of animal cells, insect cells, plant cells, yeast cells and bacteria.

[Mode 16]

The method according to mode 15, wherein the animal cells are cells derived from an animal belonging to the subphylum Vertebrata.

[Mode 17]

The method according to mode 15 or 16, wherein the animal cells are selected from the group consisting of Chinese hamster ovary tissue-derived cells (CHO cells), African green monkey kidney-derived established cell lines (Vero cells), human hepatic cancer-derived cells (HepG2 cells), canine kidney epithelial cell-derived cell lines (MDCK cells) and human hepatic cancer tissue-derived established cell lines (huGK-14).

[Mode 18]

The method according to mode 15, wherein the bacteria are selected from the group consisting of lactic acid bacteria, *E. coli*, *Bacillus subtilis* and cyanobacteria.

[Mode 19]

A substance-producing apparatus for use in the method according to any one of modes 1 to 18, including a porous polyimide film.

[Mode 20]

The substance-producing apparatus according to mode 19, wherein two or more porous polyimide films are layered either above and below or left and right.

[Mode 21]

A kit for use in the method according to any one of modes 1 to 18, including a porous polyimide film.

[Mode 22]

Use of a porous polyimide film in the method according to any one of modes 1 to 18.

[Mode 23]

A method of producing a substance using cells, the method including applying the cells to a porous polyimide

film and culturing the cells to produce the substance by the cells,
wherein the porous polyimide film has a three-layer structure consisting of an A-surface layer having a plurality of pores, a B-surface layer having a plurality of pores, and a macro-void layer sandwiched between the two surface layers,
a mean pore size in the A-surface layer is smaller than a mean pore size in the B-surface layer, and
the macro-void layer has a partition bonded to the A-surface layer and the B-surface layer, and a plurality of macro-voids surrounded by the partition, the A-surface layer, and the B-surface layer.

[Mode 24]

A substance-producing apparatus for use in the method as described herein, including a porous polyimide film.

[Mode 25]

A kit for use in the method as described herein, including a porous polyimide film.

[Mode 26]

Use of a porous polyimide film for the method as described herein.

Effect of the Invention

[0015]

Claims

1. A method of producing a substance using cells, the method including applying the cells to a porous polyimide film and culturing the cells to produce the substance by the cells,
wherein the porous polyimide film has a three-layer structure consisting of an A-surface layer having a plurality of pores, a B-surface layer having a plurality of pores, and a macro-void layer sandwiched between the two surface layers,
a mean pore size in the A-surface layer is smaller than a mean pore size in the B-surface layer, and
the macro-void layer has a partition bonded to the A-surface layer and the B-surface layer, and a plurality of macro-voids surrounded by the partition, the A-surface layer, and the B-surface layer.

2. The method according to claim 1, wherein the substance is selected from the group consisting of proteins, glycoproteins and viruses.

3. The method according to claim 1 or 2, wherein the cells are cultured under stationary culture conditions.

4. The method according to claim 1 or 2, wherein the cells are cultured under rotating culture or stirred conditions.

5. The method according to claim 1 or 2, wherein the cells are cultured in a continuous manner.

6. The method according to claim 5, including:
setting a cell culturing apparatus in an incubator and culturing the cells, wherein
the cell culturing apparatus includes:
a culturing unit that houses one or more porous polyimide films to support cells, and that comprises a culture medium supply port and a culture medium discharge port, and
a culture medium-supply unit comprising a culture medium housing vessel, a culture medium supply line, and a liquid conveyance pump that conveys the medium through the culture medium supply line, the first end of the culture medium supply line contacting the medium in the culture medium housing vessel, and the second end of the culture medium supply line being in communication with the culturing unit interior via the culture medium supply port of the culturing unit.

7. The method according to claim 6, wherein the cell culturing apparatus

does not have an air supply port, an air discharge port and an oxygen permeation film.

8. The method according to any one of claims 1 to 7, wherein the porous polyimide film is a porous polyimide film comprising a polyimide obtained from a tetracarboxylic dianhydride and a diamine.

9. The method according to claim 8, wherein the porous polyimide film is a colored porous polyimide film obtained by forming a polyamic acid solution composition including a polyamic acid solution obtained from a tetracarboxylic dianhydride and a diamine, and a coloring precursor, and then heat treating it at 250°C or higher.

10. The method according to any one of claims 1 to 9, wherein the film thickness of the porous polyimide film is no greater than 75 μm.

11. The method according to any one of claims 1 to 10, wherein the porous polyimide film is:

i) folded,

ii) wound into a roll,

iii) connected as sheets or fragments by a filamentous structure, or

iv) bound into a rope,

and suspended or anchored in the cell culture medium in the cell culturing vessel.

12. The method according to any one of claims 1 to 11, using two or more porous polyimide films layered either above and below or left and right in the cell culture medium.

13. The method according to any one of claims 1 to 12, wherein the cells are transformed by genetic engineering technology so as to express a substance.

14. The method according to any one of claims 1 to 13, wherein the cells are selected from the group consisting of animal cells, insect cells, plant cells, yeast cells and bacteria.

15. The method according to claim 14, wherein the animal cells are cells derived from an animal belonging to the subphylum Vertebrata.

16. The method according to claim 14 or 15, wherein the animal cells are selected from the group consisting of Chinese hamster ovary tissue-derived cells (CHO cells), African green monkey kidney-derived established cell lines (Vero cells), human hepatic cancer-derived cells (HepG2 cells), canine kidney epithelial cell-derived cell lines (MDCK cells) and human hepatic cancer tissue-derived established cell lines (huGK-14).

17. The method according to claim 14, wherein the bacteria are selected from the group consisting of lactic acid bacteria, *E. coli*, *Bacillus subtilis* and

cyanobacteria.

18. A substance-producing apparatus for use in the method according to any one of claims 1 to 17, including a porous polyimide film.

19. The substance-producing apparatus according to claim 18, wherein two or more porous polyimide films are layered either above and below or left and right.

20. A kit for use in the method according to any one of claims 1 to 17, including a porous polyimide film.

21. Use of a porous polyimide film for the method according to any one of claims 1 to 17.