DETERMINATION OF OPTIMAL PARAMETERS OF THE MOIST AIR BOUNDARY LAYER FLOW RELEVANT FOR THE INITIAL PERIOD OF CONTINUAL PROCESS OF KAJMAK FORMATION

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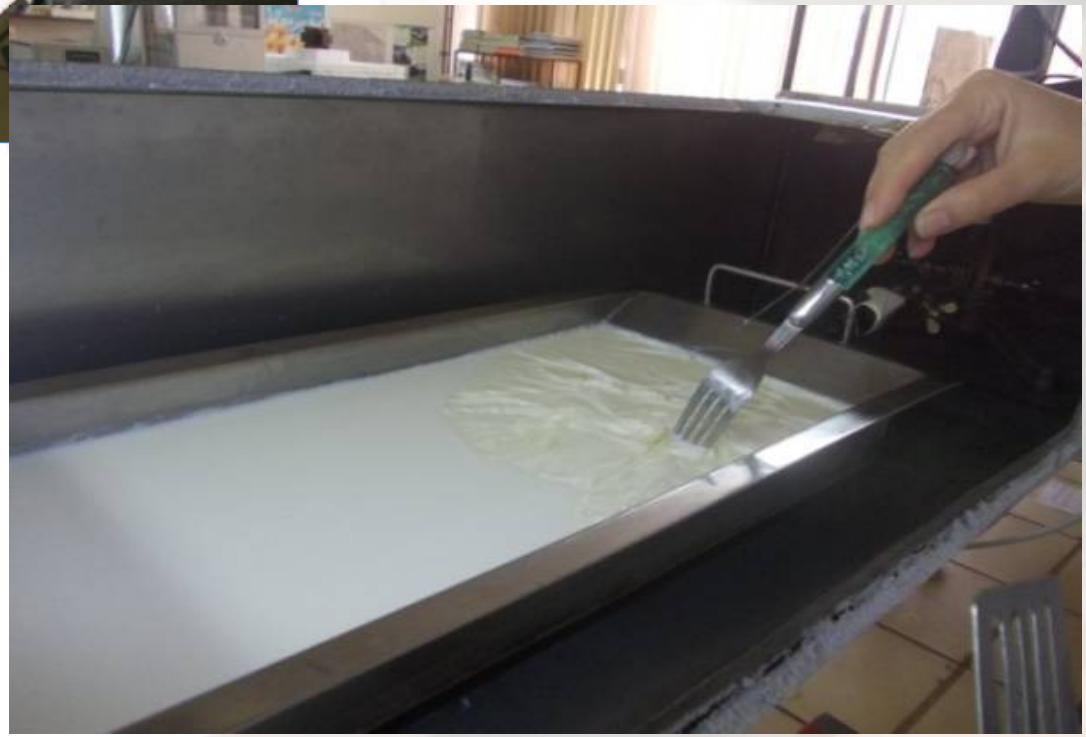

The initial phase of kajmak formation, takes place as result of combined effects of:

- **surface phenomena, where compounds with high surface activity are concentrated on the milk/air interface,**

- **intensive water evaporation due to high milk temperature.**

Factors that strongly influence the initial phase of kajmak formation process are milk temperature, thermodynamic parameters of moist air and the composition of the starting raw materials.

Skin layer composition:

- 50-60% fat,
- 10% proteins
- 30-40% moisture.

During the whole process of kajmak formation, the initially formed skin layer is getting ticker and richer, particularly with fat, yielding the final structure and composition of the product.

