milk fat and cheese whey make snack spread

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UTILIZATION of all components of milk, in particular the surplus of milk fat and the vast amounts of unreclaimed cheese whey, has led to the development of a spreadable emulsion of milk fat in concentrated sweet cheese whey. This new product has body and flavor properties that can be characterized as a combination of some of those found in butter and cream cheese. However, it cannot be considered a substitute for either of these traditional products since it has unique plasticity and taste. Members of a professional sensory panel have commented that samples have a mild, cheesy, slightly sweet and butter-like taste. Viscosity and plasticity of the spread are affected only slightly in the 50° to 100°F temperature range. And, the product does not melt.

The food spread is made by homogenization and concentration of a mixture of cheese whey and cream, or cheese whey and butteroil with skim milk. The system to process the food includes a mixing tank, high pressure pump, homogenizing valve, *Mallory* tubular heater, and a falling film evaporator of Wiegand design (custom built by Arthur Harris & Co.) The tube chest of this evaporator is partitioned to permit temperature control on both top and bottom halves of the condensing tubes. The pilot system is designed for removal of product immediately after condensing or for continuous recycling of the product through the heater, homogenizer and evaporator. A homogenizer gauge mounted on the high pressure pump indicates the pressure required to move the product through the tubular heater and homogenizing valve. This gauge serves as a crude viscometer which is used for control of the product's concentration.

A typical formulation for the milk fat-whey spread which has good stability, texture and flavor is:

	PER CENT
cream fat	34-37
whey solids	36.3-33
moisture	25
skim milk solids	4
emulsifier*	0.5
salt	0.1
potassium sorbate	0.1

*mono and diglycerides

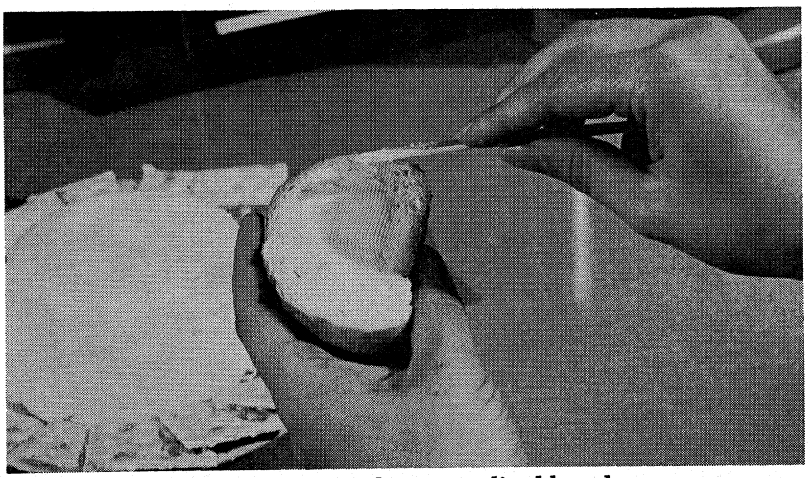
The typical analysis of a spread made with these ingredients and having a fat to nonfat solids ratio of one would be:

	PER CENT
fat	37.5
lactose	27.8
moisture	25.0
protein	5.6
ash	3.6

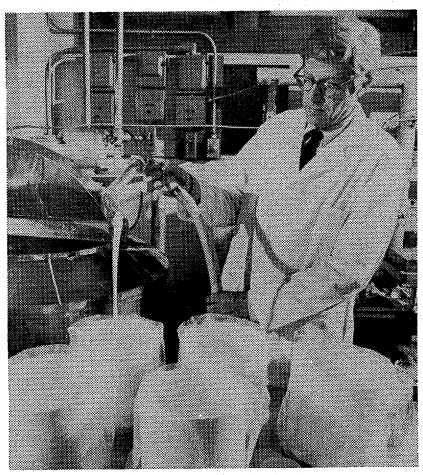
Products can be made with zero coliform and counts as low as 5,000 bacteria per gram.

Processing Procedures

Fluid cheese whey is mixed with either cream or a mixture of nine parts butteroil and one part nonfat dry milk along with added salt and emulsifier. The mix is pasteurized for



Spread goes easily on crackers and even on sliced bread.



