

Quality of Trappist cheese from Croatian dairy plant

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Summary

The paper presents technological parameters, basic chemical composition and sensory evaluation, as well as the yield of 146 samples of Trappist cheese. In terms of water content in non-fat matter (56.36-58.31 %), Trappist cheese belongs to the group of semi-hard cheeses, and in terms of content of fat in dry matter (46.06-48.63 %), it belongs to the group of full-fat cheeses. In four cheese samples *E. coli* was determined within microbiological parameters, whereas other researched bacteria were not determined. Cheese has a shape of a symmetrical ring and it has a homogenous yellow color of protective coating. Mean mass value of one cheese ring is from 2.50 to 2.55 kg. The body of cheese has a homogenous light yellow color, which is brighter along the edges. The cheese holes have the size of a pea; they are bright and patterned over the whole surface of cross section. Consistency of cheese body is elastic, soft and interconnected. The cheese has mild, pure lactic and acidic taste and odor, and it is moderately salty. The results of sensory score show that even 91.78 % of cheese samples from experimental production can be assigned to the first quality class, whereas 8.22 % of samples belong to the second quality class.

Key words: Trappist cheese, chemical composition, sensory evaluation, technological parameters, standardization

Introduction

Trappist cheese is a renowned cheese which originates from the French monasteries, and got its name after La Trappe abbey. Its reputation in our region was spread by the monks of Marija Zvijezda monastery near Banja Luka, where it had a long tradition of production, and where its production spread from - over Croatia to all of the countries of Austria-Hungary Monarchy. A long tradition of cheese making was marked exactly by Trappist, which can be considered to be the first cheese produced in dairy processing plants and the forerunner of all the later kinds which appeared in the 70s of the last century. That tradition of Trappist cheese production has been successfully continued in to-

day's "Sirela" in Bjelovar. By moving away from its original place, Trappist cheese has assumed some specific local characteristics, which have removed it from its original characteristics of semi-soft to the semi-hard type of cheese. There are several reasons for changing cheese quality and the most significant ones are commercial and economic. Regardless of all modifications, the basic production parameters and characteristics of this cheese have remained identifiable and unique (Kirin, 2003). Therefore we can talk today about Trappist cheese with the national sign and about Croatian Trappist as well (Kirin, 2002).

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Table 1. Trappist cheese technological production procedure

Tablica 1. Tehnološki proces proizvodnje sira trapista

Procedure no Broj procesa	Procedure steps Procesni koraci	Specification of technical data Opis tehničkih podataka
1	Quantity and standardization of milk Količina i tipizacija mlijeka	10.000 L Standardization of fat/Standardizacija masti: 3.0 %
2	Bactofugation of milk Baktofugiranje mlijeka	Temperature/Temperatura: 50-55 °C Emptying bactofuge: every 7 minutes Pražnjenje baktofuge: svakih 7 minuta
3	Pasteurization and cooling of milk Pasterizacija i hlađenje mlijeka	Plate pasteurizer/Pločasti paster: 74±2 °C/40 sec, Cooling on storing temperature Hlađenje na temperaturu skladištenja 4±2 °C
4	Storage of milk Skladištenje mlijeka	Temperature in storage elevator Temperatura u skladišnom silosu 4±2 °C
5	Filling the tank with heating milk Punjenje zgotovljača dogrijanim mlijekom	Additional heating to renneting temperature Dogrijavanje na temperaturu sirenja 30±1 °C
6	Mesophyllic bacterial culture addition Dodavanje mezofilne bakterijske kulture	Mesophyllic culture/Mezofilna kultura 1 %
7	Calcium chloride addition Dodavanje kalcijevog klorida	0.02 %
8	Annatto color additio Dodavanje annatto boje	150 mL
9	Clotting agent addition Dodavanje sirila	550 mL
10	Lyzozime addition Dodavanje lizozima	0.0025 %
11	Renneting/Sirenje	31±1 °C/30 min
12	Cutting the curd Rezanje gruš/sirnog zrna	Up to the size of/Do veličine 5-6 mm
13	Separating a part of whey Izdvajanje dijela sirutke	cca 3000 L
14	Technological water addition Dodavanje tehnološke vode	2000 L/50-60 °C
15	Additional heating of curd Dogrijavanje sirnog zrna	36-38 °C
16	Drying of the curd Sušenje sirnog zrna	37 °C cca 30 min
17	Emptying the tank Pražnjenje zgotovljača	-
18	Moulding Kalupljenje	Shaping, cutting cheese mass and moulding Oblikovanje, rezanje sirne mase i kalupljenje

