APPENDIX A

Folch Lipid Extraction

I. Solutions:
   A. Chloroform:methanol solution (2:1)
   B. Methanol:distilled water solution (1:1)

II. Methods:
   1. Place 0.5 ml (1 part)cream in a clean, dry test tube.
   2. Add 9.5 ml (20 part) of chloroform:methanol mixture to cream sample.
   3. Allow solution to sit overnight, with some occasional mixing.
   4. Remove precipitate from extract by filtration.
   5. Add 2.4 ml of 37% KCl solution to extract.
   6. Allow extract to centrifuge at 3200 rpm for approximately 10 min.
   7. Carefully remove lower chloroform layer into a clean, dry test tube.
   8. Wash samples with 5 ml of methanol:distilled water.
   9. Centrifuge samples at 3200 rpm for an additional 10 min.
   10. Remove chloroform, the lower layer, and place into a test tube.
   11. Dry samples under a stream of nitrogen.
   12. Record weight of tube+dried lipid sample
   13. Determine weight of dried lipid by subtracting the tube weight from the weight of tube+lipid.
   14. Determine percent lipid by dividing lipid weight by sample weight.

Cholesterol Assay

I. Solutions
   A. Ethanol:acetone solution (1:1)
   B. Acetic anhydride:sulfuric acid solution (4:1)
   C. Cholesterol standard (5 mg cholesterol/ml of chloroform)

II. Methods
   1. Place 6 ml of sample (20%) into a clean, dry test tube.
   2. Add 2.4 ml of ethanol:actenone solution to samples.
   3. For 15 min, centrifuge at 3200 rpm.
   4. Remove supernatant, place it into a test tube, and cap.
   5. Add 1.5 ml of warm ethanol:acetone (1 ml/2 ml of original solution)
   6. Place tubes in water bath at 40^{o}C to 50^{o}C for 10 min.
   7. Centrifuge samples at 3200 rpm for 15 min.
   8. Add supernatant from recent centrifugation to existing supernatant.
   9. Remove pellet and dry supernatant under a stream of nitrogen.
   10. Add 0, 0.02, 0.04, 0.06, 0.08, and 0.1 ml of cholesterol standard to tubes to yield final concentrations of 0, 0.1, 0.2, 0.3, 0.4, and 0.5 mg/ml, respectively.
   11. Place tubes under a stream of nitrogen to evaporate chloroform from standards.
   12. Add 2.5 ml of chloroform to each tube, including standards.
   13. Add 2 ml of acetic anhydride:sulfuric acid solution to each tube.
   14. Place samples on ice for 15 min and wait for development of blue-green color.
   15. Using glass cuvettes, measure absorbance at 625 nm.

Silicic Acid Column Chromatography

I. Reagents:
   A. Silicic acid (Silicar CC-4)
   B. Chloroform
   C. Methanol
   D. Acetone

II. Methods:
   1. Rinse column with acetone, followed by wetting with chloroform.
   2. Slurry approximately 2 g of slicic acid with chloroform (10 g silicic acid/gm lipid being separated) in a small beaker.
   3. Pour slurry into column and wash down with chloroform.
   4. Drain to a level just above silicic acid, without letting the column go dry.
   5. Add sample from Folch extraction (reconstituted with 1 ml chloroform) to top of column.
   6. Rinse test tube, funnel, and column with chloroform.
   7. Place flask under column for collection and wash column with 150 ml chloroform.
   8. Let chloroform drain to wash neutral lipids from column, remove flask, and discard chloroform.
   9. Place a clean flask under column and add 100 ml methanol to top of column (Fraction containing phospholipids)
   10. Let methanol drain into flask to obtain phospholipids.
   11. Allow methanol to dry on roto-vap (40^{o}C with cold water and vacuum at power setting at 160).
   12. After samples are dried, add 10 ml chloroform to resuspend phospholipids.
   13. Place samples in test tube and dry under nitogen.
   14. Wash flasks twice with 10 ml aliquots of chloroform and add to tests tubes for drying under nitrogen.