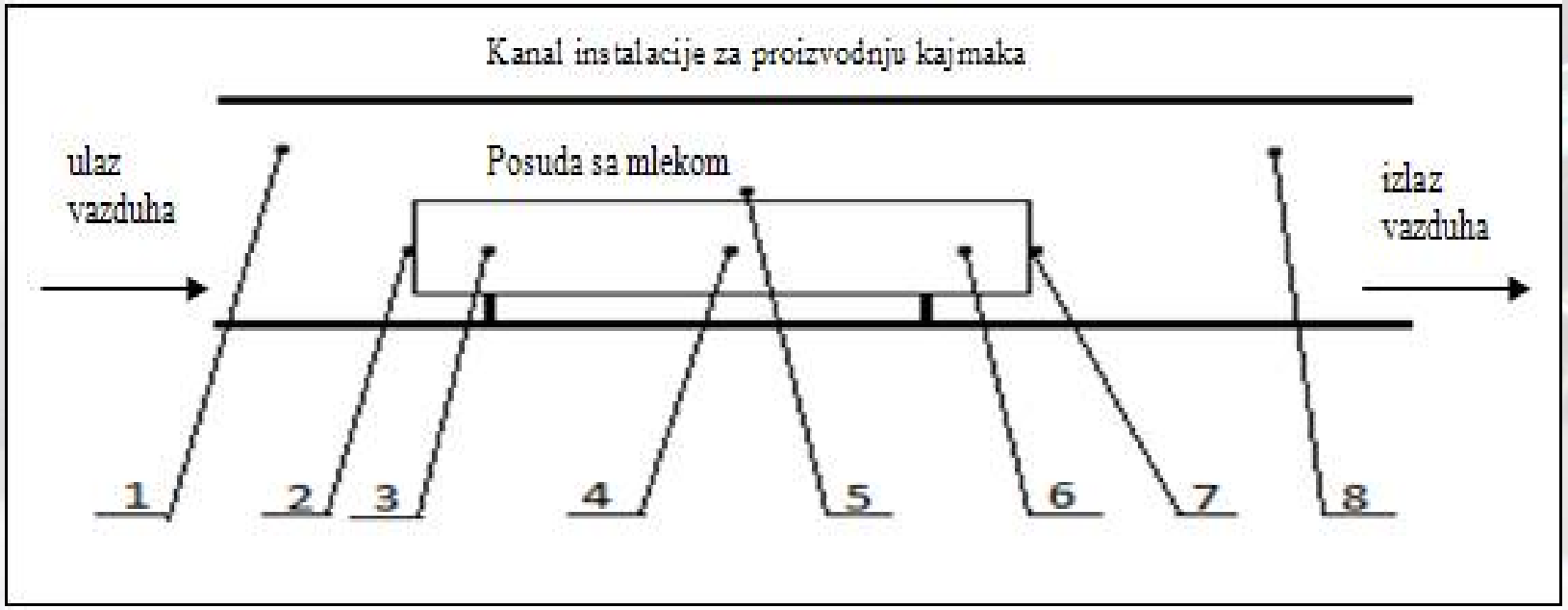

Figure 1. Laboratory instalation for kajmak production

- The measurement of milk temperature and vessel wall was performed with a digital thermometer
- Moist air thermodynamic parameters and velocity
- Air velocity in the installation in all experiments was kept constant (0.7m/s).

Trial	t [ºC]	φ [%]
D1	30	50
D2	30	70
D3	30	90
D4	40	70
D5	20	70

Table 1. Moist air status parameters at the entry into the working section of the cooling tunnel

Table 2. Material chemical composition for milk standardization

Material	Chemical compostition, %	
	Milk fat	Proteins
Raw millk	**3,50**	**3,21**
Cream	**36,00**	**2,10**
Promilk 852 A2	**1,00**	**78,00**