Filling condensed milk fat—cheese whey in containers for storage and hardening.

20 seconds at 170° F, homogenized at 2,500/500 psi and then partially condensed by passing once at the rate of 800 pounds of fluid per hour through the evaporator. The upper and lower sections of the evaporator are maintained at 170° F and 150° F respectively. At this point potassium sorbate is added to the collected concentrate. Then the mixture is continuously cycled through a tubular heater set to hold for 20 seconds at 140° F, a homogenizing valve, and the evaporator which had its temperatures lowered to 160° and 140° F. With moisture removal, the material becomes progressively more viscous and the back pressure on the pump increases. When the back pressure reaches 5,000 psi, the homogenizing valve is completely opened and the material continues to cycle in the system until the back pressure reaches 5,500 psi. The product is stored at 45° F and in two days it reaches its characteristic consistency.

Stable samples can be prepared also by a one pass homogenization of the fluid whey and fat at 4,500/500 psi followed by condensation to the desired moisture content.

The homogenization pressure, ratio of fat to solids nonfat (f/snf), and the use of an emulsifier have an effect on the stability and properties of the spread. Table I illustrates the effect of various processing conditions on the product's stability. Samples A, B, and C did not receive as much homogenization as did D, E, F and G. Samples A and B were made by adding cream (45 per cent fat) to previously concentrated whey of 36 and 56 per cent solids respectively, and then continuously homogenizing and concentrating under vacuum. In contrast, samples D and E were formulated using whey with 6.6 per cent solids and thus spent a greater amount of time in the concentration-homogenization process cycle. The higher homogenization pressure applied to sample F (in comparison to sample C) accounts for its improved stability. With 56 per cent of its protein adsorbed by fat, sample G made with butteroil and nonfat milk also showed good stability as measured by ability to resist leakage of oil from the emulsion.

Table II shows that homogenization decreases particle size up to a point. The increase in particle size at the higher pressure may be due to clumping of particles under high stress. The level of protein adsorbed by fat increases with pressure in the range studied. The mixture used for study of homogenization effects contained fluid whey and 45 per cent fat cream and had a 1.0 f/snf ratio. Samples used in Tables I and II contained 0.5 per cent emulsifier and 0.1 per cent salt.

The ratio of f/snf in the emulsion when varied from 0.83 to 1.2 may affect the size of lactose crystals unless the moisture level is carefully controlled. Study of samples periodically removed from the process during concentration showed that a product with a 1.2 f/snf ratio would have

Table I. Effect of Processing Conditions on the Stability of a One Fat/Solids Nonfat Spread and on the Level of Protein Adsorbed by Fat.

Sample Code	% Moisture of Sample	Processing Conditions	% Protein Adsorbed by Fat	Stability, cc of Oil Leakage Two Days at Room Temp.
A	26.1	CH Whey (36% solids) plus cream	40.2 ± 1.4[a]	2 cc
B	22.9	CH Whey (56% solids) plus cream	48.3 ± 1.4	3 cc
C	24.1	S.P.H. whey (6.6% solids) plus cream 2500-500 psi	43.5 ± 2.0	5 cc
D	25.4	CH Whey (6.6% solids) plus cream	53.4 ± 2.0	none (7 days)
E[b]	28.0	CH Whey (6.6% solids) plus cream	54.0 ± 2.0	none (7 days)
F	25.0	S.P.H. whey (6.6% solids) plus cream 4500-500 psi	52.7 ± 2.0	none (7 days)
G	28.3	CH Whey (6.6% solids) plus butteroil and nonfat milk	56.0 ± 2.0	none (7 days)

[a] = Standard error of the mean
[b] = 1.2 fat/solids nonfat
CH = Continuously homogenize at 2500-500 psi while condensing
S.P.H. = Single pass homogenization

Table II. Effect of Homogenizing Pressure on Fat Particle Size and Protein Adsorption of Fat particles in a 1:1 Solids Mixture of Fluid Whey Plus Cream Solids Nonfat and Cream Fat.