	Pressing cheese/Prešanje sira:	Pressing time/Vrijeme prešanja: 50 min.
	1 st phase of pressing/1. faza prešanja	12 min/1,1bar
	2 nd phase of pressing/2. faza prešanja	13 min/2,2bar
19	3 rd phase of pressing/3. faza prešanja	25 min/7bar
	Salting cheese Soljenje sira	Strength of brine/Jačina salamure: 18-20 °Bé Temperature of brine/Temperatura salamure: +13 to +17 °C Salting time/Vrijeme soljenja: 24±2 h
20		
	Draining off and drying cheese Ocjeđivanje i sušenje sira	-
21		
	Maturing and caring for cheese Zrenje i njega sira	Cheese maturing/Zrenje sira: min. 30 days/dana Temperature/Temperatura: from +8 to +15 °C Relative humidity in maturing room/Relativna vlaga u zionici: 90 % Turning cheese on shelves/Okretanje sira na policama: • at the beginning/na početku: 2 times per week/2 puta tjedno • till the end of ripening/do kraja zrenja: 1 time per week/jednom tjedno
22		
23	Rind protection/Zaštita kore	Plastic coat/4 times/Plastični premaz/4 puta
	Mature cheese packaging Pakiranje zrelog sira	Cardboard box/3 pieces Kartonska kutija/3 komada
24		
	Storing/distribution Skladištenje/distribucija	Temperature/Temperatura: from +4 °C to +8 °C
25		

The aim of this paper is to describe technological production procedure of Trappist cheese produced in "Sirela", Bjelovar dairy plant. The research will be conducted on 146 production series of cheese, and quality and hygienic safety of cheese will be evaluated.

Material and Methods

The research was conducted in "Sirela" dairy plant in the period from 1st January to 25th May 2007. 127 of collective milk samples and 146 production series of Trappist cheese were researched. Sampling and treatment of samples were performed by the Croatian standard: Milk and dairy products - Instruction for sampling (HRN EN ISO 707:1999). Analyses were performed in the laboratory of "Sirela" dairy plant, Bjelovar.

Technological production procedure of Trappist cheese

Production of Trappist cheese begins on a loading ramp of a dairy plant and finishes in cheese maturation room. It proceeds according to the tech-

nological standards shown in Table 1. Mesophilic dairy culture, which is added to the milk for coagulation and which affects the course of technological production procedure and the characteristics and quality of mature Trappist cheese, is produced by the procedure shown in Table 2.

Milk

In collective raw milk samples (n=127) which were used in the production of cheese, a quantity of fat, proteins, lactose, non-fat dry matter, pH-value, titratable acidity, density, microbiological quality and the somatic cells count were determined. Chemical composition of raw milk was determined by spectrophotometric method, by Milkoscan 400 device, pH-value was determined by a digital pH- meter (pH 340, WTW), titratable acidity by the Soxhlet- Henkel method, and the density by lactodensimetric procedure (Sabadoš, 1996). Viable count of bacteria in milk (HRN ISO 4833), *Staphylococcus aureus* (HRN EN ISO 6888-1), *Enterobacteriaceae* (HRN ISO 7402) and *Listeria monocytogenes* (HRN ISO 10560) were determined to evaluate microbiological quality.

Table 2. Production of technical dairy culture
 Tablica 2. Proizvodnja tehničke mljekarske kulture

Procedure no Broj procesa	Procedure steps Procesni koraci	Specification of technical data Opis tehničkih podataka
1	Fresh raw milk Svježe sirovo mlijeko	Analysis of raw milk by ABT test Analiza sirovog mlijeka ABT testom
2	Standardization of fat content Standardizacija masti	3.0 %
3	Bactofugation Baktofugacija	Temperature/Temperatura: 50-55 °C Emptying bactofuge/Pražnjenje baktofuge: every 7 minutes/svakih 7 minuta
4	Pasteurization of milk Pasterizacija mlijeka	74±2 °C/40 sec Cooling/Hlađenje
5	Storing the milk Skladištenje mlijeka	Temperature/Temperatura: 4±2 °C
6	Filling the duplicator with milk Punjenje duplikatora mlijekom	According to work instruction for the production of mesophilic dairy culture Prema radnoj uputi za proizvodnju mezofilne mljekarske kulture
7	Thermal processing of milk Termička obrada mlijeka	80-90 °C/90 min
8	Cooling the milk on temperature of inoculation Hlađenje mlijeka na temperaturu inokulacije	Temperature/Temperatura: 22 °C
9	Inoculation of milk Cijepljenje mlijeka	Adding lyophilized culture Dodavanje liofilizirane kulture
10	Stirring Miješanje	5-10 min
11	Incubation/Inkubacija	22 °C/18-20 hours/sati
12	Fermentation stopping Prekid fermentacije	pH 4,45-4,75
13	Cooling/Hlađenje	Temperature/Temperatura: <8 °C
14	Safe-keeping and distribution Čuvanje i distribucija	Temperature/Temperatura: 8 °C/max 3 days/dana

