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THE EFFECT ON THE VISCOSITY, BACTERIAL FLORA, AND QUALITY OF THE RESULTING ICE CREAM WHEN THE ICE CREAM MIXTURE IS RE-EMULSIFIED, REVISCOLIZED, OR RE-HOMOGENIZED.

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THE EFFECT ON THE VISCOSITY, BACTERIAL FLORA, AND QUALITY OF THE RESULTING ICE CREAM WHEN THE ICE CREAM MIXTURE IS RE-EMULSIFIED, RE-VISCOLIZED, OR RE-HOMOGENIZED.

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Abstract.—Reprocessing an ice cream mixture a second or third time using an emulsifier gives an increase in the viscosity. An ice cream mixture viscolized or homogenized a second or third time decreases the viscosity. Reprocessing the mixtures increase the number of bacteria; improves the body and texture of the ice cream; assures greater dispersion of butterfat in the mixture; decreases mechanical loss of the mixture; and gives greater increase in viscosity during the period of aging.

The benefits of processing the mixture have become so well known that it is now an indespensible operation in the manufacture of quality ice cream. Processing an ice cream mixture may be accomplished by emulsing, viscolizing, or homogenizing. The object of this investigation was to determine the effect of re-emulsing, re-viscolizing, or re-homogenizing an ice cream mixture on viscosity, bacterial content, body, and texture of the resulting ice cream, and the value of this reprocessing in still further improving the quality of the finished product.

There are a number of machines on the market known as emulsers, converters, and creamers. They are of two types. In one, the emulsification is brought about by forcing the mixtures through very small apertures by means of centrifugal force. In the other type, steam is used in various ways. All viscolizers and homogenizers are built on the principle of a triple or three cylinder pump. This gives a continuous power stroke similar to that given by a six-cylinder automobile engine. The arrangement of the machine is such that the mixture is forced through a very small aperture, resulting in the breaking up of the fat globules. The distinguishing difference between the two machines is in the size of the viscolizing or homogenizing head. This necessitates carrying a higher pressure in the homogenizer than in the viscolizer. Viscolizing at 2000 pounds pressure per square inch gives about the same results as homogenizing at 3000 pounds per square inch. When operating at these pressures, the opening in the viscolizing valve is about 3/1000 of an inch and the opening in the homogenizing valve is about 7/1000 of an inch.

Hammer[12*], in a study of ice cream on the market of Des Moines, Iowa, found an average bacterial content of 19,920,000 bacteria per cubic centimeter in ten samples of ice cream from five commercial plants. Ten samples from the college creamery gave an average bacterial count of 19,775,000.

Hammer and Goss[13] showed that the freezer may be an important source of contamination. They studied the influence of freezing in 51 samples.

Hammer and Sanders[14] found that passing the ice cream mixture through a homogenizer without pressure gave an increase in the bacterial count that was often high. When pressure was applied, an additional increase in the bacterial count was secured in only three out of nine trials.

Ayers and Johnson[2], in a study of the accuracy of determining the number of bacteria in ice cream, found that bacteria are quite evenly distributed in commercial ice cream, so that any given sample is representative of the batch.

Mortensen[15] studied factors which influence the yield and consistency of ice cream. Pasteurization decreased the viscosity of cream, but on aging the viscosity increased in the same ratio as the fat content. The body and texture of the ice cream made from homogenized cream was much superior to the body and texture of the ice cream made from either raw aged cream or pasteurized aged cream.

Everson and Ferris[7] found that homogenization at 3500 pounds pressure increased the viscosity of milk as well as cream. Emulsers, both suction and gravity feed, increased the viscosity very slightly.

Gassman's[11] micro-photographic study shows that there is a wide variation in the size of the fat globules in raw cream. When raw cream was passed through a centrifugal or steam jet emulser, the large fat globules disappeared and showed up as more numerous, but smaller size globules. The use of the viscolizer and homogenizer gave much the same results as the emulser, excepting that the fat globules were broken up to a greater degree and were more uniform in size as the pressure increased from 2000 up to 2500 pounds. Higher pressures seemed to give no greater dispersion.

Fabian and Cromley[10] found that homogenization increased the bacterial count in 74 per cent of the cases, the increase ranging from 5.9 to 1400 per cent.

*Refers to Bibliography on page 29.

Clayton[4] explains the failure of homogenized cream to whip by stating, "In normal cream a certain amount of the colloids (casein and albumin) are absorbed into the fat globules and the remaining colloidals are free in the serum to stabilize the air cells or air emulsion by concentration at the liquid-gas interfusion. But, when cream is homogenized these same colloids are abstracted onto the greatly increased surface of fat to such an extent that very few remain to stabilize the air emulsion or form the air cell walls".

Zsigmondy and Spear[18] state, "Homogenization is fundamentally a process for mechanically increasing the degree of dispersion of fat."