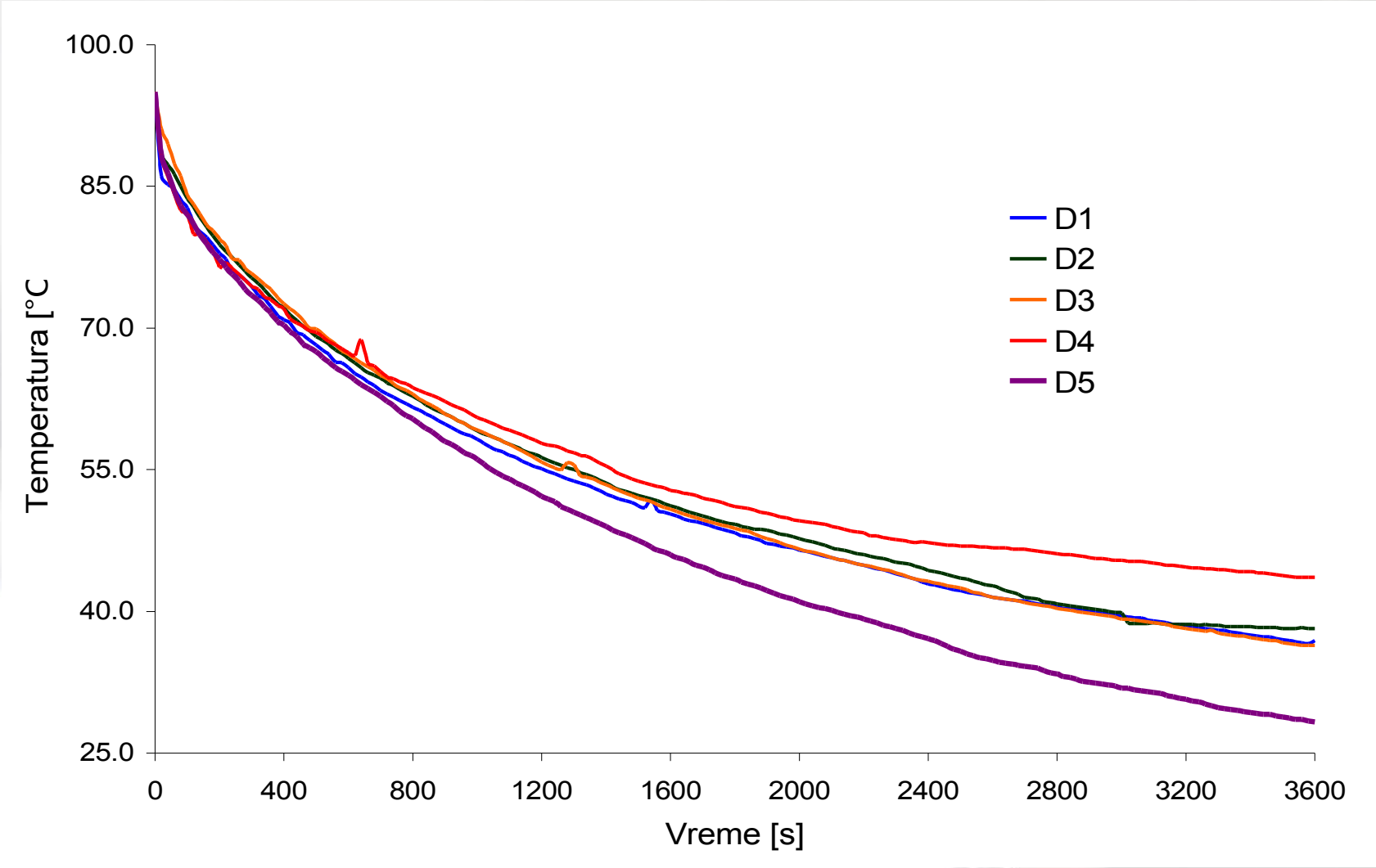

Figure 2. Moist air temperature distibution in the air boundary layer above the milk container

