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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in the transactions.

Milwaukee Calling

THE old Indian village of "Millioke", good lands, is now the great city of Milwaukee, with population of over 600,000 persons. Industry, health, culture, sports, all have produced this metropolis of Wisconsin. The fine Wisconsin Milk Sanitarians' Association, under the splendid leadership of Dr. Weckel, and the Local Committee under the efficient direction of Mr. Kleffen are arranging a program of professional interest, recreation, and entertainment that has the cordiality and warmth of the western spirit. Western! (That reminds us of the Boston boy, several years ago, who was advised to go west, so he went to —Albany.) Anyhow, Milwaukee is west to a lot of milk and food sanitarians who ought to get themselves exposed to the western spirit. What is the western spirit? Well, it is hard to define, but it surely does something to the fellow who lets himself feel it.

Are you pressed with many cares? Come on to Milwaukee.

Do you feel that you are in a blind alley? Expose yourself to the Milwaukee spirit.

Do you want a fresh outlook on your work? Catch this at Milwaukee.

Do you want to bring yourself up to date in your field? Do it at Milwaukee.

Do you want the fellowship of kindred minds in your profession? You'll have it at Milwaukee.

Do you want to meet old friends, make new ones, and encourage others who need the help that you can give? Milwaukee is your opportunity.

J. H. S.

There Is No Good Reason for Further Delay

IN the main, the agar plate count maxima for milk and milk products legally fixed in milk control ordinances and regulations were predicated upon a compromise between ideal and practically attainable plate count ranges, determined by the procedure prescribed in the Seventh Edition of *Standard Methods for the Examination of Milk and Milk Products,* or in preceding editions. Prior to 1939, the legal maxima for plate counts had been progressively lowered, as production methods and pasteurization efficiency improved, until upper limits of 50,000 per ml. for retail raw milk, 200,000 per ml. for milk for pasteurization, and 30,000 per ml. for pasteurized milk had become widely recognized as readily avoidable maxima. Upper limits for microscopic counts, and lower limits for reduction times, presumably delimiting milks of parallel quality, were based upon the former two of the foregoing plate count limits.

The Eighth Edition of *Standard Methods for the Examination of Dairy Products* prescribed a fortification of the culture medium, and permitted an option in the temperature of incubation—37° C. or 32° C. The addition of tryptone and skim milk to the agar, and incubation at 32° C., separately or together, promote the formation of visible colonies on the culture plates, so that the "counts" tend to be increased. Thus, milks the counts of which would fall within the limits fixed on the basis of Seventh Edition examination procedure might not conform to those standards when examined by Eighth Edition procedure. The fortification of the culture medium resulted, therefore, in the raising of the plate count standards for bacterial content, although the legally-fixed upper limits for plate counts (and for other measures of bacterial content) remained unchanged.

A rather generally recognized condition, the cause of which has not been so widely understood or realized, resulted from the employment of this improved bacterial culture medium, while plate count ceilings fixed on the basis of less prolific culture methods remained unchanged. As a consequence, the presumptive bacterial quality of many milk supplies has, for nearly a decade, been substandard—that is, the counts have exceeded, in far too many instances, the legally-fixed ceilings. This situation has frequently been charged to producer indifference, to shortages of supplies of detergent and bactericide and of necessary equipment replacements, or to other conditions which might have been locally prominent. In the last analysis, however, the responsibility for the slump in the bacterial quality of milk supplies rested squarely upon the shoulders of the milk sanitarian.

Now the curtain is about to rise on the second act of the drama. The Ninth Edition of *Standard Methods for Dairy Products,* soon to be published, prescribes the incubation of culture plates at 35° C. The general tendency of this provision will be to reduce to a minimum the possibilities for increases, of relatively short duration, in the incubation temperature to a point at which bacterial reproduction is inhibited, or (expressed differently) to provide a temperature more nearly the optimal for uninterrupted bacterial reproduction. (In every-day language, the object is to reduce the chances for the occasional encouraging—but false—low count.) Of course, the net results will be, in most instances, higher colony and computed plate counts.

The Committee on Standard Methods for Dairy Products has recognized its responsibility for the general effect of its improvements in agar plate technic; and, realizing that maximum limits for bacterial content determined by other procedures are largely predicated upon the presumed relationships between their results and plate counts, has stated in its report* that "Administrators should, therefore, modify enforcement procedure until the industry has been able to adjust itself to the more severe requirements."

It must be obvious that administrators who are on the defensive because milk supplies do not fall within plate count limits fixed by ordinance or regulations are not in the best position to "modify enforcement procedures". Is any administrator currently prepared to fix—or even to estimate—the plate count equivalent, by Ninth Edition procedure, of a limit fixed by ordinance on the basis of Seventh Edition Procedure?

With the application of Ninth Edition of *Standard Methods for Dairy Products* procedures for plate counts to fluid milk supplies, milk sanitarians and milk producers and distributors will encounter an aggravation of the existing situation. The remedy does not necessarily consist of an increase in pressure upon producers and distributors (this is not to imply that further improvement in milk quality is not possible). The remedy lies, rather in the correction of the fixed bacterial content limits in milk ordinances and regulations, to compensate for increases in plate count which result from improved laboratory technic, and which also affect the limits by other procedures.