Somatic cells count was determined by electronic method by Fossomatic 5000 (Foss Electric, Hillerød, Denmark).

Cheese

Technological procedure of Trappist cheese production (n=146) was followed, starting from standardized and pasteurized milk for renneting, where the content of fat and proteins, acidity level (°SH), pH-value and density was determined. The changes of acidity level (°SH) and pH-value of milk, whey and cheese were observed, based on which an acidification

curve was made. Chemical composition (quantity of water, dry matter, fat, fat in dry matter and water in non-fat matter of cheese) was determined in mature cheese. Equally, in bacteriological research parameters according to the Guidelines for food microbiological criteria (Ministry of Agriculture, Fisheries and Rural Development, 2009) were determined. Cheese was sensory evaluated after maturation. The content of fat in cheese was determined by butyrometric method according to Van Gulik and Gerber, the quantity of water by Halogen Moisture Analyzer HR73 (Mettler-Toledo, Switzerland), and the content of dry matter by subtraction of water content from 100.

Table 3. Regulation on internal evaluation of sensory traits of dairy products of "Sirela" plant (Sirela, 2005)
 Tablica 3. Pravilnik o internom ocjenjivanju organoleptičkih svojstava mliječnih proizvoda tvornice "Sirela" (Sirela, 2005.)

Characteristic Svojstvo	Description of characteristic Opis svojstva	Mark of characteristic (point) Ocjena svojstva (bod)	The highest mark (point) Najveća ocjena (bod)
Outer appearance and packaging Vanjski izgled i pakiranje	damaged rind/oštećena kora inhomogeneous color of coat/neujednačena boja premaza inflated and deformed cheese/napuhan i deformiran sir	0	
	regular cheese appearance/pravilan izgled sira homogenous color of coat/ujednačena boja premaza cheese without stains on surface/sir bez mrlja na površini	1	1
Inner appearance and consistency Unutarnji izgled i konzistencija	variegated body/šareno tijesto expressive white edge/izraziti bijeli rub irregular, large, stretched, uneven cheese holes/neppravilna, velika, rastegnuta neujednačena sirna okna tough, too soft or sticky consistency/žilava, premekana ili ljepljiva konzistencija	0	
	body of homogenous light yellow color, brighter along the edges/tijesto ujednačene svjetlo žute boje, uz rubove svjetlije cheese holes of a size of a pea, shiny, patterned/sirna okna veličine graška, sjajna, pravilno raspoređena consistency of cheese body elastic, soft and intercon- nected/konzistencija sirnog tijesta elastična mekana i povezana	2	2
Odour and taste Miris i okus	strong, strange (by ammonia, forage, mold...) bitter, too salty or unsalted taste/jaki strani (amonijačni, po krmi, pljesni...) gorki, preslan ili neslan okus expressed sourness/izražena kiselost too mature, uncharacteristic taste/prezreli nesvojstven okus	0	
	traces of strange and uncharacteristic odor and taste/tra- govi stranog i nesvojstvenog mirisa i okusa insufficiently salty or too salty taste/nedovoljno slan ili preslan okus sira	1	3
	without strange odor and taste/bez stranog mirisa i okusa moderately salty/umjereno slan insufficiently developed odor and taste/nedovoljno razvijen miris i okus	2	
	without strange admixtures/bez stranih primjesa moderately salty/umjereno slan mild, pure, moderately lactic and acidic taste and odor/blagog, čistog, umjereno mliječno kiselkastog okusa i mirisa	3	
Total/Ukupno			6

Table 4. Results of analyses of collective samples of raw milk (n=127) for the production of Trappist cheese
Tablica 4. Rezultati analiza uzoraka sirovog mlijeka (n=127) za proizvodnju trapista