Mortensen[16] found that by increasing the viscosity of the mixture, especially by the addition of binders and by homogenization, the air cells can be worked into the ice cream in a finer state of division.

Fisher[8] homogenized a series of mixtures testing 12 per cent fat, 10 per cent serum solids not fat, and 14 per cent sugar at 3000 pounds of pressure varying the acidity from 0.01 per cent to 0.05 per cent. The viscosity increased as the acidity increased.

Dahle[6] found that the higher the homogenization and viscolization pressure, the greater the viscosity.

Fay and Olsen[9], in a study of factors affecting the bacterial content of ice cream, found that homogenization caused an increase in the bacterial count.

Reid and Nelson[17] have shown that an increase in the milk solids not fat gives an increase in the viscosity due to the increase in the concentration of the mixture. This work would also indicate that there is no relation between acidity and viscosity.

Dahlberg[5], in a microscopic study of ice cream, found no definite relation between the size of the air cells and the texture of the ice cream. Fat and solids not fat seem to work together to improve the texture of ice cream.

Bendixon[3] reports that there is no relation between the viscosity of the mixture and overrun, and no relation between viscosity and acidity in untreated samples.

EXPERIMENTAL

Thirty mixtures of a standard fat and total solids content were studied, ten mixtures with each of the machines. The data presented represents an average of ten mixtures with each machine.

All cream mixtures were calculated to test 12 per cent butterfat, 35.5 per cent total solids, and 0.5 per cent gelatine. All calculations were confirmed by testing the mixtures for butterfat and total solids.

The ingredients were mixed in a batch mixer and pasteurized at 65.5° Centigrade for 30 minutes, then emulsed, viscolized, or homogenized at the pasteurization temperature. Three 55-pound batches were collected from each mixture. One batch was cooled immediately 4.4° Centigrade. The other batches were processed a second time after which one was cooled and the other processed a third time and then cooled. A pressure of 2000 pounds per square inch was applied in processing with the viscolizer and homogenizer. A pully speed of 100 R. P. M. was used in processing with the emulser. All mixtures were aged 24 hours at 4.4° Centigrade before freezing. The mixtures were frozen under similar conditions. The samples for bacteriological analysis and scoring were obtained prior to the addition of color and flavor. All samples for scoring were drawn at as near the same overrun as possible. Samples for the determination of viscosity were collected in sterilized bottles as follows: after completion of holding period at 65.5° Centigrade, after first processing, after second processing, and after third processing. These samples were held at approximately 4.4° Centigrade during the aging period.

Samples for bacteriological analysis were collected after completion of holding period at 65.5° Centigrade, after first, second, and third processing, and at intervals of two minutes during the freezing process until ten minutes had elapsed. The liquid samples were collected in sterilized 100 c.c. flasks. The samples taken during the freezing process were collected in half-pint, sealright containers. A series of sterile water blanks were plated from the sealright containers and they were found to be practically sterile. A liter of water was poured in the freezer, the agitator placed in motion and a sample taken and plated as a control of the bacteria present in the freezer.

The procedure outlined in Standard Methods[1] was followed in making the bacteriological analyses, using the volumetric basis. Samples of ice cream were removed from the sealright containers by the use of a sterilized butter trier.

A 50 c.c. pipette was standardized by noting the time required for a given volume of distilled water at 20° Centigrade to pass through the pipette. The mixtures were prepared by bringing the temperature to 20° Centigrade with as little agitation as possible. The time required for a given volume of mixture to pass through the pipette was recorded. The viscosity of each sample is reported as time viscosity.

The ice cream was scored for body and texture by three judges.

REPROCESSING WITH AN EMULSER

This series of mixtures was processed by a DeLaval Emulser.

The average time viscosity of the ten mixtures studied are shown in Table 1.

Figure 1 shows the viscosity curve of each series while aging. All follow the same general curve. Each succeeding emulsification gave a decided increase in the viscosity.

