chamber;

wherein one end of each liquid pushing plate is close to the rotation axis, and another end extends towards an inner side wall of the centrifuge chamber;

a projection of a first side of each liquid pushing plate on a plane where a chamber bottom of the centrifuge chamber is located is a straight line or an arc, and a second side of each liquid pushing plate is perpendicular to the chamber bottom of the centrifuge chamber; and

under the condition that the projection of the first side of each liquid pushing plate on the plane where the chamber bottom of the centrifuge chamber is located is a straight line, the first side of each liquid pushing plate extends in a radial direction of the centrifuge chamber.

2. The cell centrifugation apparatus of claim 1, wherein,

a first gap is arranged between one end of each liquid pushing plate close to the inner side wall of the centrifuge chamber and the inner side wall; one end of each liquid pushing plate close to the chamber bottom of the centrifuge chamber is attached to the chamber bottom.

3. The cell centrifugation apparatus of claim 1, wherein,

when the number of the liquid pushing plates is plural, the plurality of liquid pushing plates are circumferentially and uniformly distributed relative to the rotation axis.

4. The cell centrifugation apparatus of claim 3, further comprising a chamber lid;

the chamber lid is matched with an opening of the centrifuge chamber; a first liquid-through structure is arranged on the chamber lid, and a second liquid-through structure is arranged on the centrifuge chamber;

a first end of the first liquid-through structure is arranged on an outer side of the chamber

lid and distributed along the rotation axis, and a second end of the first liquid-through structure is arranged on an inner side of the chamber lid; and

the second liquid-through structure comprises a liquid-through tube and a liquid-through passage; the liquid-through tube is arranged in the centrifuge chamber; a first end of the liquid-through tube is communicated with the second end of the first liquid-through structure, and a second end of the liquid-through tube is arranged at the chamber bottom of the centrifuge chamber; the liquid-through passage is arranged in a shell wall of the chamber bottom, a first end of the liquid-through passage is communicated with the second end of the liquid-through tube, and a second end of the liquid-through passage is arranged on an inner side of the chamber bottom and communicated with an inner cavity of the centrifuge chamber.

5. The cell centrifugation apparatus of claim 3, wherein,

the shell wall of the chamber bottom of the centrifuge chamber is internally provided with a third liquid-through structure;

a first end of the third liquid-through structure is arranged on an outer side of the chamber bottom and distributed along the rotation axis, and a second end of the third liquid-through structure is arranged on the inner side of the chamber bottom and is communicated with the inner cavity of the centrifuge chamber.

6. The cell centrifugation apparatus of claim 5, wherein,

the first liquid-through structure comprises a connection tube;

the connection tube and the liquid-through tube are distributed along the rotation axis; the connection tube is internally provided with a liquid passage and a gas passage, a first end of the liquid passage is provided with a liquid connection opening, and a second end of the liquid passage is communicated with the first end of the liquid-through tube; a first end of the gas passage is provided with a gas connection opening, and a second end of the gas passage is communicated with the inner cavity of the centrifuge chamber.

7. The cell centrifugation apparatus of claim 5, wherein,

the chamber lid is provided with an air hole; and

at least one air hole is provided, and a gas permeable membrane is arranged in the air hole.

8. A cell centrifugation method based on the cell centrifugation apparatus of claim 1, comprising:

connecting the centrifuge chamber with the rotation drive mechanism, and adding the blood sample to the centrifuge chamber; and

turning on the rotation drive mechanism, the centrifuge chamber is driven to rotate by the rotation drive mechanism, so that the liquid pushing plate pushes the blood sample to rotate synchronously along the same rotation direction as the centrifuge chamber to obtain a cell suspension.

9. A cell centrifugation method based on the cell centrifugation apparatus of claim 3, comprising:

connecting the centrifuge chamber with the rotation drive mechanism, and adding the blood sample to the centrifuge chamber; and

turning on the rotation drive mechanism, the centrifuge chamber is driven to rotate by the rotation drive mechanism, so that the liquid pushing plate pushes the blood sample to rotate synchronously along the same rotation direction as the centrifuge chamber to obtain a cell suspension.