Phosphorous Analysis (Determines Phospholipid Content)

I. Reagents:
   A. Perchloric acid
   B. Na_2HPO_4 solution (0.0046 g Na_2HPO_4/500 ml distilled water)
   C. 2.5% Ammonium molybdate solution (2.501 g/100 ml distilled water)
   D. 10% Ascorbic acid solution (10.0019 g/100 ml distilled water)

II. Methods:
   1. After evaporating samples, place teflon boiling chip and 0.9 ml perchloric acid to each tube.
   2. Place samples in heating block under hood for 2 hr at approximately 145^{o}C.
   3. Make standards by adding 0.9 ml of perchloric acid to standards and blanks, preparing Na_2HPO_4 solution, and making standard solutions. Refer to the following chart:

Final phosphorous concentration (μg)	Volume of Na_2HPO_4 (ml)	Volume of distilled water (ml)	Final volume (ml)
0	0	5	5
2	1	4	5
4	2	3	5
6	3	2	5
8	4	1	5

   4. Remove samples from heating block and allow them to cool.
   5. Add 5 ml of distilled water to samples to wash down the side of tubes.
   6. To each tube, add 1 ml of ammonium molybdate solution and 1 ml of ascorbic acid solution.
   7. Heat samples in boiling water bath for 5 min.
   8. Let samples cool, then transfer to tubes for centrifugation for 5-10 min.
   9. Determine absorbance at 820 nm using blank to zero spectrophotometer.
   10. To determine phospholpid value from phosphorous content, multiply by 25.

Phosphodiesterase I Activity

I. Reagents:
   A. 2 mM p-nitrophenyl-5' thymidylate in 0.1 M glycine buffer (pH 9.6)
   B. 1% Triton X-100
   C. 0.2 N NaOH (2 g NaOH/250 ml H_20)

II. Methods:
   1. Weigh 0.01 gm of MLGM pellet into a clean, dry test tube.
   2. Add 1 ml of distilled water.
   3. Use a glass rod to make the sample homogenous.
   4. Remove 0.1 ml of homogenous sample and place into another test tube.
   5. Add 0.8 ml of 2 mM p-Nitrophenyl-5' Thymidylate in 0.1 M glycine buffer to sample.
   6. Then add 0.1 ml 1% Triton X-100.
   7. Vortex sample and incubate for approximately 15-30 min. Note the time.
   8. After incubation, add 2 ml of 0.2 N NaOH.
   9. Read absorbance at 400 nm.

Standard Curve	ml stock solution	ml H_2O
0	0	0.10
0.02	0.02	0.08
0.04	0.04	0.06
0.06	0.06	0.04
0.08	0.08	0.02
0.10	0.10	0

APPENDIX B

Table B-1. Phospholipid analysis[1] (% in sample, mg/g lipid, and % in lipid portion) of pilot plant processed components (skim, buttermilk, and aqueous phase) obtained at two separation temperatures (49°C and 55°C) and commercially processed components (buttermilk and aqueous phase).

Formulation	Separation Temperature (°C)	% Phospholipid in Sample	mg Phospholipid/ g Lipid	% Phospholipid in lipid
Skim	49	0.0155	75.546	7.555
Skim	55	0.0156	74.874	7.487
Buttermilk	49	0.1013	153.849	15.384
Buttermilk	55	0.1004	143.232	14.323
Grasslands Buttermilk		0.1393	188.012	18.803
Aqueous Phase	49	0.5015	343.752	34.375
Aqueous Phase	55	0.4634	324.084	32.408
Grasslands Aqueous Phase		0.0741	80.232	8.023
Standard Error		0.0220	24.290	2.430
[1]Values are means and standard errors for 3 replications.				
[2]AP = aqueous phase; BM = buttermilk				
*Predetermined p-value of 0.01 used to determine significance				
Contrasts				
Skim 49°C * Skim 55°C		0.9980	0.9847	0.9847
Buttermilk 49oC * Buttermilk 55oC		0.9760	0.7619	0.7619
AP 49°C * AP 55°C		0.2428	0.5761	0.5761
Pilot Plant BM * Commercial BM		0.1783	0.2057	0.2057
Pilot Plant AP * Commercial AP		* 0.0001	* 0.0001	* 0.0001
Skim * Buttermilk		* 0.0019	* 0.0092	* 0.0092
Skim* AP		* 0.0001	* 0.0001	* 0.0001
Buttermilk * AP		* 0.0001	* 0.0001	* 0.0001