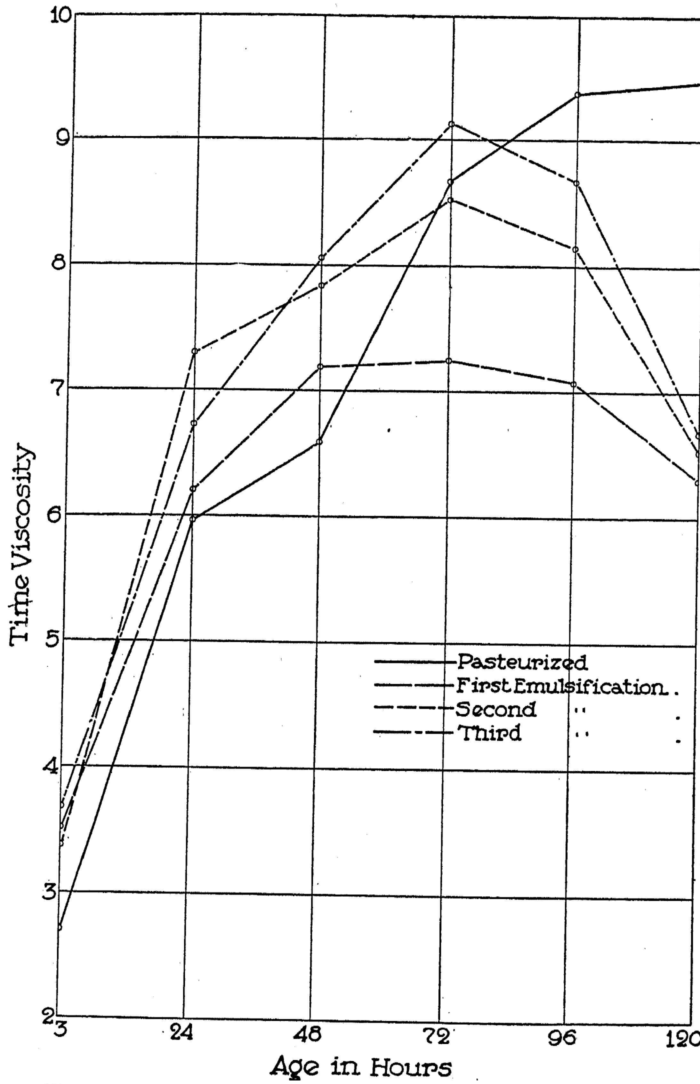

Fig. 1.—The Viscosity of Aged Mixtures as Affected by Successive Emulsifications.

As shown in Table 1, the percentage increase at the initial period of the processed mixtures over that pasteurized only, was 30.0, 24.8, and

36.2 per cent respectively. The viscosity of the unemulsified series gave a gradual increase with aging through 120 hours. The maximum viscosity of the processed series was obtained at an age of 72 hours and was followed by a decrease which became more marked upon further aging.

TABLE 1.—TIME VISCOSITY OF THE MIXTURES

Process	Aged 3 hours Initial	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 65.6°C. 30 minutes	2.70	5.98	6.59	8.67	9.36	9.46
First emulsification	3.51	6.20	7.20	7.23	7.07	6.28
Second emulsification	3.37	7.30	7.85	8.53	8.12	6.50
Third emulsification	3.68	6.74	8.06	9.12	8.66	6.67

The data presented in Table 2 shows that the emulsification of an ice cream mixture a second and third time caused a greater increase in the viscosity during the entire aging period. The greatest increase of each series was obtained during the first twenty-four hours.

TABLE 2.—THE PERCENTAGE INCREASE OVER INITIAL VISCOSITY

Process	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 65.6° C. 30 minutes	140	148	221	246	250
First emulsification	76	105	106	101	78
Second emulsification	117	132	158	140	93
Third emulsification	83	119	147	135	81

Table 3 shows that the number of bacteria increased with each successive emulsification.

TABLE 3.—EFFECT OF PROCESSING ON THE BACTERIAL COUNT

	Average of ten mixtures	Percentage increase or decrease over initial count
Pasteurized at 65.6° C. 30 minutes	7,086	------
First emulsification	7,250	+2.3
Second emulsification	8,933	+23.2
Third emulsification	11,495	+28.6

Figure 2 shows the effect of each processing during aging. The same general curve was maintained during the entire aging period.

