REVIEW ARTICLE

Cream cheese products: A review

Chanokphat Phadungath

Abstract

Phadungath, C.
Cream cheese products: A review
Songklanakarin J. Sci. Technol., 2005, 27(1) : 191-199

Cream cheese is a soft fresh acid-coagulated cheese product, which is acidified by mesophilic lactic acid starter culture, i.e. *Lactococcus* and *Leuconostoc*. Cream cheese products are categorized into two main types based on the different fat content in the initial mix and the final composition. These are double-cream cheese with at least 9-11% fat content in the initial mix, and single-cream cheese with 4.5-5% fat content in initial mix. Cream cheese was first made by using the cooked-curd method, which was developed in the early twenties, and the cold-pack and hot-pack methods were developed, and are still used at present. The products with high quality should have a uniform white to light cream color with a lightly lactic acid and cultured diacetyl flavor and aroma. The texture of the products should be smooth without lumps, grittiness, or any indication of cracking and wheying off, and with the ability to spread at room temperature.

Key words : cream cheese, soft cheese, cultured dairy product

M.Sc.(Food Science), Food Science and Technology Program, The Faculty of Science and Technology, Surindra Rajabhat University, Muang, Surin, 32000 Thailand
Corresponding e-mail: chanokphat@uwalumni.com, chanokphat_p@yahoo.com
Received, 18 March 2004 Accepted, 14 June 2004

บทคัดย่อ

ชนกภัทร ผดุงอรรถ

ผลิตภัณฑ์เนยแข็งชนิดครีม (Cream cheese)

ว. สงขลานครินทร์ วทท. 2548 27(1) : 191-199

เนยแข็งชนิดครีม (Cream cheese) คือเนยแข็งสดแบบอ่อนที่ตกตะกอนเคซีนจากการเปลี่ยนน้ำตาลแลคโตสในนมเป็นกรดแลคติก โดยแบคทีเรียประเภท mesophilic lactic acid ซึ่งได้แก่ แบคทีเรียจำพวก *Lactococcus* และ *Leuconostoc* โดยทั่วไปผลิตภัณฑ์นี้สามารถแบ่งออกได้เป็น 2 กลุ่มหลัก ได้แก่ double-cream cheese ซึ่งมีปริมาณไขมันเริ่มต้นในส่วนผสมประมาณ 9-11% และ single-cream cheese ซึ่งมีปริมาณไขมันเริ่มต้นในส่วนผสมประมาณ 4.5-5% กระบวนการผลิตของเนยแข็งชนิดนี้ในยุคเริ่มต้นใช้วิธี cooked-curd จากนั้นจึงมีการพัฒนาเป็นวิธี cold-pack และ hot-pack ซึ่งยังคงใช้อยู่ในปัจจุบัน สำหรับผลิตภัณฑ์สุดท้ายที่มีคุณภาพสูงควรมีสีขาว หรือสีครีมสม่ำเสมอ พร้อมด้วยกลิ่นเฉพาะจากกรดแลคติกและไดอะซิติล (diacetyl) นอกจากนี้เนื้อสัมผัสของผลิตภัณฑ์ควรเนียนเป็นเนื้อเดียวกัน โดยไม่ปรากฏลักษณะเม็ดกรวดหยาบเล็ก ๆ การรวมตัวกันเป็นกลุ่มก้อน การแตกของผิวหน้า และการแยกตัวของเวย์ที่ผิวหน้าของผลิตภัณฑ์ และที่สำคัญ เนยแข็งชนิดนี้ควรสามารถปาด หรือทาเป็นแผ่นได้ที่อุณหภูมิห้อง

โปรแกรมวิชาวิทยาศาสตร์และเทคโนโลยีการอาหาร คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏสุรินทร์ อำเภอเมือง จังหวัดสุรินทร์ 32000

Cream cheese is a soft, mild, rich, unripened cheese and is a creamy white, slightly acidic tasting product with a diacetyl flavor. It is usually manufactured by the coagulation of cream or mixture of milk and cream by acidification with starter culture and is ready for consumption after the manufacturing process is complete (Guinee *et al*., 1993). Cream cheese is one of the most popular soft cheese products in North America. It is used as a spread on bagels, as a salad dressing, and as an ingredient for making several kinds of desserts, such as cheesecake. Although there has been quite extensive study about cream cheese, very little work has been published and most of the information is kept exclusively within certain food companies. The objective of this article is to give an overall review of cream cheese products, including cream cheese varieties, cream cheese manufacture, qualities and defects of cream cheese, sensory evaluation of cream cheese, and recent studies on cream cheese products.