Table B-2. Percent lipid and phospholipid (% in sample, mg/ g lipid, and % in lipid portion) composition[1] of natural and reformulated creams consisting of components obtained at two different separation temperatures (49°C and 55°C) and butteroils having different melting point range characteristics (low-melt fraction and medium-melt butteroils).

Formulation	Separation Temperature(°C)	% Lipid Folch	% Phospholipid in sample	Phospholipid in lipid (mg/g)	% Phospholipid in lipid portion
20%lmbo + 80%skim	49	18.62	0.007	0.359	0.036
20%lmbo + 80%skim	55	17.46	0.006	0.360	0.036
20%mmbo + 80%skim	55	17.29	0.007	0.373	0.037
20%lmbo+70%bm+10%ap	49	18.16	0.054	2.917	0.292
20%lmbo+70%bm+10%ap	55	18.66	0.052	2.780	0.278
20%mmbo+70%bm+10%ap	55	18.88	0.052	2.740	0.274
Natural cream	49	18.03	0.049	2.646	0.265
Natural cream	55	18.65	0.049	2.570	0.257
Standard Deviation		0.378	0.006	0.297	0.029

[1]Values are means and standard errors for 3 replications.
[2]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase
[3]LM = low-melt; MM = medium-melt; BM = creams formulated with sweet buttermilk and aqueous phase
*predetermined p-value of 0.01 used to determine significance

CONTRASTS				
Skim LM 49 + Skim LM 55 * Skim MM 55	0.1268	0.9927	0.9710	0.9710
BM LM 49 + BM LM 55 * BM MM 55	0.3307	0.9487	0.7707	0.7706
Skim * BM	0.0244	* 0.0001	* 0.0001	* 0.0001
Skim * Natural	0.1327	* 0.0001	* 0.0001	* 0.0001
BM * Natural	0.5207	0.5461	0.4634	0.4621
Natural 49 * Natural 55	0.2670	0.9451	0.8602	0.8581
Skim LM 49 * Skim LM 55+MM 55	0.0176	0.9731	0.9838	0.9838
BM LM 49 * BM LM 55+BM MM 55	0.2094	0.8016	0.6723	0.6721

Table B-3. Protein and phospholipid content[1] of a given amount of surface material isolated from the lipid globules natural and reformulated creams processed from components from two separation temperatures (49°C and 55°C) and butteroils having different melting range characteristics (low and medium-melt butteroils)

Formulation	Separation Temperature(°C)	SM/Cream (mg/g)	Protein/ MM(mg/10mg)	Phospholipid/ MM(mg/10mg)
20%lmbo + 80%skim	49	28.480	2.858	0.032
20%lmbo + 80%skim	55	27.147	3.199	0.032
20%mmbo + 80%skim	55	24.490	3.707	0.028
20%lmbo + 70%bm + 10%ap	49	20.237	4.672	0.110
20%lmbo + 70%bm + 10%ap	55	20.789	5.079	0.109
20%mmbo + 70%bm + 10%ap	55	19.161	5.457	0.111
Natural cream	49	17.041	5.504	0.132
Natural cream	55	17.176	5.764	0.132
Standard error		4.961	0.429	0.015