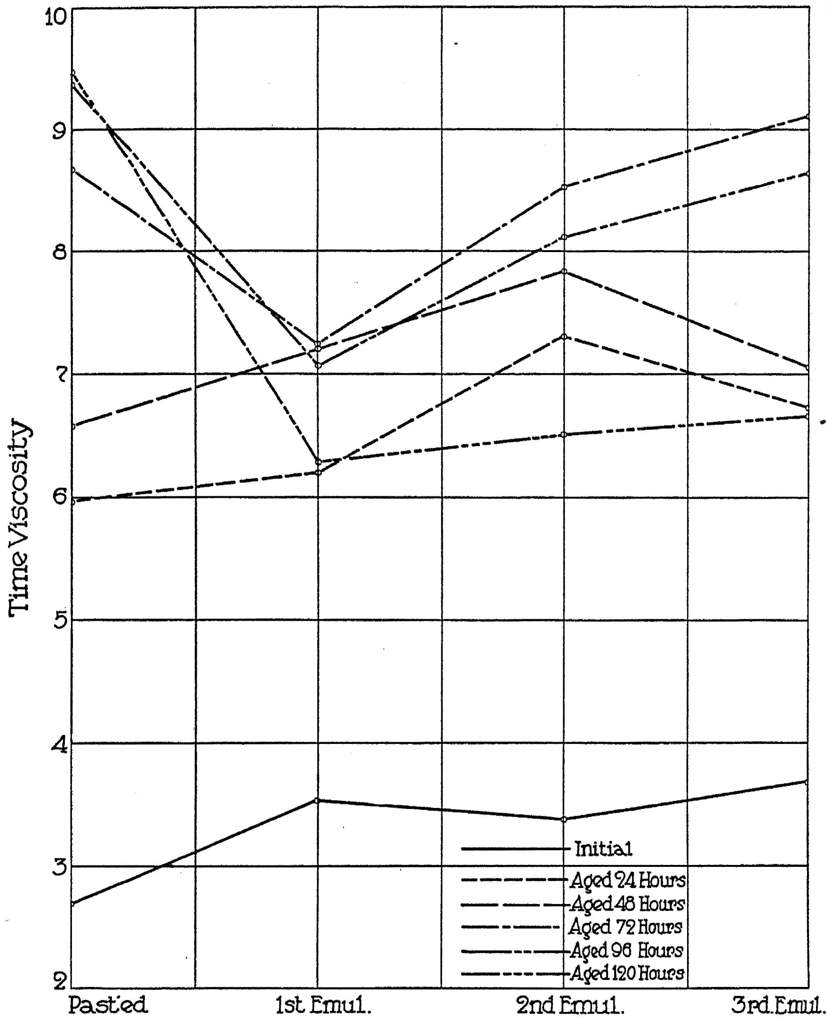

Fig. 2.—The Relation of Successive Emulsifications and the Viscosity of the Mixtures Aged for Varied Periods of Time.

Data showing that the first and second emulsifications gave a marked increase, while the series emulsified a third time gave a slight decrease are presented in Table 4. All the samples showed a very low count as compared with the initial count which indicated that the conditions were well under control. If, therefore, proper methods are used, the increase in the bacterial count due to freezing should not be great enough to be of importance in selling ice cream under a minimum bacterial count.

TABLE 4.—THE EFFECT OF FREEZING ON THE BACTERIAL COUNT

Process	Mixture after aging	Time exposed to freezing temperature in freezer				
		2 Minutes	4 Minutes	6 Minutes	8 Minutes	10 Minutes
First emulsification	8,075	13,853	14,783	15,060	16,640	13,143
Second emulsification	6,725	13,170	10,627	10,131	10,000	9,543
Third emulsification	8,015	8,187	7,547	7,825	7,485	7,610

TABLE 5.—PLACEMENT OF THE PROCESSED ICE CREAMS AS SCORED

Number of mixture	First	Second	Third
1	III	II	I
2	III	II	I
3	III	II	I
4	III	I	II
5	II	III	I
6	III	II	I
7	III	II	I
8	III	II	I
9	III	I	II
10	II	III	I

The rankings of the processed ice creams are given in Table 5. The Roman numerals correspond to the number of emulsifications given the respective mixtures. When scored, 80 per cent of the mixtures emulsified a third time placed first and the remaining 20 per cent placed second. The mixtures emulsified a second time placed 20 per cent first, 60 per cent second, and 20 per cent third. Eighty per cent of the mixtures emulsified one time placed third, and the remaining 20 per cent placed second. All samples were pronounced good ice cream. There seemed to be a greater improvement of the first over the second emulsification than the second over the third emulsification. All samples were scored by three judges.

Table 6 shows that the mixtures as analyzed checked very closely with the calculations. Variation in the fat and total solids content was negligible and had no effect on the viscosity of body and texture of the finished ice cream.

TABLE 6.—ANALYSIS OF THE MIXTURES

Number of mixture	Fat (percentage)	Total solids (percentage)
1	12.0	35.0
2	11.8	35.2
3	12.0	34.8
4	12.0	35.0
5	11.5	35.3
6	11.5	35.0
7	11.5	35.0
8	12.0	35.5
9	12.0	35.6
10	11.8	35.4

REPROCESSING WITH A VISCOLIZER

The experimental work with the viscolizer was carried on in cooperation with a local ice cream company. A viscolizer having a capacity of 1000 pounds per hour was used. The mixture was pasteurized at 76.6° Centigrade for 20 minutes and then cooled to 43.3° Centigrade and viscolized.

The average time viscosity of the viscolized series is reported in Table 7.