Cream cheese varieties

Cream cheese products are often categorized into two main types based on the different fat content in the initial mix and the final composition. These are double-cream cheese with at least 9-11% fat content in the initial mix, and single-cream cheese with 4.5-5% fat content in the initial mix (Guinee *et al*., 1993). There are also other similar kinds of cream cheeses based on different fat and dry matter contents. In the United States, the Food and Drug Administration (FDA) regulations state that cream cheese has to have at least 33% fat and not more than 55% moisture content. The Canadian standard for cream cheese requires at least 30% fat content in the product, and in France, the cream-type cheese such as 'Triple creme' has to have at least 75% fat in dry matter content (Sanchez *et al*., 1996). Neufchatel is also similar to cream cheese but has a different fat content in the initial mix as well as the final product composition, as shown in Tables 1 and 2 (Kosikowski and Mistry, 1999). Table 1 shows the ratio of fat to solids not fat (SNF) in the initial mix for cream and Neufchatel cheeses, and Table 2 shows the chemical composition (% w/w) of cream and Neufchatel cheeses.

Cream cheese manufacture

The first standard for cream cheese was that

Table 1. Ratio of Fat to SNF in mix for cream and Neufchatel cheese.**

Variety	Fat in mix (%)	SNF in mix (%)	Fat in cheese (%)	Moisture in cheese (%)
Cream cheese	15	7.5	35.7	54.0
	13	7.7	35.5	54.3
	11*	7.8	33.0	54.5
	9	8.0	33.0	53.0
Neufchatel cheese	9	8.0	23.7	64.2
	7	8.2	21.6	64.8
	5*	8.4	20.0	63.8
	3	8.5	20.0	56.3

*** = Most economical ratio**
**** Adapted from Kosikowski and Mistry, 1999**

Table 2. Chemical composition (% w/w) of Cream and Neufchatel cheeses*.

Variety	Moisture	Fat	Protein	Lactose	Salt	pH
Cream						
Double	60	30	8-10	2-3	0.75	4.6
Single	70	14	12	3.5	0.75	4.6
Neufchatel	74	20	12	-	0.75	4.6

***Does not meet US standard, adapted from Puhan *et al.*, 1994**

issued in 1921 by the Federal Food and Drug Act. It stated that, "Cream cheese is the unripened cheese made by the Neufchatel process from whole milk enriched with cream. It contains in the water-free substance not less than sixty-five per cent (65%) of milk fat." This product would be considered nowadays as a high-fat Neufchatel cheese (Lundstedt, 1954). The cooked-curd method was developed in the early twenties, and later on, the cold-pack and hot-pack methods were developed, and are still used for cream cheese making today (Roundy, 1939; Lundstedt, 1954). Traditionally, the draining step for removing whey was done by putting the curd in the cloth bags and letting it drain by gravity for 24 hours to meet the desired moisture standards for the product. One of the most important accomplishments for cream cheese making was the invention of the centrifugal separator for the continuous curd draining (or whey removal) from the hot cheese curd to facilitate attaining the standard composition for immediate and continuous packaging while hot. This device lets the cheese be packaged in a much more sterile and aseptic-like condition, and provides the product with a longer shelf life (Link, 1945).

In the separator method for cream cheese making with the production diagram as shown in Figure 1, the starting mixture for making cream cheese is standardized to 8-14% fat for double cream cheese, and to 3-5% fat for single cream cheese. Then the mix is homogenized (12-14 MPa at 50-55ºC), pasteurized (66-68ºC for 30 min or 72-75ºC for 30-90 s) and cooled to the desired setting temperature (20-30ºC). The mix is inoculated with D-type starter culture (i.e. *Lactococcus* starter). The level of starter culture and the set temperature depend on the incubation period; two of the common incubation conditions are the