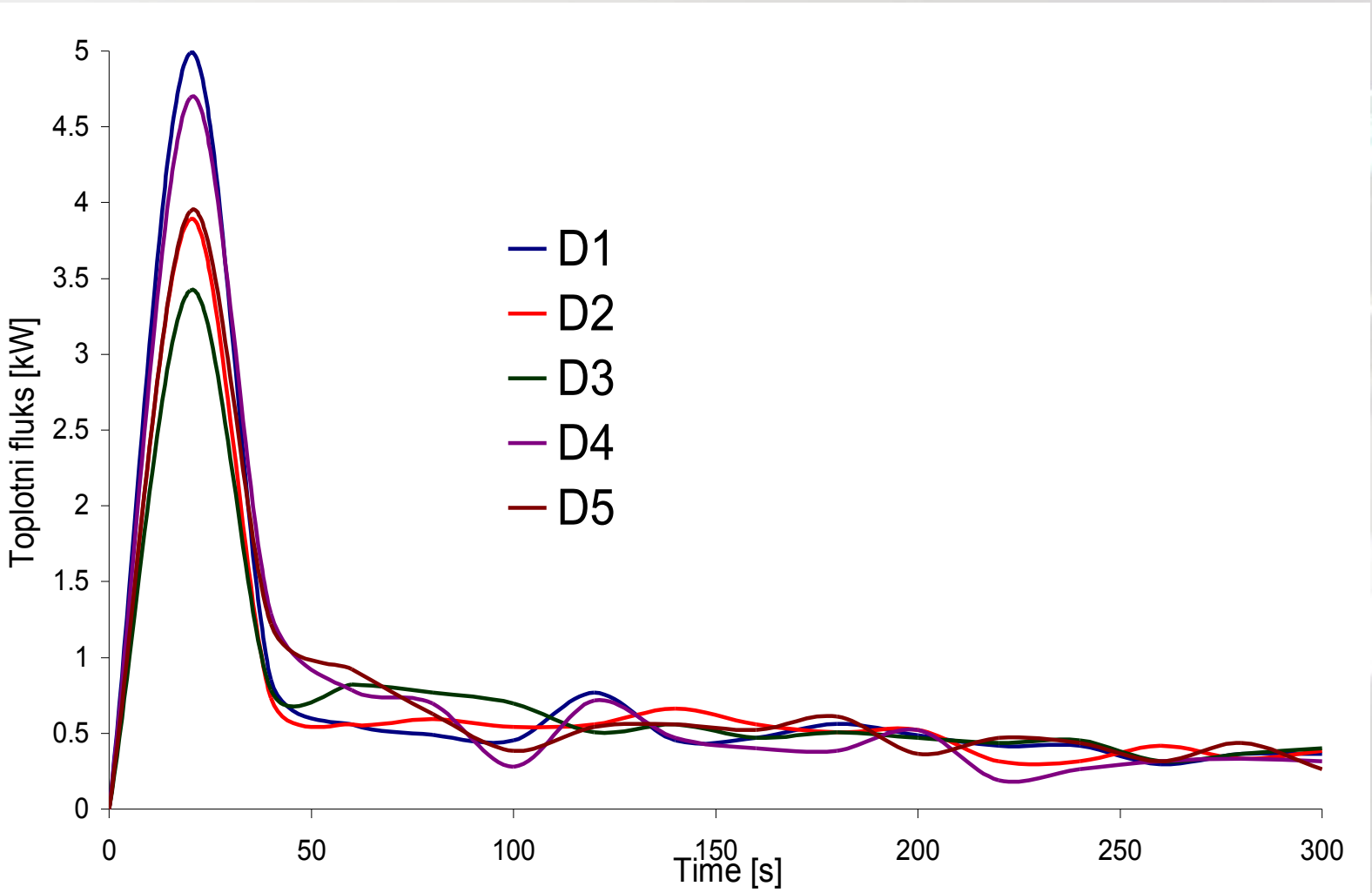

Figure 3. The total heat flux exchanged between milk and moist air during the first 300s of processes