TABLE 7.—TIME VISCOSITY OF THE MIXTURES

Process	Aged 3 hours Initial	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 76.6°C. 20 minutes	1.40	1.62	1.64	1.41	1.17	1.38
First viscolization	2.72	3.04	3.02	3.41	2.91	3.35
Second viscolization	1.91	2.28	2.32	2.49	2.35	2.83
Third viscolization	1.74	2.07	2.09	2.37	2.15	2.51

Viscolizing the mixtures one time gave a marked increase in the viscosity, while re-viscolizing decreased the viscosity. The first viscolizing increased the viscosity 94.0 per cent over that of the unprocessed series. A second viscolization increased the viscosity 36.0 per cent as compared with the unprocessed series, but decreased the viscosity 42 per cent as compared with the series viscolized only one time. The third viscolization increased the viscosity 24.0 per cent over that of the unprocessed series, but decreased the viscosity 56.0 and 9.0 per cent respectively as compared with the first and second viscolizations. These differences in viscosity held throughout the aging period with little variation in the percentage difference.

TABLE 8.—PERCENTAGE DIFFERENCES IN AGED PROCESSED MIXTURES COMPARED WITH THE INITIAL VISCOSITY

	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 76.6° F. 20 minutes	+15	+17	+.7	—19	—7
First viscolization	+11	+11	+25	+ 7	+23
Second viscolization	+19	+21	+30	+23	+47
Third viscolization	+19	+20	+36	+26	+44

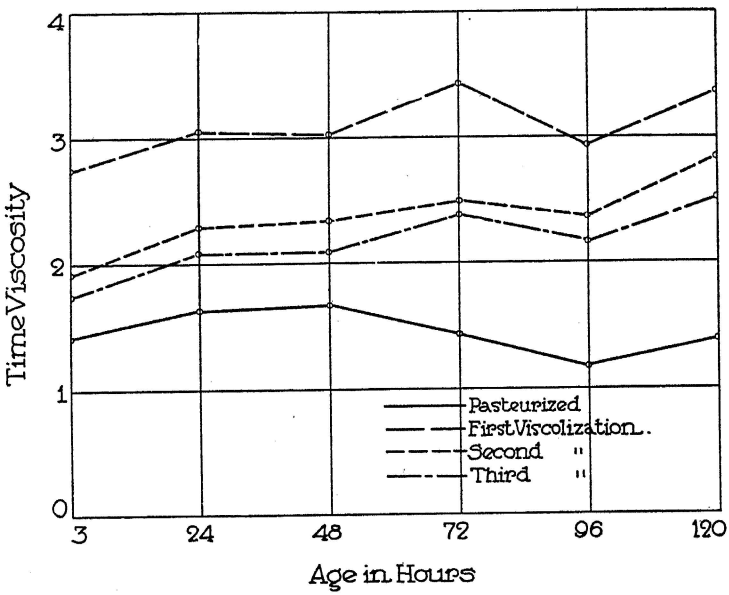

Fig. 3.—The Viscosity of Aged Mixtures as Affected by Successive Viscolizations.

The data presented in Table 8 show that in each series the greatest increase in the viscosity was during the first 24 hours aging. The processed series reached a maximum viscosity at 72 hours age, while the unprocessed series reached maximum viscosity at 48 hours age. The percentage increase of each re-processed series was greater than the percentage increase of the series processed once.

Figure 3 illustrates the viscosity curve of each series as affected by processing. The curve for each viscolization follows the same general trend, but varies some in individual increases. The difference in time viscosity between the first and second viscolization was greater than that of the second and third.

Figure 4 illustrates graphically the effect of each processing during aging. The persistency of the effect of each processing was great enough to hold during aging.

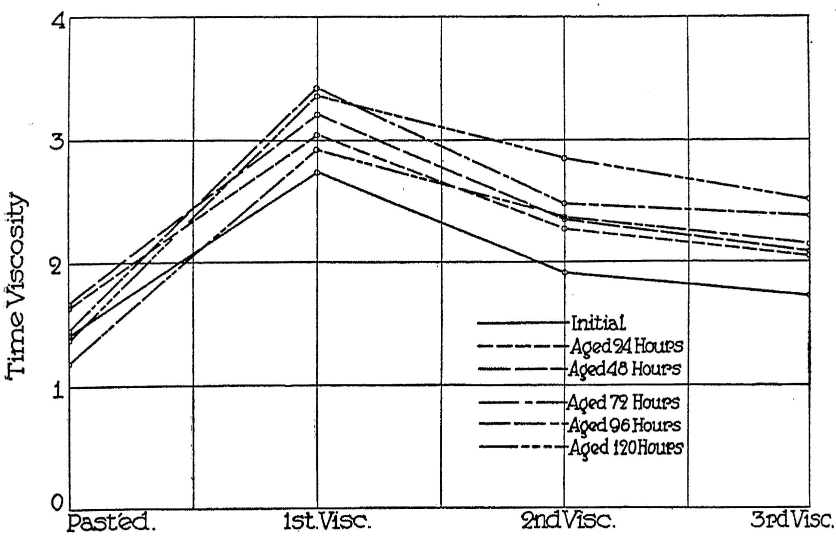

Fig. 4.—The Relation of Successive Viscolizations and the Viscosity of the Mixtures Aged for Varied Periods of Time.