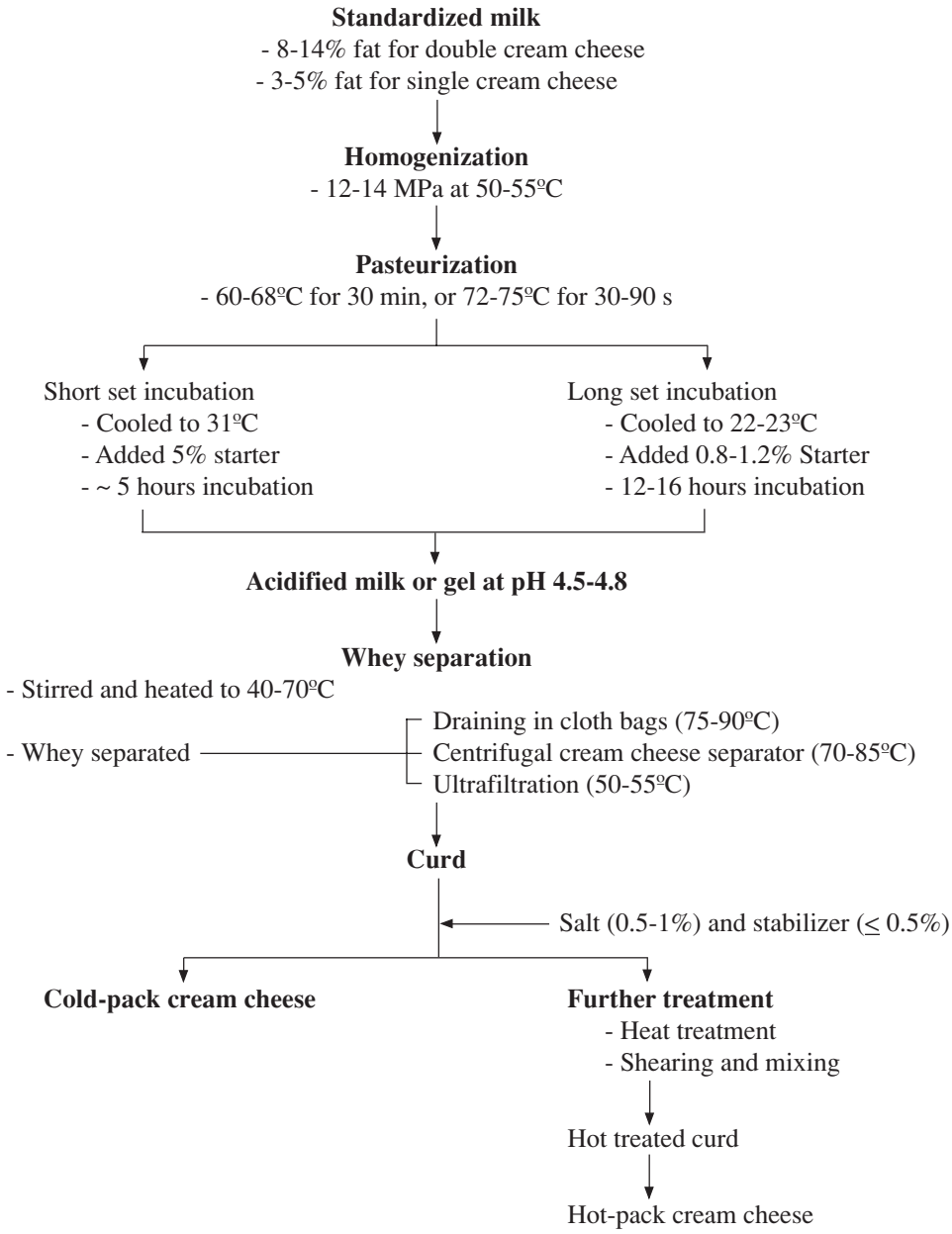

Figure 1. Processing steps for cream cheese making.
Adapted from: Singh and Tewari, 1990; Singh and Tewari, 1991; Guinee, Pudja, and Farkye, 1993; Kosikowski, and Mistry, 1999; and Lucey, 2003

short-set incubation with 5% starter culture, an incubation temperature of 31ºC and an incubation period of approximately 5 hours, and the long-set incubation with 0.8-1.2% starter culture, a temperature of 22-23ºC, and an incubation period of 12-16 hours. The mix is held at the specific temperature until reaching the desired pH of 4.5-4.8, as shown in Figure 2A (Singh and Tewari, 1990; Singh and Tewari, 1991; Guinee *et al*., 1993; Kosikowski, and Mistry, 1999; and Lucey, 2003).