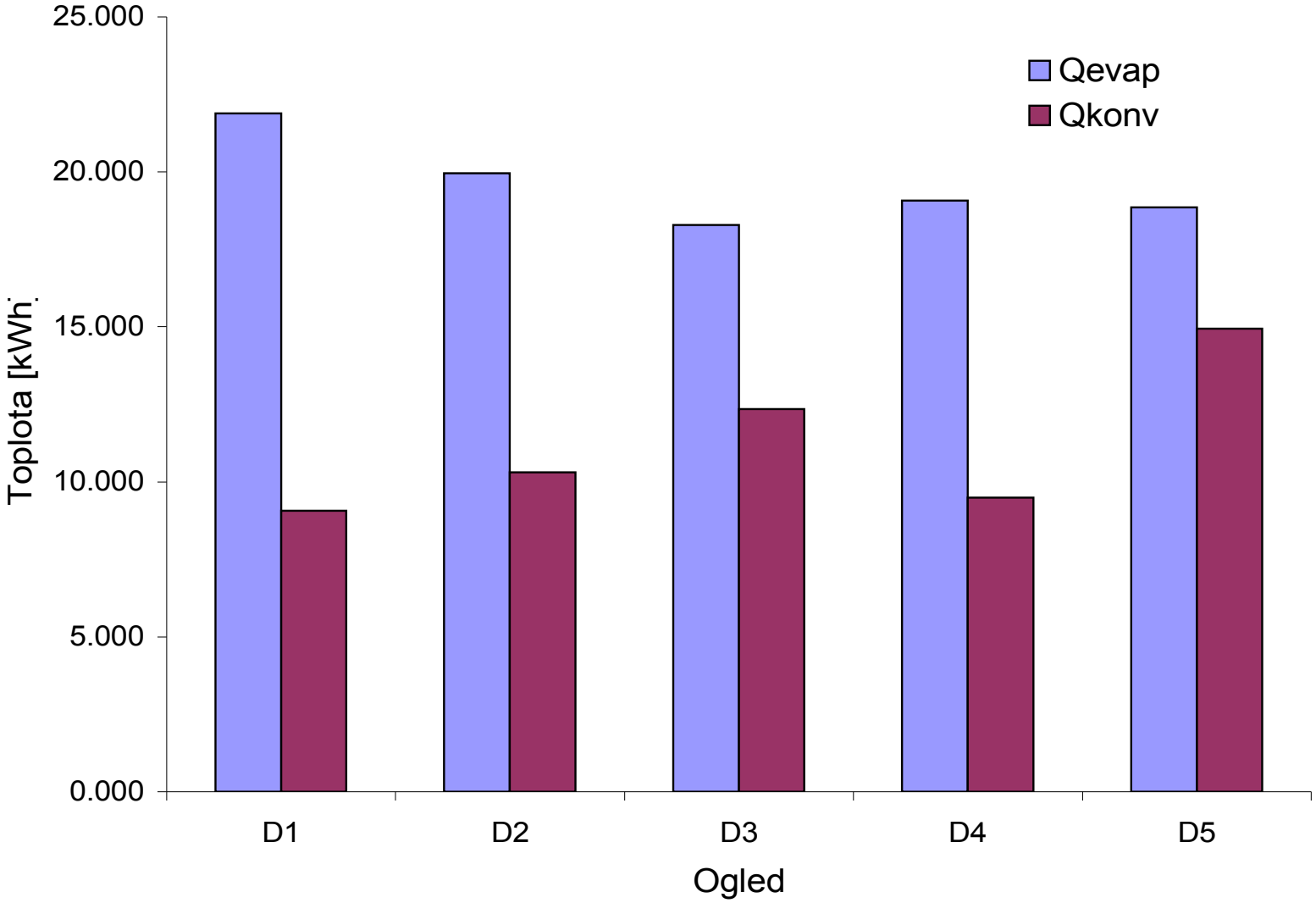

Figure 4. The values of the heat exchanged in all experiments during the period of 3600s

Table 3. Yield and composition of skin layer samples in relation to moist air temperatu at 70% relative humidity

Trial	Yeald [g]				Composition [%]		
	Skin layer	Fat	Proteins	DM	Fat	Proteins	DM
D5	35,67±0,58 a	18,19±0,46 a	3,24±0,05 a	22,80±0,47 a	51,00±0,50 a	9,09±0,02 a	63,91±0,30 a
D2	40,67±2,52 b	22,36±1,18 b	3,38±0,37 b	27,50±1,47 b	55,00±0,50 b	8,31±0,62 a	67,64±0,79 b
D4	38,67±2,08 ab	22,67±0,96 b	3,31±0,10 b	27,09±1,27 b	58,67±1,15 c	8,58±0,21 a	70,08±0,47 c

Table 4. Yield and composition of skin layer samples in relation to moist air relative humidity at 30°C

Trial	Yeald [g]				Composition [%]		
	Skin layer	Fat		Skin layer	Fat		Skin layer
D1	31,33±1,15 a	19,22±0,87 a	2,35±0,22 a	22,76±1,13 a	61,33±1,76 a	7,50±0,50 a	72,62±2,26 a
D2	40,67±2,52 b	22,36±1,18 b	3,38±0,37 b	27,50±1,47 b	55,00±0,50 b	8,31±0,62 a	67,64±0,79 b
D3	37,00±1,00 c	20,35±0,64 a	3,31±0,27 b	23,82±0,59 a	55,00±0,87 b	8,93±0,65 a	64,38±0,14 c

The initial stage of the skin layer formation is characterized by instability in the exchange of heat and mass transfer between milk on cooling and moist air that flows over the milk surface.

Yield and composition of the skin layer formed are sensitive to variation of moist air parameters (temperature and relative humidity).

The observed variations in the intensity of evaporative cooling indicate changes in the porosity of the formed skin layer.

By applying the parameters of moist air in the sample D2 (t =30 ° C, φ= 70%), the most acceptable composition as well as the highest yield of the skin layer was obtained.