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OPTIMIZING THE TECHNOLOGY FOR OBTAINING THE COTTAGE CHEESE TYPE

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Abstract
Cottage cheese is an unripened type of cheese, slightly acid, made from skimmed milk. In order to optimize the technology for obtaining this type of cheese, we analyze the activity of lactic cultures in time, taking into consideration the pH for different samples of raw milk. The chemical composition of the milk enriched with solid substance, and the type of culture used had a great influence in the process of obtaining the Cottage cheese. Parameters that were influenced were especially the fermentation period, the pH at curd cutting and further processing. From the obtained results, the use of starter frozen cultures was the most effective option regardless of milk composition. In the full and effective optimization of technological process for obtaining Cottage cheeses, it is recommended the use of enriched milk with solid substance and inoculated with frozen starter culture.

Keywords: cheese , milk , chemical composition , fermentation

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1. INTRODUCTION

A significant proportion of total milk produced worldwide is converted to cheese [Huppertz, 2006]. The art of cheese making has been augmented steadily by greater knowledge on the science of cheese making [Fox and McSweeney, 2004].
Cheese is the most diverse group of dairy products and is, arguably, the most academically interesting and challenging [Fox and McSweeney, 2004]. A considerable international trade exists in the principal varieties of cheese, many of which are produced in several countries but which may not be identical [McSweeney et al., 2004].
Cheeses are consumed for their highly regarded nutritional value, and enjoyed for their complex and varied eating quality [Delahunty and Drake, 2004]. The sensory properties of food are important determinants in the choice of foodstuffs by the consumer, and flavor plays a prominent role in this context [Le Quéré, 2004] .
Cottage cheese and Quarg and other cheeses where the coagulation of milk occurs by acid rather than by rennet, as in most other cheese varieties (e.g., Cheddar) [Lucey, 2004]. It is a soft, fresh, cooked curd cheese which is usually eaten within a week after being prepared [Carroll, 1996]. Fortification of milk low in casein (2.4% casein or 9% total milk solids) with very low heat–treated nonfat dry milk can improve cheese yield and quality [Johnson, 2001].
Cheese cannot be made without the use of certain species of lactic acid bacteria (LAB), the major functions of which are to produce lactic acid from lactose during manufacture and cause biochemical changes during ripening, which help to develop the characteristic flavor of the cheese being made [Parente and Cogan, 2004].
Members of the lactic acid bacteria (LAB) such as Lacto - coccus lactis, Streptococcus thermophilus, and Lactobacillus, Leuconostoc and Pediococcus spp. are commonly used on an industrial scale in the dairy industry for the production of fermented milk products such as cheese, buttermilk and yoghurt [McGrath, 2004].
Two types of cultures are used in cheese making: primary and secondary [Chamba and Irlinger, 2004]. Starter cultures used by the dairy industry can be broadly divided into two types, mesophilic and thermophilic, based on their optimum growth temperature [Callanan, and Ross, 2004]. Selection of the beneficial

natural flora in milk, such as lactobacilli, streptococci and lactococci, or direct addition of these as starter cultures, preserves products and in many instances allows competition with bacterial pathogens [Donnelly, 2004]. Starter bacteria are primarily responsible for acid production during manufacture and, thus, need to be capable of producing sufficient acid to reduce the pH of milk rapidly; a useful rule of thumb is a pH<5.3 in milk in 6 h at 30-37 ~ depending on the cheese variety [Beresford, and Williams, 2004] .

Cheese contains a high concentration of essential nutrients relative to its energy level. Its precise nutrient content is influenced by the type of milk used (species, stage of lactation, full-fat, low-fat, skim), the manner of manufacture and, to a lesser extent, the degree of ripening [Fox, 2004; O'Brien and O'Connor, 2004].

Because the chemical composition of milk is influenced by various factors it is important to optimize the technological process for obtaining Cottage cheese by:

- the use of raw milk with an optimal chemical composition to achieve a finished product in accordance with quality standards;
- improve the manufacturing term by using culture of microorganisms such as: frozen, dried and of production. After several tests on cultures of microorganisms, it will be determined the optimal version;
- obtaining a firmer curd processing for further processing.

2. MATERIALS AND METHODS

It was followed the technological process of obtaining the Cottage cheese type by using three samples of milk raw material:

- sample A: skim milk;
- sample B: skim milk with 10% added milk powder
- sample C: skimmed milk with 5% added sodium caseinate.

Milk analysis: Main technological parameters of raw milk were taken with the Milkoscan Device that determined dry matter content, density, content of protein, lactose, fat content and acidity.

It was analysed the way starter cultures influence the fermentation period for each of the samples; the following starter cultures were used:

- starter culture of lyophilized production;
- starter culture of frozen production;
- starter culture obtained by the classic process.

Sowing the crop was done at 30 ± 2 ° C for each sample.

Analysis of the finished product: Main technological parameters analyzed were: sensory analysis, the SR 6345:1995 method, determination of acidity, method ISO 2963:1993, determination of salt content, ISO 5943:2007, determination of fat, ISO 3433:2009; determination of dry substance ISO 5534:2004.