Month Mjesec	n	Fat Mast (%)	Proteins Bjelančevine (%)	Lactose Laktoza (%)	Dry matter without fat Bezmasna suha tvar (%)	Total viable count Ukupni broj bakterija /mL*	Somatic cells count broj somatskih stanica /mL
January Siječanj	26	4.28	3.42	4.61	8.71	651.961	184.580
February Veljača	25	4.23	3.41	4.63	8.72	848.040	141.280
March Ožujak	26	4.24	3.42	4.60	8.76	564.692	230.923
April Travanj	25	4.21	3.37	4.57	8.69	583.000	238.000
May Svibanj	25	4.11	3.34	4.54	8.67	589.000	194.800
Σn	127						

*cfu/mL

The content of salt was determined by Volhard method (Sabadoš, 1996), and the pH-value of cheese by pH-meter (pH 340, WTW).

Fat in dry matter was calculated according to the formula:

$$\frac{\text{fat (\%)} \times 100}{\text{dry matter (\%)}}$$

The content of water in non- fat matter is calculated according to the formula:

$$\frac{\text{Quantity of water in cheese} \times 100}{100 - \text{quantity of fat in cheese}}$$

Cheese samples were researched for the presence of bacteria *Salmonella* spp. (HRN EN ISO 6785), *S. aureus* (HRN EN ISO 6888-1), *Escherichia coli* (Coli-ID, BioMerieux, France), *Listeria monocytogenes* (HRN ISO 10560) and sulphitreducing clostridia (HRN ISO 15213).

Mature Trappist cheese was sensory evaluated based on outer appearance, cross- cut appearance, characteristics of cheese body and its color, odor and taste. Evaluation of organoleptic traits of

the researched production of Trappist cheese during the year 2007 was performed according to the Regulation (Sirela, 2005) shown in Table 3. The evaluation was conducted by a group of 10 evaluators, and the samples were allocated to appropriate quality categories based on achieved points. Cheese yield was determined by weighing and by calculation (Sabadoš, 1996).

Statistical analysis

Statistical data processing was performed by the basic methods of descriptive statistics by the Statistica 7.1 program.

Results and Discussion

The results of chemical analyses and the results of the total viable count of bacteria and somatic cells determination of raw and pasteurized milk aimed for the production of Trappist cheese are presented in Tables 4 and 5. The results of chemical and organoleptic analyses and cheese yield are presented

Table 5. Results of physical and chemical research of pasteurized milk samples (n=146) for the production of Trappist cheese

Tablica 5. Rezultati fizikalno-kemijskih pretraga pasteriziranog mlijeka (n=146) za proizvodnju trapista

Date Datum	Quantity Količina (kg)	n	Fat content	Protein content	Acidity/Kiselost		Density Gustoća (1,0...)
			Mast (%)	Bjelančevine (%)	°SH	pH	
19.01.	192907	19	3.05	3.00	6.2	6.67	340
08.02.	194305	19	3.00	3.36	6.2	6.66	306
02.03.	163418	16	3.00	3.38	6.2	6.67	306
16.03.	194080	19	3.05	3.32	6.2	6.65	305
06.04.	161809	17	3.00	3.33	6.2	6.66	303
20.04.	194942	20	3.00	3.34	6.2	6.66	310
11.05.	196251	20	3.00	3.32	6.2	6.67	304
25.05.	162559	16	3.00	3.24	6.2	6.67	302
Total	1460271	146					

Table 6. Results of mature Trappist cheese chemical composition (n=146)

Tablica 6. Rezultati kemijskih pretraga zrelog trapista (n=146)

Date Datum	n	Parameter/Pokazatelj, %					pH
		Water Voda	Water in non-fat matter Voda u bezmasnoj tvari	Dry matter Suha tvar	Fat Mast	Fat in dry matter Mast u suhoj tvari	
19.01.	19	40.30	56.36	59.70	28.50	47.73	5.39
08.02.	19	40.30	55.59	59.70	27.50	46.06	5.42
02.03.	16	40.00	55.94	60.00	28.50	47.50	5.41
16.03.	19	40.90	56.80	59.10	28.00	47.37	5.40
06.04.	17	40.70	56.92	59.30	28.50	48.06	5.41
20.04.	20	39.60	55.77	60.40	29.00	48.01	5.29
11.05.	20	39.50	55.83	61.00	29.25	48.36	5.55
25.05.	16	41.4	58.31	58.6	29.00	48.63	5.33
Total	146						

in Tables 6-8. An acidification curve of Trappist cheese, that is, changes in acidity (pH) of substrate in different production phases is shown in Picture 1. In four cheese samples *E. coli* was determined within microbiological parameters, whereas other researched bacteria were not determined.