Homogenization Pressure in psi	Median Particle Size in Microns	% Protein Adsorbed by Fat
None	4.2[a]	29.8 ± 2.0[b]
1500-500	0.97	41.4 ± 2.0
2500-500	0.82	44.5 ± 2.0
3500-500	0.86	44.2 ± 2.0
4500-500	1.02	50.6 ± 2.0

[a] = From J. Dairy Sci. 49, 1371-1375, 1966
[b] = Standard error of the mean

Table III. Effect of Emulsifier on Milk Fat-Cheese Whey Emulsions.

Ratio of Fat/Solids Nonfat	Source of Fat	Emulsifier Added	% Moisture of Spread	Texture	Stability cc Oil Leaked in 7 Days	% Protein Adsorbed by Fat
1	cream	0	29.5	sandy	trace	46.9
		0.5%	30.5	sandy	trace	46.5
0.83	cream	0	26.2	smooth	0	49.6
		0.5%	26.5	smooth	0	51.9
1	cream	0	28.0	slightly sandy	1	50.0
		0.5%	26.2	smooth	0	45.0
1	butteroil	0	22.5	smooth	12	20.1
		0.5%	20.9	smooth	4	17.4

large lactose crystals and be very sandy to the palate at a calculated moisture above 26.5 per cent. Sandiness was detected also when moisture was above 28.0 to 28.5 per cent for a 1.0 f/snf ratio, and above 30 per cent moisture when the ratio was 0.83. In each of these three formulations the concentration of lactose at these critical levels is calculated to be 47 per cent. Thus, to obtain a product with numerous small lactose crystals that cannot be detected by the palate a concentration of lactose greater than 47 per cent is required. If the concentration is less than 47 per cent, larger lactose crystals are formed which are sandy to the palate.

Use of emulsifier is recommended since it will decrease the viscosity and make the product softer and easier to spread. Table III compares formulations made with and without emulsifier. Note also that butteroil adsorbs much less protein than does the fat in a cream system, unless dry skim milk solids are included. (Refer to Sample G in Table I.)

Sensory Evaluation

Spreads were judged by 16 to 20 members of the Dairy Products Laboratory using the nine point hedonic scale (*1*). Fifteen-gram samples were placed in wax cups and brought to room temperature within one-half hour before evaluation. The panel members spread the product on salted soda crackers for evaluation of both texture and flavor. The data on the randomly presented samples was treated statistically (*2*).

An arbitrary level of 0.1 per cent added salt was chosen as being most suitable for addition to the samples.

The taste of even 0.5 per cent salt is pronounced in this product. The addition of 0.5 or 1.0 per cent salt is without significant added effect on panel scores of the spread. Salt was added by direct blending into four to six pounds of the freshly processed spread before it cooled and hardened.

The spread can be held at room temperature in excess of one week with no loss of panel acceptability or change in pH. And, the spreads can be stored up to four months time at 45° F with no significant loss of flavor or texture. Beyond this time, slight to moderately oxidized flavors may develop. Professional members of the taste panel generally score well made samples of the product seven on the nine point hedonic scale. Furthermore, distribution of numerous samples to the general public has shown a high level of acceptability. The product was liked very much by 86 per cent of one group of consumers.

The spreads are not stable when frozen. After two weeks at 5°, the spreads become mealy when thawed. Many initially expel water and oil after thawing one to two days. They are as physically stable when stored for several days at 70° F as at 98° F. However, the spread stored at 98° F soon acquires a strong cheese flavor.

On exposure to air the products case harden, turn slightly darker in color on the surface, and lose moisture at room temperature under average humidity conditions. These changes can be easily circumvented by packaging in plastic tubs. ō

References

(1) Peryam, D.R. and F.J. Pilgrim. 1957. Hedonic scale method for measuring food preferences. Food Tech. 11 insert 9-15.
(2) Snedecor, G.W. 1959. STATISTICAL METHODS (Fifth Ed.) Iowa State College Press, Ames, Iowa.

Note: Reference to brand or firm name does not constitute endorsement by USDA over others of a similar nature not mentioned.