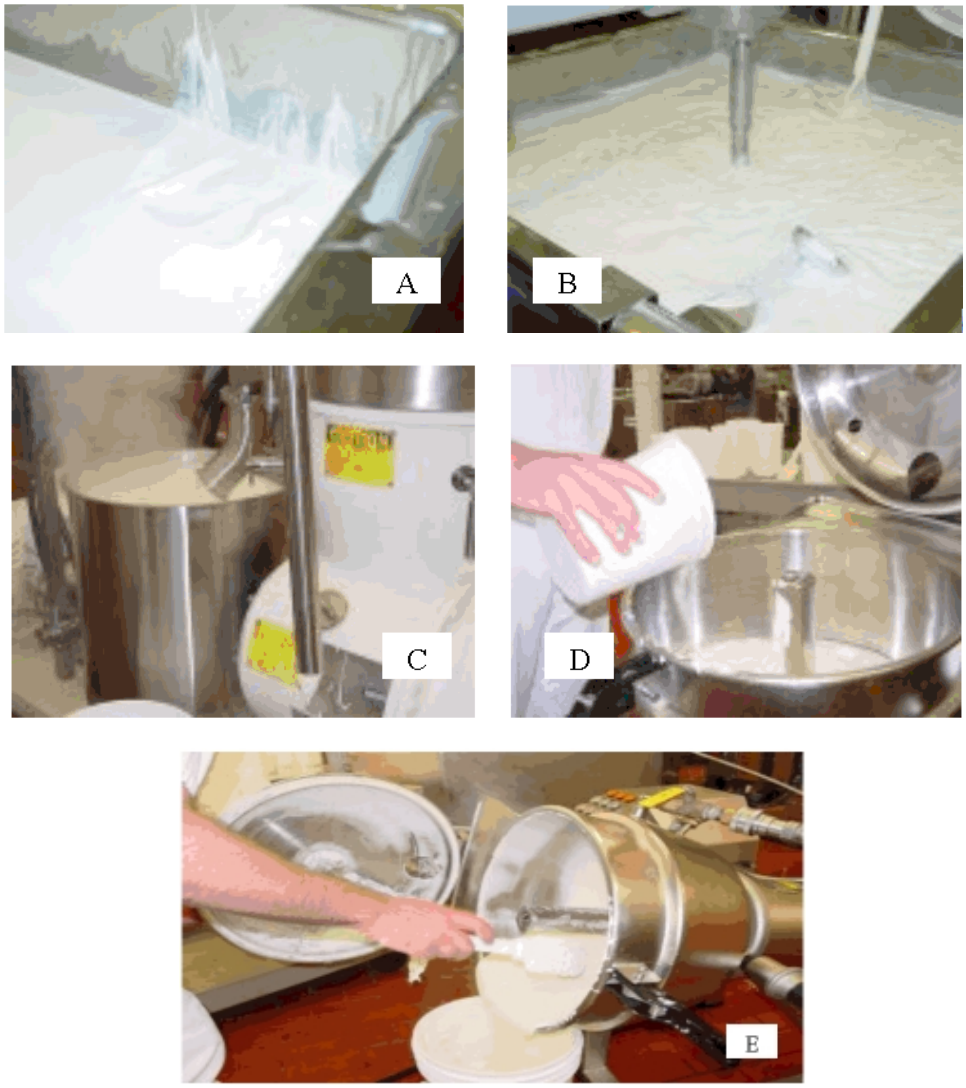

Figure 2. Cream cheese processing steps
A) Acidified milk gel at pH 4.7-4.8; B) Stirring and heating to get ready for whey separation step; C) Whey separation by centrifugal cream cheese separator; D) Mixing with salt and stabilizer and shearing; E) Hot-pack cream cheese

The acidification step is achieved by the fermentation of lactose by *Lactococcus* starter (Fox and McSweeney, 1998). The resulting coagulum is gently stirred and heated (for more effective whey separation) to 50-70ºC in a ripening tank for the batch method (Figure 2B) or in a heat exchanger for the continuous method. Whey is then separated from the curd by several methods; the traditional method involves letting the hot curd (75-90ºC) drain in cloth bags overnight, while the modern methods use a cream cheese centrifugal separator operating at 70-85ºC (Figure 2C) or ultrafiltration at 50-55ºC. After whey separation, the hot curd is cooled down to 10-20ºC, then mixed with salt (0.5-1%) and not more than 0.5% stabilizer (usually a combination of some of the following; locust bean gum, guar gum, xanthan gum, sodium alginate, and carrageenan), and packaged directly as a cold-