[1]Values are means and standard errors for 3 replications.
[2l]mbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase
[3] LM = low-melt; MM = medium-melt; BM = creams formulated with buttermilk and aqueous phase
*predetermined p-value of 0.01 used to determine significance

Contrasts			
Skim LM 49 + Skim LM 55 * Skim MM 5	0.5930	0.2177	0.8485
BM LM 49 + BM LM 55 * BM MM 55	0.8272	0.2869	0.9160
Skim * BM	0.1233	* 0.0001	* 0.0001
Skim * Nat	0.0524	* 0.0001	* 0.0001
BM * Nat	0.5248	0.1714	0.1343
Nat 49 * Nat 55	0.9850	0.6750	0.9714
Skim LM 49 * Skim LM 49 + Skim MM 55	0.6681	0.2765	0.9433
BM LM 49 * BM LM 49 + BM MM 55	0.9662	0.2762	0.9765

APPENDIX C
Feathering Assay

1. Prepare 0.012 M sodium acetate buffer by adding 0.9844 g of sodium acetate per liter distilled water.
2. Make 1 M acetic acid solution by combining 5.8 ml of glacial acetic acid to 100 ml of distilled water.
3. To make 0.012 M acetic acid solution, bring 12 ml of 1 M acetic acid to 1 liter
4. Adjust sodium acetate buffer pH to 5 by pipett addition of 0.012 M acetic acid solution.
5. Make citric acid solution by adding 0.3202 g of citric acid to 100 ml of distilled water.
6. Add 2.24 g of sodium citrate to 100 ml of distilled water to make sodium citrate solution.
7. Prepare sodium acetate buffers, varying in pH, using the following chart:

pH of Buffer	Sodium Acetate (ml)	Citric Acid (ml)	Sodium Citrate (ml)	Distilled Water (ml)
4.70	90	5		5
4.75	90	4		6
4.81	90	3		7
4.86	90	2		8
4.92	90	1		9
5.00	90			10
5.09	90		1	9
5.20	90		2	8
5.31	90		3	7
5.45	90		4	6
5.60	90		5	5

8. If necessary, adjust pH by adding citric acid or sodium citrate solution.
9. Add 10 ml of each buffer system to a separate clean, dry test tube.
10. Heat buffer solutions in a water bath to 85^{o}C.
11. Add approximately 1 ml of cream to each test tube and remove test tubes from water bath.
12. After 2 minutes, visually examine for incidence of feathering.
13. Issue a feathering score based on the lowest pH at which feathering was observed.

Determination of Sensory Quality of Natural and Reformulated Creams

I. Materials for training
   A. Handout with description of off-flavors common in cream (Jensen and Poulsen, 1992)
   B. Copy of Scorecard used during sensory evaluation of cream
   C. 500 ml cream samples having off-flavors described below for sampling by trained panelists
   D. Cups for sampling, water for rinsing, and spit cups

II. Description of off-flavors focused on during training

Off-flavor	Cause	Description of Flavor
A. Light-induced oxidized	Exposure to sunlight or fluorescent light	Cardboardy or paperboardy
B. Oxidized flavor	Oxidation of unsaturated fatty acids in milkfat	Cardboardy, tallowy, metallic, or oily
C. Rancid flavor	Lipase hydrolysis of milkfat triglycerides to free fatty acids	Butyric or soapy
D. Cooked flavor	Exposure of H_2S groups of whey proteins during pasteurization	Cooked, heated, or caramelized
E. Flat flavor	Lack of aroma or fat	Watery or flat
F. Lacks freshness flavor	Product is close to end of shelf-life	Old or stale
G. Malty	Growth of *Streptococcus lactis*	Malt
Fruity	Growth of *Pseudomonas fragi*	Fruit flavor, particularly strawberry

III. Sensory evaluation of creams
   1. Samples given 3 digit code and randomized for presentation to panelists
   2. Samples served to panelists at refrigeration temperature.
   3. A minimum of 65% "In" responses are required for cream to be "In" specification.

