RESEARCHES CONCERNING THE SOUR CREAM OBTAING USING KINETIC MODIFIERS OF ANIONIC CLAY TYPE

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Abstract:
This paper goal is the study of the basic clays influence to some properties of the sour cream obtained by sweet sour. There was determined the titrable acidity and the plasma's acidity of the sour cream obtained by sweet sour fermentation with selected bacteria cultures and within presence of hydrotalcite clays. Anionic clays develop a basicity that had positive effect on the sour cream thanks to the fact that it can delay the lactic acid influence and accelerate the fermentation. In this paper was performed a kinetic study regarding the influence of the clay amount on sour cream acidity.

Keywords: sour cream, anionic clays, acidity, kinetic modifier

1. INTRODUCTION

Sour cream is a dairy product with a high percentage of fat, generally manufactured from cow milk [1]. There are two general categories of cream: sweet cream for alimentation and for cooking necessities (whip cream preparation, creams, etc.) and sour cream. According to standards the alimentation the cream needs to fulfil the following sensorial characteristics presented in Table 1.

Tabel 1. The main sensorial characteristics of the cow milk cream [2]

Characteristic	Cream type	
	Sweet cream	Sour cream
Aspect and consistency	Omogen, fluid, without fat aglomeration or proteic substances	Omogen,thick, without fat aglomeration and proteic substances
Taste and smell	Sweet, clean, with a pasteurization taste, without taste and without foreign smell	Nice, aromatized, poor sour, of lactic fermentation, no taste and no foreign smell.
Colour	From white to uniform white-yellow	

Fermentation is the key process in fermented sour cream manufacturing technology [2]. After the introduction of the fermentation culture in the sour cream a mixing process takes place for uniformizing of the culture distribution in the whole amount of the sweet cream. During fermentation is important that the sour cream not been exposed to another mixing process. An important role in sensorial properties formation of the sour cream has the fermentation temperature which depends of the bacteria species used in the culture. If we want to obtain sour cream with 20, 25, 30 % fat we need bacteria cultures of mezophilic bacteria's (*Streptococus.lactis, Streptococus cremoris, Streptococus diacetilactis* etc.) and the optimal fermentation temperature is 20-24ºC in

the summer time and 22-26ºC in the winter. In case of using of mixtures of mezophilic and thermopile bacteria cultures, the fermentation temperature is established at 28-30ºC. This thermal regime allows a normal development of both microorganism species [1,3]. The raw material fermentation at low temperatures (18-19ºC) leads to a reduction of the microorganisms activity, the final product obtains present a low coagulation degree and is unstable to mechanic actions. The increasing of the fermentation temperature over the optimal values contributes to the rise of the acidity, elimination of the buttermilk and appearance of sensorial defects. The fermentation process duration at industrial level varied between 7 up to 16 hours depending on the cream type that is desired to obtain, of temperature, the quality of the culture and of the raw material.

Clays are minerals that present a special structure, in independent layers one of the others. The thickness of a layer is approximately $7\overset{0}{A}$. The layers slide one from each other and the distance between them can be fixed by intercalating water molecules or identical volume cations. This property determines the swelling of the clays that leads to specific functions. Anionic clays are natural or synthetic lamellar mixed hydroxides with interlayer spaces containing exchangeable anions [4]. The most important properties of clays are: swelling properties, colloidal properties, adsorption and ion exchange capacity [4].

In the literature there are studies regarding the influence of some anionic type clays on yogurt manufacturing process [5-7] and on cottage cheese process. In the literature there are not found studies regarding the influence of the anionic clays to fermentation kinetic of the sour cream manufacturing process.

2. EXPERIMENTAL PART

The purpose of this research is to study the basic clays effect on sour cream fermentation process, seeded previously with selected lactic cultures. During this research, there were varied two factors: the clay amount added and the fermentation duration. It was followed the total acidity and the plasma acidity of the final product. The fermentation temperature was maintained constant at 30ºC.

The sour cream acidity can be express either as the sour cream's global acidity depending of the plasma's acidity, either as the plasma's acidity depending of the total acidity of the sour cream:

$$\text{Plasma's acidity: } (A_p) = \frac{100A_s}{100G_s} \quad (1)$$

$$\text{Global acidity: } (A_s) = V \; x \; F \; x \; 10 \quad (2)$$

where: A_p represent the plasma's acidity (Thurner degree), G_s - the percentage of fats from the sour cream, A_s - the sour cream's global acidity (Thurner degree), V - NaOH 0,1N solution volume used for titration [cm^3] and F - the correction factor for the NaOH solution.

As raw material it was used sweet cream with 32% fats, produced by S.C. Dorna S.A. It was preliminary determined the acidity of the sour cream-raw material: A_s =20ºT and $A_p = 0{,}625^0$T. The anionic clay utilized was a pharmaceutical purity form of hydrotalcite. The samples seeded with the same amount of activated selected lactic cultures [8] and with different amounts of anionic clays were maintained in oven at 30ºC. From time to time there were taking-of samples and determined the acidity according to a method described below. The sour cream's acidity was determined by Thorner's method which consist in the titration of a mix formed by 10 cm^3 of sour cream, 20-25 ml distilled H_2O brought at temperature of 40-45^0 C (the water heats because of the sour cream adherence on the pipette surface) with a solution of NaOH 0,1 N in the presence of phenolphthalein 1% alcoholic solution [8]. The factor of the 0,1 N NaOH solution (F) was determined a priori: F = 0,98.