Chemical composition of raw milk, with the content of fat and proteins in the first place, has a double importance in developed dairy industry, as for the producers of milk, so for the dairy plant, i.e. for the manufacturers. Purchase price for the first ones is determined based on the content of fat and

proteins. The content of milk taken over from the producers is important for cheese makers, not only as an expense for the basic raw material, but also because of planning and realizing cheese yield, that is, the degree of usability of raw material. In the end, chemical composition of milk has a deciding effect on the course of technological production procedure and on organoleptic traits of mature cheese.

So, relatively high mean value of individual components of raw milk in comparison to the standards is visible in Table 4. The quantity of milk fat, proteins and non-fat dry matter in raw milk in the

Table 7. Marks of sensory quality of Trappist cheese samples (n=146)
 Tablica 7. Ocjene organoleptičke kakvoće uzoraka trapista (n=146)

Date of production Datum proizvodnje	No. of cheese groups Broj šarži	Quality classes/Razredi kvalitete					
		I class/I. razred		II class/II. razred		III class/ III. razred	
		n	%	n	%	n	%
19.01.	19	17	89.47	2	10.53	-	-
08.02.	19	18	94.73	1	5.26	-	-
02.03.	16	14	87.50	2	12.50	-	-
16.03.	19	17	89.47	2	10.53	-	-
06.04.	17	16	94.11	1	5.88	-	-
20.04.	20	18	90.00	2	10.00	-	-
11.05.	20	18	90.00	2	10.00	-	-
25.05.	16	16	100.00	-	-	-	-
Total	146	134		12		-	-
%	100.00		91.78		8.22	-	-

*Quality classes: I class: 5-6 points, II class: 3-4 points, III class: 0-2 points

*Razredi kvalitete: I. razred: 5-6 bodova, II. razred: 3-4 boda, III. razred: 0-2 boda

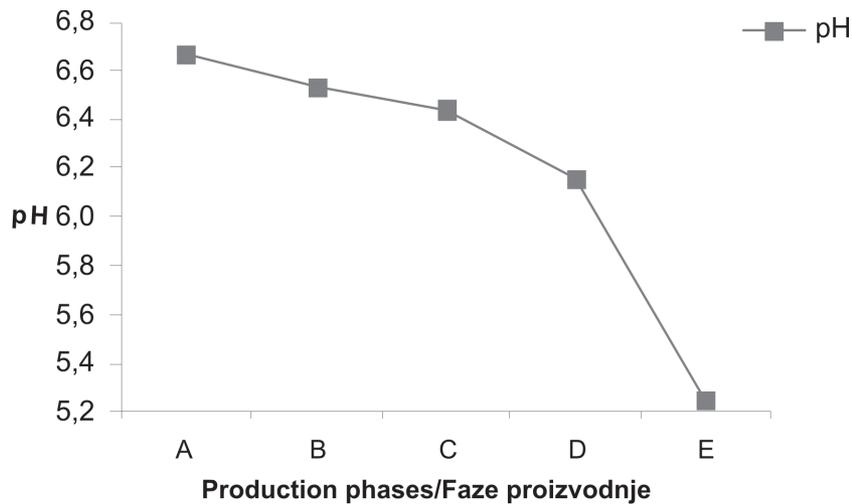
Table 8. Trappist cheese yield
 Tablica 8. Obračun prinosa sira trapista

Date Datum	Processed milk Prerađeno mlijeka (kg)	Pieces of cheese Komadi sira	Mass 1 piece of cheese Masa komada sira (kg)	Quantity of obtained cheese Količina dobivenog sira (kg)	Yield Randman (%)	Quantity of milk for 1 kg of cheese Utrošak mlijeka za kg sira (kg)
19.01	192907	6988	2.6000	18169	9.42	10.62
08.02	194305	6964	2.5999	18106	9.31	10.73
02.03	163418	5950	2.6008	15475	9.46	10.56
16.03	194080	6963	2.6000	18104	9.32	10.72
06.04	161809	5906	2.6009	15361	9.49	10.53
20.04	194942	6980	2.6010	18155	9.31	10.73
11.05	196251	6989	2.6000	18172	9.25	10.80
25.05	162559	5880	2.6000	15288	9.40	10.63
Total	1460271	52620		136830	-	-

period of research complies with the prescribed demands of quality. Mean value of lactose quantity in raw milk was in range from 4.54 % to 4.63 %, and it was significantly lower from the proscribed demands of quality (Croatian official bulletin, 2000).