Virginia Polytechnic Institute and State University
Informed Consent for Participation in Sensory Evaluation

Title of Project: The Effect of Milkfat Fraction Melting Properties on Physical Properties of Reformulated Cream

Principal Investigator: Lisa L. Scott

I. THE PURPOSE OF THIS PROJECT

You are invited to participate on a sensory evaluation panel regarding the quality of reformulated creams. The purpose of the investigation is to determine whether the quality of various reformulated creams is "in" or "out" of specification according to quality standards.

II. PROCEDURES

There will be 3 sessions over a period of 3 days involving about 10 minutes at each session. You will be presented with approximately 8 samples at each session. As a panelist, it is critical to the project that you attend each session. Should you find a sample unpalatable or offensive, you may choose to spit it out and continue to other samples.

Certain individuals are sensitive to some foods such as **milk**, eggs, wheat gluten, strawberries, chocolate, artificial sweeteners, fish, etc. If you are aware of any food or drug allergies, list them in the following space.

III. BENEFITS/RISKS OF THE PROJECT

Your participation in the project is essential in determining if the reformulated creams meet quality specifications. You may receive the results or summary of the panel when the project is completed. Some risk may be involved if you have an unknown food allergy.

IV. EXTENT OF AN0NYMITY AND CONFIDENTIALITY

The results of your performance as a panelist will be kept strictly confidential. Individual panelists will be referred to by code for analyses and in any publication of the results.

V. COMPENSATION

No Monetary Compensation

VI. FREEDOM TO WITHDRAW

It is essential to sensory evaluation projects that you complete each session in so far as possible. However, there may be conditions preventing your completion of all sessions. If after reading

and becoming familiar with the sensory project, you decide not to participate as a panelist, you may withdraw at any time without penalty.

VII. Approval of Research

This research project has been approved by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University and by the human subjects review of the Department of Food Science and Technology.

VIII. SUBJECT'S RESPONSIBILITIES

I know of no reason I cannot participate in this study which will require: (list sessions to be attended or other requirements.)

_____ Signature/Date

Please provide address and phone number so investigator may reach you in case of emergency or schedule changes.

Address _____

Phone _____

----------(tear off)----------

IX. SUBJECT'S PERMISSION (provide tear off for human subject to keep)

I have read the information about the conditions of this sensory evaluation project and give my voluntary consent for participation in this project.

I know of no reason I cannot participate in this study which will require: (list sessions to be attended or other requirements.)

_____

Signature Date

Should I have any questions about this research or its conduct, I should contact:

Lisa L. Scott 231-3037
Principal Investigator/Phone

Dr. Susan Duncan 231-8657
Faculty Advisor/Phone

Tom Hurd 231-6077
Director, Sponsored Programs/Phone

The Effect of Milkfat Fraction Melting Properties on Physical Properties of Reformulated Creams

Replication 1

Lisa L. Scott

❖ Instructions

Please evaluate the samples presented to you and indicate in the space provided if they are "in" or "out" of specification. Use the space provided to indicate why you considered a sample to be "out of specification."

Sample _____ In [ ] Out [ ]

Reasons if "out"

_____

_____

_____

Sample _____ In [ ] Out [ ]

Reasons if "out"

_____

_____

_____

Sample _____ In [ ] Out [ ]

Reasons if "out"

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Sample _____ In [ ] Out [ ]

Reasons if "out"

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Sample _____ In [ ] Out [ ]

Reasons if “out”

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Sample _____ In [ ] Out [ ]

Reasons if “out”

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Sample _____ In [ ] Out [ ]

Reasons if “out”

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Sample _____ In [ ] Out [ ]

Reasons if “out”

_____

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_____

APPENDIX D

Table D-1. Creaming stability (percent change in fat content of top layer) for natural and reformulated creams processed from components obtained at two separation temperatures (49°C and 55°C) stored over a two week period at 3.3°C.