pack cream cheese with the shelf life of about 2-3 weeks. For hot-pack cream cheese product, the curd is mixed with salt and stabilizer and heated to 70-85ºC in a mixing tank (e.g., process cheese-type cooker or in a scraped surface-heated vats, as shown in Figure 2D and 2E) to get a good mixture and modify the texture of the product. The hot curd is pumped to the packaging device and packed while hot. The shelf life of the hot pack product is around 3 months at 4-8ºC (Singh and Tewari, 1990; Singh and Tewari, 1991; Guinee *et al*., 1993; Kosikowski, and Mistry, 1999; and Lucey, 2003).

Qualities and defects

According to USDA (1994), cream cheese and related products should have a uniform white to light cream color with a slightly lactic acid and cultured diacetyl flavor and aroma; off-flavors such as bitter, sulfide, yeasty, and unnatural flavor should not be present. The texture of the products should be smooth without lumps or grittiness, and the products should not show any indication of cracking, or wheying off. The cheese products should be spreadable at room temperature (68ºF or 20ºC) or when cold (45ºF or 7.2ºC) if labeled as 'soft', and the product should be of medium firmness when refrigerated (≤ 45ºF or 7.2ºC). The compositional standards are shown in Table 3.

Defects in cream cheese can occur depending on the final pH of the cheese. The texture of the cheese will be soft, and the cheese will lack flavor, if the pH of the cheese is too high (> 4.7). If the pH of the cheese is too low (< 4.6), the texture may be too grainy, and the flavor will be too acidic. In addition, cream cheese defects include whey separation from the product during storage and a grainy, sandy, or chalky texture, especially in the lower-fat types (Lucey, 2003).

Sensory evaluation of cream cheese

Several studies have been done on the sensory evaluation of cream cheese, and the important cream cheese attributes and definitions based on the 15-point-unstructured scale can be summarized as shown in Table 4.

In addition to those attributes, spreadability is one of the most important textural properties for cream cheese (Breidinger and Steffe, 2001), and to determine spreadability a certain force is required to initiate the flow (Konkoly *et al*., 1999). It has been demonstrated that consumers found the force to initiate the flow, which is generated on the knife during spreading the food on crackers, to be an indication of spreadability for a variety of foods including cream cheese (Kokini and Dickie, 1982). Therefore, another important cream cheese attribute is spreadability, which is a texture attribute performed by hand, and the definition based on the score from the 15-point-unstructured scale are; low = hard to spread (2 mm layer) on a cracker (high resistance), and high = easy to spread (2 mm layer) on a cracker (low resistance) (Wendin *et al*., 2000).

Recent studies on cream cheese products

There has been quite extensive study on cream cheese for more than eight decades, but most of the research has focused on the final product,

Table 3. Analytical requirements for cream cheese and related products*.

Product	Percent moisture (Maximum)	Percent Milkfat (By weight of finished food)	pH	Percent salt (Maximum)
Cream cheese	55	33 % (minimum)	4.4 - 4.9	1.4
Reduced fat cream cheese	70	≥ 16.5 % but < 20%	4.4 - 5.1	1.4
Light/Lite cream cheese	70	≥ 0.5 % but < 16.5%	4.4 - 5.2	1.4
Neufchatel cheese	65	≥ 20 % but < 33%	4.4 - 5.0	1.4

***Adapted from USDA, 1994**

Table 4. Cream cheese attributes and definitions.**

Appearance	
Attributes	**Definition***
Yellow color	Low = white, High = yellow
Granularity	Low = a smooth cheese, High = a grainy cheese
Watery	Wet and shiny look
Compact	Low = porous, High = compact
Texture and Mouth feel	
Attributes	**Definition***
Firmness	From slightly firm to very firm
Smoothness	From slightly smooth to very smooth
Rate of dissipation	From fast to slow
Granularity	Low = a smooth cheese, High = a grainy cheese
Adhesiveness	From easy to difficult
Flavor and Taste	
Attributes	**Definition***
Acidity (sourness)	- Fresh sourness, reminding of yogurt - From slight to extreme
Saltiness	- Taste of salt - From slight to extreme
Creaminess (butter-like flavor)	- Flavor of butter - From slight to extreme