TABLE 9.—THE EFFECT OF PROCESSING ON THE BACTERIAL COUNT

	Average	Percentage increase or decrease over initial count
Pasteurization at 76.6°C. 20 minutes	29,888	------
First viscolization	42,638	+46.0
Second viscolization	51,250	+71.5
Third viscolization	No sample	------

Due to the difficulty of collecting samples before going over the cooler, samples were not taken for bacteriological analysis after the third viscolization. Each successive processing gave an increase in the plate count. This increase was probably due to the breaking up of clumps of organisms. The results are shown in Table 9.

The increase in the number of bacteria while freezing was fairly uniform. This very slight increase is probably due to the agitation of the dasher in breaking up of clumps of organisms and would indicate that the viscolizing pressure applied was effective in disintegrating the large clumps of organisms. Table 10 gives the results obtained.

TABLE 10.—THE EFFECT OF FREEZING ON THE BACTERIAL COUNT

Process	Mixture after aging	Time exposed to freezing temperature in freezer				
		2 Minutes	4 Minutes	6 Minutes	8 Minutes	10 Minutes
First viscolization	58,833	61,866	59,833	60,833	67,666	50,750
Second viscolization	46,500	54,125	51,500	53,125	53,666	54,125
Third viscolization	56,222	66,222	64,222	64,999	62,122	67,277

The placings of the viscolized ice cream is given in Table 11. Sixty per cent of the samples viscolized a third time, 30 per cent of the samples viscolized a second time, and 10 per cent of the samples viscolized one time placed first. The samples placed second consisted of 30 per cent viscolized a third time and 70 per cent of the samples viscolized a second time. Ninety per cent of the samples viscolized only one time placed third. Ninety per cent of the samples placing first and 100 per cent of the samples placing second had been reviscolized.

TABLE 11.—PLACEMENT OF THE PROCESSED ICE CREAMS AS SCORED

Number of Mixture	First	Second	Third
1	I	II	III
2	III	II	I
3	III	II	I
4	II	III	I
5	II	III	I
6	III	II	I
7	III	II	I
8	III	II	I
8	II	III	I
10	III	II	I

REPROCESSING WITH A HOMOGENIZER

A Gaulin homogenizer was used for processing this series of mixtures.

The results of the viscosity determinations are recorded in Table 12.

The series homogenized one time showed an average increase of 50.9 per cent in viscosity as compared with the unprocessed series. Homogenizing a second time increased the viscosity 9.0 per cent over that of the unprocessed series, but decreased the viscosity 38.3 per cent when compared with the series homogenized once. A third homogenization increased the viscosity 5.9 per cent over the unprocessed series, but decreased the viscosity 42.4 per cent and 3.0 per cent respectively when compared with the first and second homogenizations. There was a marked similarity between the viscolized and the homogenized series. In each case, the first processing increased the viscosity but each succeeding

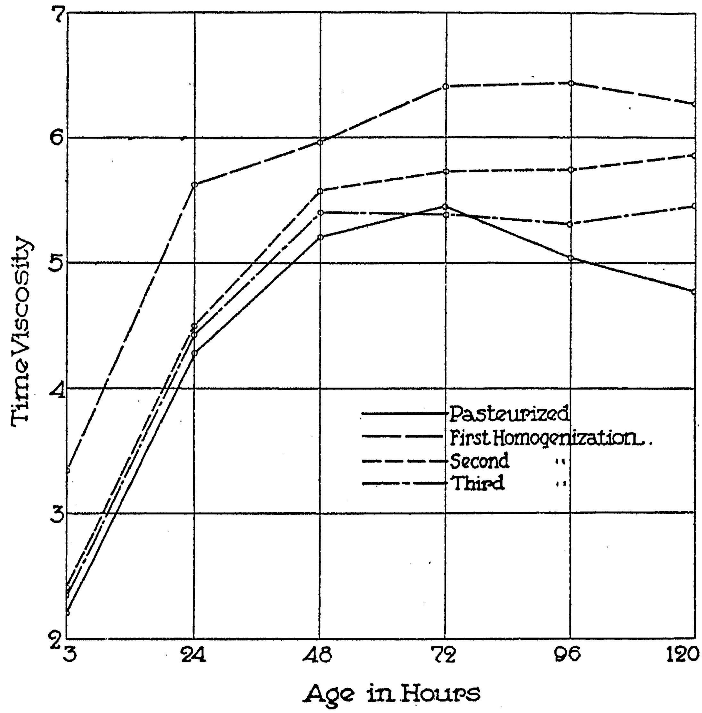

Fig. 5.—The Viscosity of Aged Mixtures as Affected by Successive Homogenizations.

