CLAIMS

1. A method for concentrating dairy products, comprising a step of performing reverse osmosis concentration treatment on raw milk using a reverse osmosis membrane; the reverse osmosis concentration treatment comprises a low-pressure reverse osmosis membrane concentration treatment and a high-pressure reverse osmosis membrane concentration treatment;

wherein the low-pressure reverse osmosis membrane concentration treatment uses a first predetermined pressure to perform reverse osmosis concentration treatment on feed, and the high-pressure reverse osmosis membrane concentration treatment uses a second predetermined pressure to perform reverse osmosis concentration treatment on feed, wherein the first predetermined pressure is less than the second predetermined pressure,

wherein the low-pressure reverse osmosis membrane treatment comprises a multi-stage concentration treatment (preferably a 1- to 14-stage concentration treatment, more preferably a 6- to 11-stage concentration treatment), in the low-pressure reverse osmosis membrane treatment, the pressure used in the first three stages is 1 to 50 bar (preferably 1 to 40 bar, more preferably 25 to 35 bar); preferably, in the low-pressure reverse osmosis membrane treatment, the pressure used in the fourth and subsequent stages is 30 to 60 bar (preferably 40 to 50 bar, more preferably 43 to 47 bar); and

wherein the high-pressure reverse osmosis membrane treatment comprises a multi-stage concentration treatment (preferably a 1- to 6-stage concentration treatment, more preferably a 2- to 4-stage concentration treatment), the pressure used in the high-pressure reverse osmosis membrane treatment is 50 to 200 bar (preferably 60 to 80 bar, more preferably 60 to 65 bar).

2. The concentration method according to claim 1, wherein each stage of the low-pressure reverse osmosis membrane treatment and/or each stage of the high-pressure reverse osmosis membrane treatment uses one or more membrane assemblies; more preferably, each membrane assembly comprises one membrane or more membranes which are connected in series, in parallel, or in a combination of series and parallel.

3. The concentration method according to claim 2, wherein the pressure used in each stage of the multi-stage concentration treatment of the low-pressure reverse osmosis membrane treatment is different.

4. The concentration method according to any of claims 1-3, wherein the pressure used in each stage of the multi-stage concentration treatment of the high-pressure reverse osmosis membrane treatment is different.

5. The concentration method according to any one of claims 1 to 4, wherein the temperature of a feed liquid to be concentrated in the concentration method is 20 °C or lower (preferably 0 to 15 °C, more preferably 7 to 15 °C);
preferably, the temperature of the concentrated feed liquid is maintained below 15 °C (more preferably, maintained at 10 to 14 °C) by a high-pressure radiator; preferably, the high-pressure radiator is arranged at a feed port or a discharge port of the predetermined stage(s) of the high-pressure reverse osmosis membrane treatment unit.

6. The concentration method according to any one of claims 1 to 5, wherein after the step of the reverse osmosis concentration treatment, further comprising: v) a cooling step; vi) a filling step; vii) a freezing step; and/or viii) cleaning step.

7. The concentration method according to claim 6, wherein the cooling step uses two-stage cooling; preferably, the first stage of the cooling uses an ice water as a refrigerant; preferably, the second stage of the cooling uses a solution of ethylene glycol in water as a refrigerant.

8. The concentration method according to claim 6, wherein preferably, the temperature of the first stage of the cooling is maintained at 2 to 10 °C (more preferably 4 to 7 °C); preferably, the temperature of the second stage of the cooling is maintained at -1 to -4 °C (more preferably -2 to -3 °C).

9. The concentration method according to claim 6, wherein the filling temperature of the filling step is maintained at 1 to -4 °C, more preferably -2 to -3 °C.

10. The concentration method according to claim 6, wherein the freezing temperature of the freezing step is maintained at -10 to -24 °C, more preferably -18 to -22 °C.

11. A concentrated dairy product, wherein the total solid content is 30 to 50%, preferably 35 to 45%, more preferably 40 to 45%;
after the concentrated dairy product is diluted to the total solid content level of raw milk according to a concentration ratio, the detected furosine content is 8 to 15 mg/100g protein;
preferably, after the concentrated dairy product is diluted to the total solid content level of raw milk according to a concentration ratio, the detected retention amount of IgG (immunoglobulin G) is higher than 95%;
preferably, after the concentrated dairy product is diluted to the total solid content level of raw milk according to a concentration ratio, the detected retention rate of GMP (glycomacropeptide) is 100%.

12. A feed liquid concentration device, comprising:
a concentration unit, which is arranged downstream of a homogenization unit and successively comprises a low-pressure concentration unit and a high-pressure concentration unit, wherein the low-pressure concentration unit performs a reverse osmosis concentration treatment on the feed liquids flowing therethrough at a first predetermined pressure, and the high-pressure concentration unit performs a reverse osmosis concentration treatment on the feed liquids flowing therethrough at a second predetermined pressure, wherein the first predetermined pressure is less than the second predetermined pressure,
wherein the low-pressure concentration unit comprises a plurality of stages, in the low-pressure concentration unit, the pressure used in the first three stages is 1 to 50 bar (preferably 1 to 40 bar, more preferably 25 to 35 bar); preferably, in the low-pressure concentration unit, the pressure used in the fourth and subsequent stages is 30 to 60 bar (preferably 40 to 50 bar, more preferably 43 to 47 bar),

wherein the high-pressure concentration unit comprises a plurality of stages, the pressure used in the high-pressure concentration unit is 50 to 200 bar (preferably 60 to 80 bar, more preferably 60 to 65 bar),

further comprising: a cooling unit, which is arranged downstream of the concentration unit to cool the feed liquid concentrated by the concentration unit, wherein the cooling unit comprises a first cooling unit and a second cooling unit, and

wherein the second cooling unit comprises a low-temperature critical tube-type heat exchanger.

13. The feed liquid concentration device according to claim 12, wherein each stage of the low-pressure concentration unit and/or each stage of the high-pressure concentration unit comprises one or more membrane assemblies, and each membrane assembly comprises one membrane or more membranes which are connected in series, in parallel, or in a combination of series and parallel.

14. The feed liquid concentration device according to claim 13, wherein the pressures in various stages of the multi-stage low-pressure concentration unit and/or the multi-stage high-pressure concentration unit are different.

15. The feed liquid concentration device according to claim 14, wherein the concentration unit further comprises a low-pressure heat exchanger, which is arranged at a feed port or a discharge port of the predetermined stage(s) of the low-pressure concentration unit to maintain the temperature of the concentrated feed liquid below 15 °C; and/or a high-pressure heat exchanger, which is arranged at a feed port or a discharge port of the predetermined stage(s) of the high-pressure concentration unit to maintain the temperature of the concentrated feed liquid below 15 °C.

16. The feed liquid concentration device according to claim 12, wherein the first cooling unit cools the feed liquid to the first cooling temperature, and the second cooling unit further cools the feed liquid cooled by the first cooling unit to a second cooling temperature lower than the

first cooling temperature.

17. The feed liquid concentration device according to any of claims 12 to 16, further comprising a cleaning unit, which cleans the feed liquid concentration device after the feed liquid concentration is completed.

18. The feed liquid concentration device according to any of claims 12 to 16, wherein the feed liquid is cow milk.