3. RESULTS AND CONCLUSIONS

In the following tables are presented the obtained results.

Table 1. Chemical composition of milk

Determination	Sample		
	A	B	C
Dey substance	8,51	9,93	10,73
Density (g/cm^3)	1,0286	1,030	1,029
Protein (%)	3,24	3,74	5,29
Lactose (%)	4,49	5,29	4,44
Fat (%)	0,05	0,05	0,10

A: skim milk; **B**: skim milk with 10% added milk powder;
C: skimmed milk with 5% added sodium caseinate

Results correspond to the values of existing quality standards for milk.

The influence of crop activity in time depending on pH is shown in the table below for each sample of milk:

Table 2. Sample A- skim milk

Time (hour)	pH Analysis for Fresco frozen starter cultures for sample A	pH Analysis of XPL – 20 Freeze-dried starter culture for sample A	PH Analysis for classic production starter cultures for sample A
	pH	pH	pH
10.00	6,32	6,53	6,57
14.00	5,23	5,77	6,29
18.00	4,55	4,84	5,24
22.00	4,42	4,65	4,93
02.00	4,31	4,51	4,64
06.00	4,24	4,39	4,56

Note that for pH Fresco frozen starter cultures for sample A decreases faster than the other two samples analyzed.

Table 3. Sample B - skim milk with added milk powder

Time (hour)	pH Analysis for frozen starter cultures for sample B	pH Analysis for dried starter cultures for sample B	pH Analysis for classic production starter culture for sample B
	pH	pH	pH
10.00	6,31	6,41	6,6
14.00	4,7	5,44	6,39
18.00	4,44	4,68	5,89
22.00	4,34	4,47	5,21
02.00	4,24	4,33	4,57
06.00	4,24	4,28	4,5

From the results obtained, all frozen starter cultures Fresco pH for sample B decreases faster than the other two samples analyzed.

Table 4. Sample C : skimmed milk with added sodium caseinate

Time (hour)	pH Analysis for frozen starter cultures for sample C	pH Analysis for dried starter cultures for sample C	pH Analysis for classic production starter culture for sample C
	pH	pH	pH
10.00	6,14	6,6	6,64
14.00	4,7	5,09	6,39
18.00	4,34	4,52	5,97
22.00	4,26	4,39	5,33
02.00	4,23	4,27	4,76
06.00	4,23	4,25	4,59

By adding sodium caseinate, pH Fresco frozen starter cultures for sample C decreases faster than the other two samples analyzed.
Appearance and consistency of the curd after cutting:

Fig 1. Starter cultures from classic production

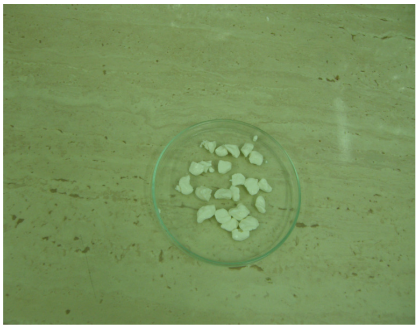

Fig 2. Dried starter cultures

Fig 3. Frozen starter cultures

Table 5 Cottage cheese

Determination	Cottage Cheese		
	SAMPLE A	SAMPLE B	SAMPLE C
Organoleptic features	According to technical specification of the product	According to technical specification of the product	According to technical specification of the product
Dry substance	18,24	20,34	20,08
Acidity (°T)	72	74	70
Protein (%)	15,39	16,87	16,77
Fat (%)	4,5	4,5	4,5
Lactose (%)	2,00	2,68	2,24
Salt	1,05	0,92	0,98

After sowing starter culture milk samples frozen berries were made larger, firmer, glossier compared to grains formed after seeding with other types of culture.

4. CONCLUSIONS

Chemical composition of milk by enriching it with dry substances, and the type of culture used had a great influence in the process of obtaining the Cottage cheese. Parameters are influenced in particular by the fermentation period, by the pH of curd when cutting it and by further processing.

The results obtained using frozen starter cultures are the most efficient option regardless milk composition because fermentation occurs in less time than other types of cultures (freeze-dried starter culture and classic production) for all samples of milk taken for analysis.

SAMPLE A: - Starter cultures from classic production: 15,2h

- dried starter cultures: 11,4h
- frozen starter cultures: 9h

SAMPLE B: - Starter cultures from classic production: 15,8h

- dried starter cultures: 9,4h
- frozen starter cultures: 7,3h

SAMPLE C: - Starter cultures from classic production: 15,3h

- dried starter cultures: 8h
- frozen starter cultures: 6,2h

After sowing milk samples with starter frozen culture, the formed berries were larger, firmer, more glossy, compared with grains formed after sowing with other types of culture.

In conclusion, for a complete and efficient optimization of the technological process of obtaining Cottage cheeses, we recommend a dry substance enriched milk and inoculated with starter frozen culture.

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