Microbiological quality of raw milk is an indicator of hygienic conditions during production and also an indicator of milk handling until delivery to dairy plant and it has a great importance in milk processing, especially in cheese making (Kammerlehner,

2003), It is determined by total viable count of bacteria in 1 L of milk. The results of bacteriological research indicate the fact that samples of raw milk do not comply with the proscribed legal acts because of an increased total viable count of bacteria (Croatian official bulletin, 2000). That points to the need of further hygienic measures in primary milk production, improvement of production and education of producers. In proper and hygienically appropriate milking, milk contains between 100 and 5000 bac-



Production phases/Faze proizvodnje: A - milk before renneting/mljeko prije sirenja; B- milk after adding culture/mljeko nakon dodavanja culture; C - whey/sirutka; D - cheese before salting/sir prije soljenja; E - cheese after salting/sir nakon soljenja

Figure 1. Average acidification curve of Trappist cheese
Slika 1. Prosječna krivulja acidifikacije sira trapista

teria in 1 mL (Desmaures et al., 1997), whereas in the cases of unhygienic milking and procedures after the milking that count can reach even 10^7 /mL (Poutrel et al., 1996; Slaghuis, 1996). Cem-pirkova (2007) has also found that the total viable count of bacteria in raw cow's milk is from 3.5×10^3 - 1.9×10^5 CFU/mL ($x = 2.4 \times 10^4$ CFU/mL), depending on the manner the cows are kept and conditions of milking. The highest viable count of bacteria (N/mL) in our research was determined in samples of milk purchased in February ($N = 848040$ /mL), whereas the least count of bacteria was determined in March (564692 /mL). It is less than the total count stated by Poutrel et al. (1996) and Slaghuis (1996), but it still indicates inappropriate hygienic conditions in milk production. Nevertheless, raw milk with an increased total viable count of microorganisms is used in cheese making due to producing practice in a dairy plant. In an obligatory thermal processing of milk, the total viable count of microorganisms is decreased by the pasteurization procedure to an acceptable count, and that milk is then used in cheese making after the repeated microbiological research. Of course, such practice means some extra expenses (microbiological research) and it represents a critical point in cheese making. The count of somatic cells was also determined in the period of research and that is a parameter which indicates the state of udder health in dairy cattle, and it also has

a great importance for milk renneting, as well as for quality and quantity of gained cheese (Kammerlehner, 2003). As it can be seen from Table 4., the results of the analyses, i.e. mean value of the somatic cells count in samples of raw milk, comply with the proscribed legal demands (Croatian official bulletin, 2000).

The results of physical and chemical research of pasteurized milk (Table 5) do not indicate a too large aberration in quantity of fat and water, and the level of acidity and pH value are about equal during the period of observation. Still, a partial monthly variation is present in proteins quantity in milk for renneting. Considering the fact that the quantity of proteins is not adjusted, this fact can affect the cheese yield. Actually, even the content of fat should be standardized considering the content of proteins (Kammerlehner, 2003). A lower density of milk for renneting is also noticeable, while the acidity is very good.

The determined pH-values of whey in half of samples ($n = 146$) in the production of Trappist cheese from this research were within limits of pH 6.45-6.46, which indicates good activity of dairy culture. In 63.01 % of the samples the pH-value of Trappist cheese before the salting was ranging between 6.20 and 6.30, that is, after the salting from 5.20 to 5.30 in 87.67 % of the samples (Picture 1).

It is desirable for the pH-value of cheese before the salting to be less than 6.2 and after the salting from 5.10 to 5.40 which, at the same time, represents a technological standard for semi-hard cheeses Gouda and Edamac (Del Prato, 1998; Kammerlehner, 2003).

