Claims

1. A method for directly heating (DE) a protein-enriched milk product (P) by introducing steam (D) into said milk product (P),

   (a) wherein, during the direct heating (DE), the steam (D) heats the milk product (P) so as to produce a germ-free state by means of direct high-temperature pasteurization (HE) to a high pasteurization temperature (THE),

   (b) wherein, prior to direct heating (DE), the milk product (P) is indirectly preheated (VE) to a preheating temperature (TVE) and, following on from the preheating (VE) when viewed in the direction of flow of the milk product (P), a first instance (HH1) of keeping the preheated milk product (P) at temperature is carried out for a defined and controlled first dwell time ($\Delta t1$),

   (c) wherein, following on from the direct heating (DE) to the high pasteurization temperature (THE) when viewed in the direction of flow of the milk product (P), a second instance (HH2) of keeping the milk product (P) at temperature is carried out for a defined and controlled second dwell time ($\Delta t2$), and

   (d) wherein water (W) in an amount corresponding to that of the previously supplied steam (D) is removed from the high-temperature pasteurized milk product (P) that has been kept at temperature by flash cooling (FK) by means of decompression to a lower pressure,

   characterized in that

   - the milk product (P) which is preheated and kept at temperature is indirectly cooled (K) prior to direct heating (DE) by means of a recuperative cooling step from the preheating temperature (TVE) to a cool-down temperature (TK) with a temperature difference (ΔTK) in a range from 5 K(elvin) to 10 K ($\Delta TK \leq$ (5 to 10) K),
   - the direct heating (DE) from the cool-down temperature (TK) to the high pasteurization temperature (THE) is controlled by means of direct heating setting parameters which are known per se, and
   - in accordance with feature (d), the milk product (P) is cooled by flash cooling (K) from the high pasteurization temperature (THE) to a necessarily required exit temperature (TA).

2. The method according to claim 1,
characterized in that
the temperature difference (ΔTK) is 10 K (ΔTK = 10 K).

3. The method according to claim 1 or 2,
characterized in that
the direct heating setting parameters are pressure, temperature, duration of action of the steam.

4. The method according to any one of the preceding claims,
characterized in that
the direct heating (DE) is achieved by means of a per se known infusion method (IFV).

5. The method according to any one of the claims 1 to 3,
characterized in that
the direct heating (DE) is achieved by means of a per se known injection method (IJV).

6. A system (1000) for directly heating (DE) a protein-enriched milk product (P) by introducing steam (D) into said milk product (P), comprising, in a manner known per se,
   - a direct heating apparatus (8; 80, 800) for the milk product (P) for direct high-temperature pasteurization (HE) by means of steam (D) to a high pasteurization temperature (THE),
   - a preheater (2) that is arranged upstream of the direct heating apparatus (8; 8, 800) when viewed in the direction of flow of the milk product (P) and that is designed as a recuperator and that serves to indirectly preheat (VE) the milk product (P) to a preheating temperature (TVE),
   - a first holding tube (4) for a first instance (HH1) of keeping the preheated milk product (P) at temperature and arranged between the direct heating apparatus (8; 80, 800) and the preheater (2),

- a first conveying apparatus (10) arranged downstream of the direct heating apparatus (8; 80, 800) for conveying the high-temperature pasteurized milk product (P),
- a second holding tube (12) arranged downstream of the first conveying apparatus (10) for a second instance (HH2) of keeping the high-temperature pasteurized milk product (P) at temperature,
- a vacuum apparatus (14) arranged downstream of the second holding tube (12) and in which water (W) in an amount corresponding to that of the previously supplied steam (D) is subsequently removed from the high-temperature pasteurized milk product (P) that has been kept at temperature by flash cooling (FK) by means of decompression to a lower pressure,

characterized in that

a cooler (6) designed as a recuperator is arranged between the direct heating apparatus (8; 80, 800) and the first holding tube (4), which cooler cools the preheated milk product (P) down from a preheating temperature (TVE) to a cool-down temperature (TK) by means of indirect cooling (K).

7. The system according to claim 6,

characterized in that

the direct heating apparatus (8) is designed in the form of a per se known infusion apparatus (80).

8. The system according to claim 6,

characterized in that

the direct heating apparatus (8) is designed in the form of a per se known injection apparatus (800).