*** The definitions are based on score given for the attributes on the 15-point-unstructured scale.**
**** Adapted from: Kalab *et al.*, 1981; Modler *et al.*, 1985, and Wendin *et al.*, 2000**

which includes the study of microstructure of experimental and commercial cream cheese products (Kalab *et al*., 1981; Kalab and Modler, 1984; Wendin *et al*., 2000), the study of newly-developed cream cheese, such as cream cheese by ultrafiltration (Covacevich and Kosikowski, 1977), development of microstructure in a cream cheese based on quesco blanco cheese (Kalab and Modler, 1985), and the study of textural and rheological properties of experimental and commercial cream cheese products (Hori, 1982; Buchheim and Thomasaw, 1984; Sanchez *et al*., 1994a; Sanchez *et al*., 1994b; Sanchez *et al*., 1996; Sanchez and Hardy, 1997; Konkoly *et al*., 1999; Breidinger and Steffe, 2001). In fact, an extensive amount of research work for cream cheese has been done in research centers of food companies, but unfortunately, very little work has been published, or most of those research works are registered as United States Patents (Sharpless, 1939; Link, 1945; Hynes *et al*., 1975; Baker, 1981; Koide *et al*., 1983; Crane, 1992; Yamaguchi *et al*., 1999; Kijowski *et al*., 2000; Han, 2002). However, there is quite limited research on the acidified milk gel stage of cream cheese products, which, in fact, is a critical stage in order to get desired final cream cheese with high textural, rheological and sensory properties. Phadungath (2003) studied the structure development in cream cheese and the impact of processing factors on cheese texture, and sensory properties.

She found that five main processing conditions, namely fat content in standardized milk, homogenization pressure, inoculum level, incubation temperature, and pH at breaking the milk gel, had significant effects on the firmness of the acidified milk gel prior to being the cream cheese product. The data obtained from texture and rheological measurements implied that higher fat content (12% versus 0%), higher inoculum level (2% versus 1%), higher incubation temperature (26ºC versus 20ºC), and higher homogenization pressure (250 bar versus 100 bar) gave acid gels with firmer texture, while lower pH at breaking the gels (pH 4.7 versus pH 5.1) gave acid gels with firmer texture. In addition, the data obtained from texture measurements, TPA measurements, and sensory evaluation implied that homogenization pressure and incubation temperature affected the firmness of cream cheese samples.

Summary

Cream cheese is a soft fresh acid-coagulated cheese product. It is one of the most popular soft-cheese products in North America, and also often used as food ingredient in many applications. Although there has been quite extensive study about cream cheese, very little work has been published and most of the information is kept exclusively within certain food companies. In addition, the research on the acidified milk gel stage of cream cheese products, which, in fact, is a critical stage in order to get desired final cream cheese with high textural, rheological and sensory properties, is still limited. Therefore, more research work on this stage is required in order to acquire better understanding and apply this knowledge to the study of overall properties of cream cheese products.

References

Baker, D.B. 1981. Preparation of low fat imitation cream cheese. United States Patent, US (4,244,983).

Breidinger, S.L. and Steffe, J.F. 2001. Texture map of cream cheese. J. Food Sci., 66(3): 453-456.

Buchheim, W. and Thomasaw, J. 1984. Structural changes in cream cheese induced by thermal processing and emulsifying salts. N. European Dairy J., 50: 38-44.

Covacevich, H.R. and Kosikowski, F.V. 1977. Cream cheese by ultrafiltration. J. Food Sci., 42(5): 1362-1372.

Crane, L.A. 1992. Method of manufacture of a non-fat cream cheese product. United States Patent, US (5,079,024).

Fox, P.F. and McSweeney, P.L.H. 1998. Chemistry and biochemistry of cheese and fermented milk, in Dairy Chemistry and Biochemistry. Blackie Academic & Professional, London, pp. 419-421.

Guinee, T.P., Pudja, P.D., and Farkye, N.Y. 1993. Fresh acid-curd cheese varieties, in P.F. Fox (Ed), Cheese: Chemistry, Physics and Microbiology. Chapman & Hall, London, pp. 363-419.

Han, X.Q. 2002. Process for making cream cheese products without whey separation. United States Patent, US (6,406,736).

Hori, T. 1982. Effects of freezing and thawing green curds before processing on the rheological properties of cream cheese. J. Food Sci., 47: 1811-1817.

Hynes, J.Y. and Vakaleris, D.G. 1975. Preparation of a low fat cream cheese product. United States Patent, US (3,929,892).