The results of the analysis of basic chemical composition of mature Trappist cheese from Table 6 showed that there are not any significant aberrations from chemical composition of cheeses produced during the period of research. The quantity of fat ranges within narrow limits from 27.50 to 29.25 % (47.37-48.63 in dry matter), which is in compliance with the research by Kirin (2001), according to which, the quantity of fat in samples of Trappist with the rind was from 24.51 to 29.00 %. The quantity of water ranged 39.50 to 41.40 % (55.59-58.31 % in non-fat matter), and dry matter from 58.60 to 61.00 %. The researched samples comply with the Regulation on Milk and Dairy products (Croatian official bulletin, 2007).

The results of microbiological analyses implicit that the majority of researched samples comply with Guidelines for food microbiological criteria (Ministry of Agriculture, Fisheries and Rural Development, 2009). Still, in four cheese samples *E. coli* was found in a count larger than 100/g. In comparison with the results of microbiological researches of Trappist cheese and similar semi-hard cheeses Edamac and Podravec of other authors (Miletić, 1966; Kirin, 1987), the results of the researched Trappist cheese indicate a certain progress in cheese health safety improvement but also a further need of microbiological irregularity causes elimination, firstly the finding of *E. coli* bacteria, i.e. enterobacteria.

Trappist cheese belongs to a group of semi-hard cheeses which can be consumed in slices, but it can also be used as a cheese for grating, especially more mature ones. Its sensory traits are presented in the existing professional literature (Sabadoš and Rajšić, 1980; Kirin, 2003). Based on that, Trappist cheese could be described in short as a semi-hard cheese with smooth, yellowish rind, yellow or yellowish color of cheese body with patterned cheese holes of a size of a lentil, with characteristic odor, and full, characteristic and well expressed taste. The results of organoleptic quality evaluation (Table 7) of Trappist cheese in this research show that majority of samples (91.78 %) belong to the first quality

class, whereas in the second quality class there are 8.22 % of cheese samples from experimental production.

Cheese yield represents an economically important element in cheese production. The quantity of processed milk, cheese and their average mass and quantity of cheese, that is, its yield and the quantity of used milk for 1 kg of cheese in the observed period of production are shown in Table 8. Based on the obtained results, as a base for standardization and potential protection of authenticity labels, geographical origin or a traditional reputation of Trappist cheese, the following values and characteristics could be defined: cheese has a shape of a symmetrical ring and a homogenous yellow color of protective coat. Mean mass value of one ring of cheese is from 2.50 to 2.55 kg. Cheese body is of homogenous light yellow color, brighter along the edges. Cheese holes have the size of a pea; they are shiny and patterned over the whole surface of cross section. The consistency of cheese body is elastic, soft and interconnected. Cheese has a mild, pure lactic and acidic taste and odor, and it is moderately salty. According to its chemical composition it belongs to the group of semi-hard cheeses. According to the provisions of the Regulation (Croatian official bulletin, 2007), semi-hard cheeses contain 54 to 69 % of water in non-fat cheese matter, and the minimum period of semi-hard cheeses maturation is two weeks. Considering the share of water in non-fat cheese matter and consistency and content of cheese body, Trappist cheese is produced and launched to the market as a semi-hard cheese.

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Kvaliteta sira trapista proizvedenog u hrvatskoj mljekari

Sažetak

U radu su prikazani tehnološki parametri, osnovni kemijski sastav i organoleptička svojstva te prinos 146 uzoraka sira trapista. Prema sadržaju vode u bezmasnoj tvari (56,36-58,31 %) sir trapist

pripada skupini polutvrđih sireva, a prema sadržaju masti u suhoj tvari (46,06-48,63 %) skupini masnih sireva. U četiri uzorka je utvrđena prisutnost bakterije *Escherichia coli*. Sir ima oblik pravilnog koluta, ujednačene žute boje zaštitnog premaza. Srednja vrijednost mase jednog koluta sira iznosi od 2,50-2,55 kg. Tijesto sira je ujednačene svijetložute boje, uz rubove svjetlije. Sirna okašca su veličine zrna graška, sjajna i pravilno raspoređena po cijeloj površini prereza. Konzistencija sirnog tijesta je elastična, mekana i povezana. Sir je blagog, čistog mliječno kiselkastog okusa i mirisa, te umjereno slan. Rezultati ocjene organoleptičkih svojstava i kvalitete pokazuju da se čak 91,78 % uzoraka sira iz pokusne proizvodnje može svrstati u I. razred kvalitete, dok je 8,22 % uzoraka sira pripadalo II. razredu kvalitete.

Ključne riječi: sir trapist, kemijski sastav, organoleptička svojstva, tehnološki parametri, standardizacija

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