10. A cell centrifugation method based on the cell centrifugation apparatus of claim 4, comprising:

connecting the centrifuge chamber with the rotation drive mechanism, and adding the blood sample to the centrifuge chamber; and

turning on the rotation drive mechanism, the centrifuge chamber is driven to rotate by the rotation drive mechanism, so that the liquid pushing plate pushes the blood sample to rotate synchronously along the same rotation direction as the centrifuge chamber to obtain a cell suspension.

11. A cell washing method based on the cell centrifugation apparatus of claim 1, comprising:

when the blood sample is centrifuged by the cell centrifugation apparatus, inputing normal saline into the centrifuge chamber through the second liquid-through structure of the centrifuge chamber, so that cell surface of the blood sample is washed by the added normal saline during centrifugation; and

after a centrifugation time of the blood sample reaches a preset time, extracting the liquid in the centrifuge chamber through the second liquid-through structure, so as to discharge a

waste liquid after cell washing.

12. A cell washing method based on the cell centrifugation apparatus of claim 3, comprising:

when the blood sample is centrifuged by the cell centrifugation apparatus, inputing normal saline into the centrifuge chamber through the second liquid-through structure of the centrifuge chamber, so that cell surface of the blood sample is washed by the added normal saline during centrifugation; and

after a centrifugation time of the blood sample reaches a preset time, extracting the liquid in the centrifuge chamber through the second liquid-through structure, so as to discharge a waste liquid after cell washing.

13. A cell washing method based on the cell centrifugation apparatus of claim 4, comprising:

when the blood sample is centrifuged by the cell centrifugation apparatus, inputing normal saline into the centrifuge chamber through the second liquid-through structure of the centrifuge chamber, so that cell surface of the blood sample is washed by the added normal saline during centrifugation; and

after a centrifugation time of the blood sample reaches a preset time, extracting the liquid in the centrifuge chamber through the second liquid-through structure, so as to discharge a waste liquid after cell washing.

14. A cell culture method based on the cell centrifugation apparatus of claim 1, comprising:

adding a cell suspension with cells to be cultured into the centrifuge chamber, adjusting cell density of the cell suspension to a first preset density, and adding antibodies or magnetic beads into the centrifuge chamber to activate the cells;

inputting carbon dioxide gas with a preset concentration and a culture medium with a preset components into the centrifuge chamber, and placing the centrifuge chamber containing the cell suspension and the culture medium in a preset constant temperature environment for cell culture; and

detecting the cell density in the centrifuge chamber, and turning off the rotation drive mechanism to perform static culture on the cells when the cell density is less than a second preset density; when the cell density is greater than the second preset density, turning on the

rotation drive mechanism, after a first preset time, turning off a second preset time, and with this cycle, performing dynamic culture on the cells.

15. A cell culture method based on the cell centrifugation apparatus of claim 3, comprising:

adding a cell suspension with cells to be cultured into the centrifuge chamber, adjusting cell density of the cell suspension to a first preset density, and adding antibodies or magnetic beads into the centrifuge chamber to activate the cells;

inputting carbon dioxide gas with a preset concentration and a culture medium with a preset components into the centrifuge chamber, and placing the centrifuge chamber containing the cell suspension and the culture medium in a preset constant temperature environment for cell culture; and

detecting the cell density in the centrifuge chamber, and turning off the rotation drive mechanism to perform static culture on the cells when the cell density is less than a second preset density; when the cell density is greater than the second preset density, turning on the rotation drive mechanism, after a first preset time, turning off a second preset time, and with this cycle, performing dynamic culture on the cells.

16. A cell culture method based on the cell centrifugation apparatus of claim 4, comprising:

adding a cell suspension with cells to be cultured into the centrifuge chamber, adjusting cell density of the cell suspension to a first preset density, and adding antibodies or magnetic beads into the centrifuge chamber to activate the cells;

inputting carbon dioxide gas with a preset concentration and a culture medium with a preset components into the centrifuge chamber, and placing the centrifuge chamber containing the cell suspension and the culture medium in a preset constant temperature environment for cell culture; and

detecting the cell density in the centrifuge chamber, and turning off the rotation drive mechanism to perform static culture on the cells when the cell density is less than a second preset density; when the cell density is greater than the second preset density, turning on the rotation drive mechanism, after a first preset time, turning off a second preset time, and with this cycle, performing dynamic culture on the cells.