TABLE 12.—TIME VISCOSITY OF THE MIXTURES

Process	Aged 3 hours Initial	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 65.5°C. 30 minutes	2.20	4.25	5.20	5.45	5.04	4.78
First homogenization	3.32	5.62	5.96	6.41	6.44	6.30
Second homogenization	2.40	4.49	5.58	5.73	5.75	5.88
Third homogenization	2.33	4.43	5.40	5.39	5.31	5.46

processing gave a marked decrease in the viscosity. The decrease between the first and second processing was greater than the decrease between the second and third.

The data in Table 13 indicates that there is a close relation between the initial viscosity and the percentage increase during aging; the lower the initial viscosity the greater the percentage increase. However, this increase was never great enough to bring the viscosity of the low series up to those having a high initial viscosity.

TABLE 13.—PERCENTAGE INCREASE OVER THE INITIAL VISCOSITY

Process	Aged 24 hours	Aged 48 hours	Aged 72 hours	Aged 96 hours	Aged 120 hours
Pasteurized at 65.5° C. 30 minutes	94	136	147	129	117
First homogenization	69	79	92	94	89
Second homogenization	87	132	136	140	145
Third homogenization	90	131	131	128	134

Table 14 shows that each processing seems to increase the plate count. The decrease in the series homogenized a third time may be due to the length of time required for re-processing.

TABLE 14.—THE EFFECT OF PROCESSING ON THE BACTERIAL COUNT

	Average	Percentage increase or decrease over initial count
Pasteurized at 65.5°C. 30 minutes	10,468	------
First homogenization	10,600	+1.2
Second homogenization	12,400	+17.7
Third homogenization	7,740	-35.2

Freezing, as shown in Table 15, seemed to have no direct effect on the bacterial count which would indicate that the homogenization of the mixture was thorough in disintegrating the groups of different organisms. The first series gave a slight increase in the plate count, while the second and third series showed a very slight decrease. The increase in the first series may be due to breaking up of clumps of organisms.

Figure 6 illustrates the effect of each processing on the viscosity during the aging. The effect of each processing held throughout the aging period.

TABLE 15.—THE EFFECT OF FREEZING ON THE BACTERIAL COUNT

Process	Mixture after aging	Time exposed to freezing temperature in freezer				
		2 Minutes	4 Minutes	6 Minutes	8 Minutes	10 Minutes
First homogenization	14,100	15,900	15,940	17,200	17,300	17,470
Second homogenization	13,230	11,222	11,700	12,160	11,600	12,400
Third homogenization	13,820	9,210	8,720	7,800	9,620	9,000

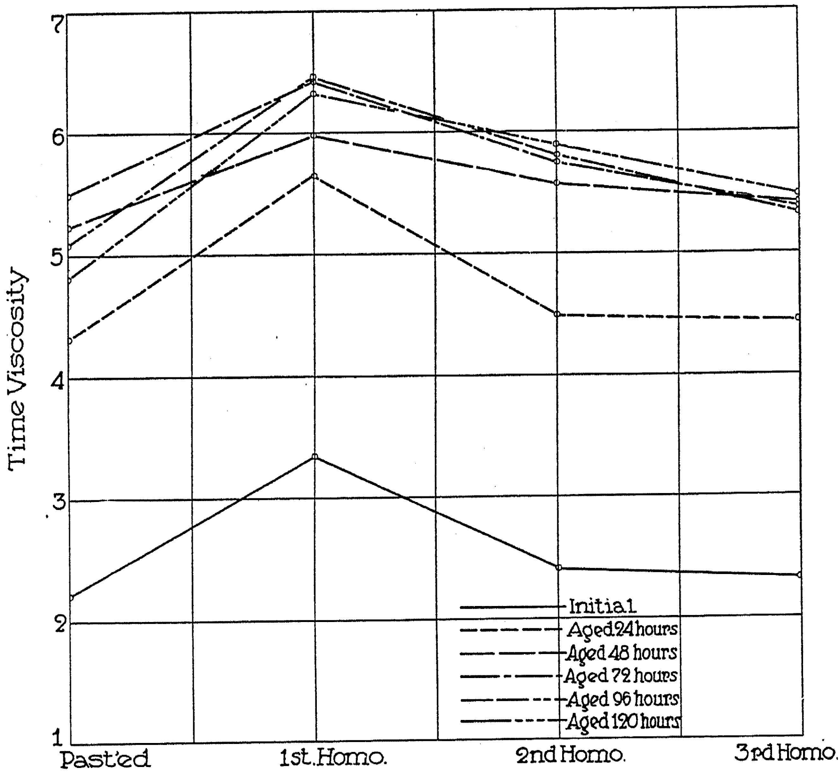

Fig. 6.—The Relation of Successive Homogenizations and the Viscosity of the Mixtures Aged for Varied Periods of Time.