		Day						
Formulation	Separation Temperature (°C)	1	3	5	7	9	11	13
20%lmbo + 80%skim	49	-1.2	-1.6	2.5	3.7	10.8	13.6	19.9
20%lmbo + 80%skim	55	-0.8	1.2	2.9	3.7	5.4	6.6	8.7
20%mmbo + 80%skim	55	0.4	0.9	0.9	4.6	6.6	10.0	12.4
20%lmbo+70%bm+10%ap	49	-2.4	-2.8	-0.8	0.8	0.8	3.2	11.7
20%lmbo+70%bm+10%ap	55	-2.4	-2.8	-2.0	2.1	3.7	7.3	9.7
20%mmbo+70%bm+10%ap	55	-4.7	-2.3	-0.8	1.2	2.8	4.7	10.7
Natural cream	49	-5.2	-2.5	-1.5	2.9	9.8	9.5	13.7
Natural cream	55	-5.9	-3.3	-2.2	-1.1	1.6	2.4	5.6
Standard error	1.715							

[1]Values are means for 3 replications.
[2]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase
*Predetermined p-value of 0.01 to determine statistical significance

Table D-2. Creaming stability (percent change in fat content of bottom layer) for natural and reformulated creams processed from components obtained at two different separation temperatures (49°C and 55°C) stored over a two week period at 3.3°C.

		Day						
Formulation	Separation Temperature (°C)	1	3	5	7	9	11	13
20%lmbo + 80%skim	49	-2.1	-2.5	-5.4	-9.9	-18.2	-19.8	-24.8
20%lmbo + 80%skim	55	-1.2	-2.5	-6.2	-9.9	-14.5	-17.4	-17.4
20%mmbo + 80%skim	55	-2.9	-3.7	-5.4	-7.5	-10.7	-14.0	-15.3
20%lmbo+70%bm+10%ap	49	-3.2	-2.4	-6.4	-9.2	-11.6	-12.8	-22.2
20%lmbo+70%bm+10%ap	55	-3.6	-4.8	-6.4	-10.9	-12.1	-15.7	-20.0
20%mmbo+70%bm+10%ap	55	-4.3	-7.0	-6.3	-9.8	-13.3	-16.8	-22.0
Natural cream	49	-7.3	-8.0	-8.0	-12.1	-16.3	-18.5	-24.4
Natural cream	55	-8.3	-11.0	-10.9	-16.2	-18.8	-21.2	-25.3
Standard error	1.646							

[1]Values are means for 3 replications.
[2]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase
*Predetermined p-value of 0.01 to determine statistical significance

Table D-3. Apparent viscosity (shear rate = 692 s^{-1}) of natural and reformulated creams at 7°C processed from components obtained at two separation temperatures (49°C and 55°C) stored at 3.3°C for a two week storage period.

Formulation	Separation Temperature (°C)	Day 1	Day 7	Day 13
20%lmbo + 80%skim	49	50.4	51.3	46.7
20%lmbo + 80%skim	55	58.9	59.1	54.8
20%mmbo + 80%skim	55	83.4	87.2	77.6
20%lmbo+70%bm+10%ap	49	49.0	42.0	44.3
20%lmbo+70%bm+10%ap	55	57.3	53.2	56.3
20%mmbo+70%bm+10%ap	55	77.4	77.8	75.4
Natural cream	49	48.3	75.2	65.5
Natural cream	55	65.8	75.4	84.1
Standard Error	3.975			

[1]Values are means for 3 replications.
[2]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase
*Predetermined p-value of 0.01 to determine statistical significance

CONTRASTS

49°C Skim LM * 55°C Skim LM + 55°C Skim MM	0.0254
49°C Skim BM LM * 55°C BM LM + 55°C BM MM	0.0228
49°C Nat* 55°C Nat	0.2265
49°C Skim LM + 55°C Skim LM * 55°C Skim MM	* 0.0033
49°C BM LM + 55°C BM LM * 55°C BM MM	* 0.0063
Skim * BM	0.4706
Skim * Nat	0.3629
BM* Nat	0.1311

Table D-4. Incidence of feathering (pH of buffer at which feathering occurred) of reformulated creams consisting of low-melt or medium-melt fractionated butteroil and natural creams processed from components obtained at two separation temperatures (49°C and 55°C) over a two week storage period at 3.3°C.