Kalab, M., Sargant, A.G., and Froehlich, D.A. 1981. Electron microscopy and sensory evaluation of commercial cream cheese. Scanning Electron Microsc., 111: 473-482, 514.

Kalab, M. and Modler, H.W. 1984. Milk gel structure. XV. electron microscopy of whey protein-based Cream cheese spread. Milchwissenschaft, 39(6): 323-327.

Kijowski, M., Kettani, M.S., and Trop, S.A. 2000. Method of manufacture of cream cheese products. United States Patent, US (6,096,352).

Koide, K., Yoneda, Y., and Musashi, K. 1983. Process for producing a cream cheese-like food. United States Patent, US (4,397,878).

Kokini, J.L., and Dickie, A. 1982. A model of food spreadability from fluid mechanics. J. Texture Stud., 13(2): 211-227.

Konkoly, A.M., Flores, R.A., and Castell-Perez, M.E. 1999. Use of spiral adapter in the characterization of commercial cream cheeses. Applied Eng. Agri., 15(5): 539-542.

Kosikowski, F.V., and Mistry, V.V. 1999. Bakers', Neufchatel, cream, quark, and ymer, in Cheese and fermented milk foods: Volume II, procedures and analysis. F.V. Kosikowski, L.L.C., Virginia, pp. 42-55.

Link, O.J. 1945. Cream cheese manufacture. United States Patent, US (2,387,276).

Lucey, J.A. 2003. Acid and acid/heat coagulated cheese, in Encyclopedia of dairy sciences, Vol. 1 (ed. H. Roginski, J.W. Fuquay, and P.F. Fox), Academic Press, London, pp. 350-356.

Lundstedt, E. 1954. Our industry today: Brief review of current topics. J. Dairy Sci., 37: 243-246.

Modler, H.W., Poste, L.M., and Butler, G. 1985. Sensory evaluation of an all-dairy formulated cream-type produced by a new method. J. Dairy Sci., 68(11): 2835-2839.

Phadungath, C. 2003. A study of structure development in cream cheese and the impact of processing conditions on cheese texture and sensory. M.S. thesis. Univ. of Wisconsin, Madison.

Puhan, Z., Driessen, F.M., Jelen, P., and Tamime, A.Y. 1994. Fresh products-yoghurts, fermented milks, quarg and fresh cheese. Mljekarstvo, 44(4): 285-298.

Roundy, Z.D. 1939. A study of the control of the physical properties, composition and quality of cream cheese. Ph.D. thesis. Univ. of Wisconsin, Madison.

Sanchez, C., Beauregard, J.L., Chassagne, M.H., Bimbenet, J.J., and Hardy, J. 1994a. Rheological and textural behaviour of double cream cheese, Part I: Effect of curd homogenization. J. Food Eng., 23: 579-594.

Sanchez, C., Beauregard, J.L., Chassagne, M.H., Duquenoy, A., and Hardy, J. 1994b. Rheological and textural behaviour of double cream cheese, Part II: Effect of curd cooling rate. J. Food Eng., 23: 595-608.

Sanchez, C., Beauregard, J.L., Chassagne, M.H., Bimbenet, J.J., and Hardy, J. 1996. Effects of processing on rheology and structure of double cream cheese. Food Res. Intern., 28(6): 547-552.

Sanchez, C. and Hardy, J. 1997. Structuring and stability of double cream cheese. European Dairy Magazine, 4: 8-10.

Sharpless, C.P. 1939. Process of manufacturing cream cheese. United States Patent, US (2,098,764).

Singh, S. and Tewari, B.D. 1990. Optimization of manufacturing technique for cream cheese. Indian J. Dairy Sci., 43 (3): 428-432.

Singh, S. and Tewari, B.D. 1991. Cream cheese production: A review. Indian J. Dairy Sci., 44(5): 348-351.

USDA. 1994. USDA Specifications for cream cheese, cream cheese with other foods, and related products. Dairy Division. Agricultural Marketing Service. United States Department of Agriculture.

Wendin, K., Langton, M., Caous, L., and Hall, G. 2000. Dynamic analyses of sensory and microstructural properties of cream cheese. Food Chem., 71 (2000): 363-378.

Yamaguchi, Y., Sakaue, Y., and Sawamura, N. 1999. Process for the production of cream cheese-like products. United States Patent, US (5,882,704).