The homogenized samples were all judged to be good ice cream and the difference between the homogenizations was not marked. Fifty percent of the mixtures homogenized a third time placed first, 30 per cent second, and 20 per cent third. The mixtures homogenized a second time, placed 30 per cent first, 50 per cent second, and 20 per cent third. The mixtures homogenized once, placed 20 per cent first, 20 per cent second, and 60 per cent third. The placings are shown in Table 16.

TABLE 16.—PLACEMENT OF THE PROCESSED ICE CREAM

Number of Mixtures	First	Second	Third
1	III	I	II
2	II	I	III
3	I	II	III
4	II	III	I
5	III	II	I
6	I	III	II
7	III	II	I
8	III	II	I
9	III	II	I
10	II	III	I

Table 17 shows that the fat and total solids content were controlled very closely. The data of the homogenized mixtures gave results which were comparable to the determinations of the viscolized mixtures. This is especially true of the viscosity determinations.

TABLE 17.—ANALYSIS OF MIXTURES

Number of mixture	Fat (percentage)	Total solids (percentage)
1	12.0	35.0
2	12.0	35.0
3	11.8	35.0
4	12.0	34.5
5	12.0	36.0
6	12.2	36.0
7	12.0	35.0
8	12.0	35.4
9	11.8	35.2
10	12.0	35.0

DISCUSSION OF RESULTS

The re-emulsification, re-viscolization, and re-homogenization gave a marked increase in the viscosity as compared with the unprocessed mixtures. Each successive emulsification gave a still further increase in the viscosity, while each succeeding viscolization or homogenization gave a marked decrease in the viscosity. The decrease between the first and second was greater than the decrease between the second and third processings. The increase in the viscosity with each successive emulsification was probably due to the low pressure to which the mixture was subjected in passing through the apertures of the emulser bowl. The efficiency of three emulsifications in dispersing the fat globules into the serum is probably not as great as when viscolized or homogenized one time. The cause of the decrease in the viscosity due to reprocessing with a viscolizer or homogenizer is not well understood and a study of this particular phase of the problem is being continued.

Each successive processing tended to increase the bacterial content excepting in a few instances when a decrease was observed which was probably due to the extended time of holding the mixture at the pasteurization temperature awaiting reprocessing. The increase may have been due, in part, to the disintegration of the clumps of organisms when exposed to higher pressure.

Samples of ice cream taken intermittingly from the freezer during the freezing process indicated a slight increase in the plate count. The reprocessed mixtures did not show as great an increase as the mixture processed but one time. The increase in the plate count during freezing was thought to be apparent rather than real and caused by the breaking up of groups of organisms.

In each series a majority of the samples of the finished ice cream which were placed first by the judges, had been reprocessed. The improvements between the first and second processings was more pronounced than the improvement when the mixtures were processed but one time. When the placings of the finished ice creams are compared with the viscosity reports in Tables 1, 7, and 12, it is observed that in the emulsified series, the samples having the highest viscosity placed first, while in the viscolized and homogenized series the samples having the lowest viscosity were given the highest rating. These results are somewhat contrary to the belief of many ice cream makers who consider a high viscosity as the important factor in making good ice cream. The results presented in this paper indicate that a maximum dispersion of the fat glubules is of more importance than a high viscosity.

The butterfat and total solids content of all mixtures was uniform.

SUMMARY AND CONCLUSIONS

1. The emulsification, viscolization, or homogenization of ice cream mixtures causes an increase in the viscosity as compared to the viscosity of unprocessed mixtures.

2. Re-emulsification of ice cream mixtures a second and a third time gives an increase in the viscosity with each successive processing.

3. A second and third viscolization or homogenization decreases viscosity of ice cream mixtures. The cause of this decrease is not known.

4. Each successive processing increases the bacterial content. This increase is thought to be due to the breaking up of the groups of organisms.

5. The freezing of the mixtures tends to give a slight increase in the bacterial count which is believed to be due to the disintegration of clumps of organisms.

6. After the pasteurization of ice cream mixtures, each subsequent operation tends to increase the number of bacteria.

7. Reprocessing ice cream mixtures does not increase the bacterial count enough to be of commercial importance.

8. Reprocessing ice cream mixtures improves the body and texture of the resulting ice cream.

9. A maximum dispersion of the butterfat into the serum seems to be more important in producing a high quality of cream than the viscosity of the mixture.

10. Reprocessing an ice cream mixture gives a product that can be cared for with greater ease and less mechanical loss.

11. Reprocessing the ice cream mixture is a practice to be recommended wherever ice cream is sold on a quality basis.

12. An ice cream mixture which has been reprocessed shows a greater increase in viscosity during aging than a mixture which has been processed but one time.

13. Ice cream mixtures, when processed, reach their maximum viscosity when aged from 72 to 96 hours. Reprocessing of the mixtures does not seem to alter the time when the maximum viscosity is obtained.

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