Formulation	Separation Temperature (°C)	Day	pH										
			4.70	4.75	4.81	4.86	4.92	5.00	5.09	5.20	5.31	5.45	5.60
20%lmbo+80%skim	49	1						+	++				
		7							++	+			
		13						+	++				
20%lmbo+80%skim	55	1						+	++				
		7							+++				
		13							+++				
20%mmbo+80%skim	55	1						+	++				
		7						+	++				
		13							+++				
20%lmbo+70%bm+10%ap	49	1					+		++				
		7					+		+	+			
		13						+	++				
20%lmbo+70%bm+10%ap	55	1					+	++					
		7							++	+			
		13						+	+	+			
20%mmbo+70%bm+10%ap	55	1						++	+				
		7						+	++				
		13						+	+	+			
Natural	49	1					+	+	+				
		7							+++				
		13					+		+	+			
Natural	55	1						++	+				
		7						++	+				
		13						+++					

Table D-5. Aerobic, modified psychrotrophic, and coliform plate counts[1] for 10° dilution of natural and reformulated creams processed from components obtained at two different separation temperatures (49°C and 55°C) stored at 3.3°C on Day 0 of reformulation.

		Method of Enumeration		
Formulation	Separation Temperature (°C)	Aerobic Count (cfu/ml)	mPBC (cfu/ml)	Coliform (cfu/ml)
20%lmbo + 80%skim	49	18	< 5	< 5
20%lmbo + 80%skim	55	13	< 5	< 5
20%mmbo + 80%skim	55	18	< 5	< 5
20%lmbo+70%bm+10%ap	49	9	< 5	< 5
20%lmbo+70%bm+10%ap	55	10	< 5	< 5
20%mmbo+70%bm+10%ap	55	34	< 5	< 5
Natural cream	49	7	< 5	< 5
Natural cream	55	6	< 5	< 5

[1]Values are means for 3 replications.
[2]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase

Table D-6. Number of "In" and "Out" of specification responses for reformulated and natural creams within 4 days of refrigerated storage at 3.3°C.

Formulation	Separation Temperature (°C)	Number of "In" Responses	Number of "Out" Responses	In/Out
20%lmbo + 80%skim	49	19	17	Out
20%lmbo + 80%skim	55	21	15	Out
20%mmbo + 80%skim	55	26	10	In
20%lmbo+70%bm+10%ap	49	26	10	In
20%lmbo+70%bm+10%ap	55	30	6	In
20%mmbo+70%bm+10%ap	55	30	6	In
Natural cream	49	24	12	In
Natural cream	55	30	6	In

[1]lmbo = low-melt butteroil; mmbo = medium-melt butteroil; bm = buttermilk; ap = aqueous phase

VITAE

Lisa L. Scott

Lisa L. Scott was born to Mr. and Mrs. Lawrence L. Scott, Jr. on June 17, 1974. Miss Scott graduated as Salutatorian from Oscar Smith High School in June of 1992, and entered Virginia Polytechnic Institute the fall semester of that year. She obtained her Bachelor of Science degree in Food Science and Technology in May of 1997. Her interest in dairy processing began her junior year of college. Since then, she has completed courses in dairy processing and dairy product evaluation. The summer of that year, Miss Scott interned at Milkco, Sky-King, Inc., a dairy processing facility in North Carolina. Miss Scott entered the graduate program in Food Science and Technology in the fall of 1997 under the direction of Dr. Susan Duncan. She received her Master of Science degree in Food Science and Technology in September 1999. After completion of her graduate degree, Miss Scott will be employed by Archer Daniels Midland Company as a Beverage Technologist.