3. RESULTS AND DISCUSSION

The results obtained after the experimental protocol described above are presented in Table 2 and Table 3.

Table 2 . Titrable acidity of the sour cream samples

Clay addition [g/10 mL cream]	Titrable acidity [^{o}T] after different periods of fermentation							
	0 h	3.5 h	7 h	9 h	11 h	13 h	15 h	16 h
0	24	29	34	37	42	48	52	61
0.33	23	27	32	35	39	42	50	58
0.66	21	25	29	32	35	40	47	55
0.99	18	23	27	30	33	38	44	51
1.33	16	20	25	28	32	36	.42	49
1.66	15	19	23	26	28	34	41	47
1.99	15	18	22	25	26	32	38	43
2.5	14	17	22	24	25	31	36	40

Table 3. Plasma's acidity of the sour cream samples

Clay addition [g/10 mL cream]	Sour cream's plasma acidity = f (fermentation time) [^{o}T]							
	0 h	3.5 h	7 h	9 h	11 h	13 h	15 h	16 h
0	0,75	0,90	1,06	1,15	1,31	1,5	1,62	1,9
0.33	0,71	0,84	1	1,09	1,21	1,31	1,56	1,81
0.66	0,656	0,78	0,9	1	1,09	1,25	1,46	1,71
0.99	0,56	0,71	0,84	0,93	1.,03	1,18	1,37	1,59
1.33	0,5	0,62	0,78	0,87	1	1,12	1,31	1,53
1.66	0,46	0,59	0,71	0,81	0,87	1,06	1,28	1,46
1.99	0,46	0,56	0,68	0,78	0,81	1	1,18	1,34
2.5	0,43	0,53	0,68	0,75	0,78	0,96	1,12	1,25

During all the experiments it can be observed that the amount of the added clay influence the acidity for the same fermentation period. Subsequent, the sour cream acidity decrease as the clay amount increase and as the fermentation duration increase. The same conclusion is redone from Figure 1 that represents the fermentation time influence of the titrable acidity of sour cream in case of addition of different amounts of anionic clay. In Fig. 1 it can be observed that the clay add in the fabrication process of the fermented sour cream modifies the kinetics of the fermentation process. This represents an advantage because the obtained product in „clay add" version presents a lower acidity, so it is created a favourable medium for developing of the lactic bacteria's, in this manner the fermentation process being favoured. In case of the blank sample (fermentation without clay adding) it sees that the acidity grows to values that exceed 60 ^{0}T (the titrable acidity), which means that the environment's pH decreases a lot, this leading to the destruction of the lactic bacteria's; the obtained product is inferior qualitative and has a lower conservation duration.

4. CONCLUSIONS

The fermentation processes are representatives in food industry. These are quite difficult to control because of the complexity of the chemical and biochemical processes that are the basis for obtaining of food products in which fermentation represent the key-stage.

The sour cream is a base product in the human's life; the process that stays at the base of obtaining this product is represented by the fermentation, as an effect of the conversion of lactose in lactic acid.

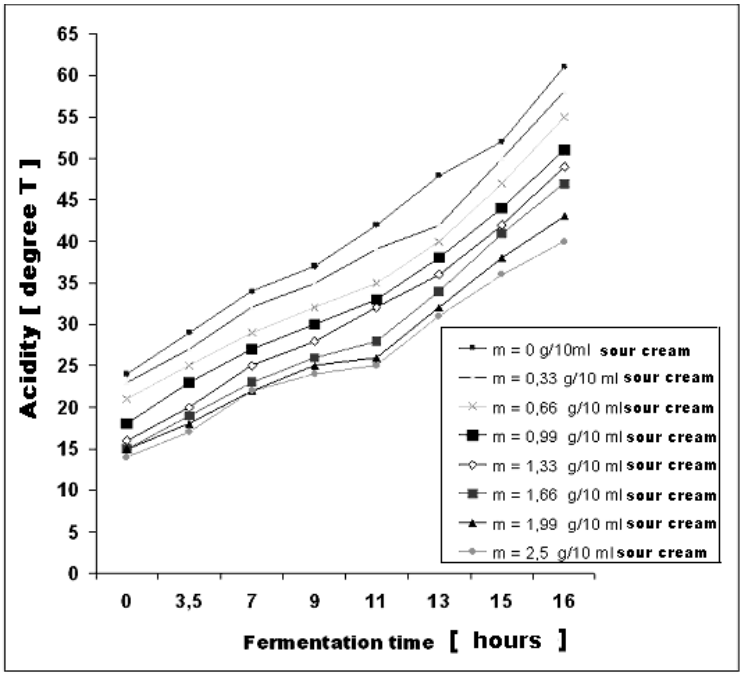

Fig.. 1Fermentation time influence of titrable acidity of sour cream in case of addition of different amounts of clay

The lactic acid formation during the fermentation processes of sweet cream inhibits lactic bacteria's growth and development because of the lactate anion. By adding basic clay in the fermentation process of the sour cream it grows the number of the lactic bacteria's because the excess of lactic acid is "adsorbed" by the anionic clay. Hence, using basic clay of hydrotalcite type, that is an anion exchanger clay, the lactate anion is fixed and the lactic bacteria's can multiplies. This leads to the obtaining of a superior product from quality point of view that presents a higher keeping quality than the products obtained by classic technology.

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