Such a remedy should be founded upon sound data. A mass study of the comparative counts obtained by plating duplicate portions of samples by Seventh Edition and by Ninth Edition procedures should be undertaken by every milk sanitarian and milk distributor with available laboratory facilities. If a clearing-house of the data obtained is established, and the data are carefully analyzed and integrated, it should be possible to determine the nature and extent of the changes which need to be made in the fixed bacterial content limits in milk ordinances.

There is no good reason for further delay in this needed reform.

C. A. A.

Any data collected may be sent to the Editor, this Journal, who will forward it to Mr. Abele.

Let's Applaud Achievement

RECENTLY, the American Public Health Association has announced (by circularization to fellows and members of the Food and Nutrition Section) that an award has been established for administration by that section for meritorious achievement in the nutrition field. Thus a new opportunity is accorded for applauding the work of our colleagues. Why?

Well, in the first place, it is eminently proper to say "thank you" to anyone who has conferred a favor. We all know that scientific achievement does not spring "full orbed from the mind of Jove." It stems from hard work, self sacrifice, and personal victory over discouragement, frustrations, and obstacles of many varieties. It means vision realized, objectives pursued, hopes achieved. No hope of receiving money or a medal or even a hand-clap spurred its endeavor. It seeks no reward other than the joy of accomplishment. (If any reader doubts this, let him try to get a research staff to write up their results or professional people to submit manuscripts for an annual meeting program or

* Report of the Joint Editorial Committee for *Standard Methods for the Examination of Dairy Products*, *Amer. J. Pub. Health*, June, 1947, p. 755.

for publication!) No, the researcher saw a need; he acted to meet it; he followed through.

Our professional colleagues have set up awards in many fields. This new one in nutrition motivates us again to urge the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS to interest themselves in this kind of thing. Surely, technology is just as important as fundamental science. If the latter is not applied to our life and times, it lies buried in books and scientific journals, known to only a favored few. Breaking into routine practice by showing present obscureness of interpretation or inaccurate operation or limitations to our knowledge of why we do what we do, all these require a depth of knowledge, a sureness of technique, and a scientific type of mind which is the equal in value (to humanity) of the purely research type. Inasmuch as we give a cup to the winner of a race, why not give a medal to the man who presents a new idea? We cite brave acts of life-saving and military accomplishment, why not do as much when life is saved and living is made healthier?

The only objections to such a program with which this writer is cognizant are the means and the occasion: the means being the financial support, and the occasion, the actual achievement. We believe that the financial means can be located when a policy of recognizing achievement is adopted.

We are so close to much in the field of milk and food sanitation that we do not recognize some of the great advances. Take the ice cream industry for example. Ice cream used to be merely a dessert, served at weddings, Fourths of July, and at most quite rarely. Look at the situation now—a huge industry. How come? A man's vision, knowledge, interest.

Look at the phosphatase test! We have sought such a procedure for years. Now behold its refinement and application! All this did not just happen. Again, a man.

Then again, the examination of milk. What has this technique done for industry, public health, laboratory procedure! A man again!

Pasteurization precision, regulatory revolution, disease diagnosis and control, nutritional advance—all these and more have been developed within the recent memory of all of us. And we have never said even, "Thank you."

J. H. S.

Make room reservations now for the thirty-fourth annual meeting.
Hotel Schroeder, Milwaukee, Wisconsin, October 16–18.

A Study of the Germicidal Efficiency of Can Washing Compounds

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INTRODUCTION

THERE has been an abundance of fundamental work reported in the literature relating to the germicidal efficiency of alkaline washing compounds and their individual component salts. The work of Levine and his associates (1927, 1931, 1942), Sherman (1927), Meyers (1927), and Phillips, Mack, and Frandsen (1928) relate specifically to this problem. In addition, the work conducted by a number of manufacturers of cleaning compounds and the research supported by them has added greatly to our information on the subject. Within the past several years there have been a large number of reports in the literature relating to the cleaning and germicidal efficiency of acidic mixtures or acid cleaners. The principal contributions on acid cleaners have been made by Parker (1940, 1941, 1943), Scales (1940, 1942) and Schwarzkopf (1942). No attempt has been made here to review completely the literature relating to the germicidal efficiency of alkaline and acid cleaners.

A study of the dairy laws of a number of states show that for can washing an alkalinity of 0.05 to 0.10 percent as Na_2O is recommended. Preliminary work using alkaline solutions at the recommended concentration indicated that the concentration of the alkali was too low to provide any germicidal action. In view of these facts and the large expenditure involved in can washing, it seemed most desirable to investigate this operation.

EXPERIMENTAL

In establishing a procedure for the evaluation of the germicidal efficiency of various can washing compounds, it was thought desirable to conduct the investigation under plant conditions with incoming milk cans. In the past, emphasis has been placed on the visual observation of cans as an index of the cleaning efficiency of a particular can washing compound. Since the visual examination of the inside of a can does not reveal the bacterial flora, it was felt that periodic can rinse counts as suggested in *Standard Methods for the Examination of Dairy Products* (1941) would give a more reliable index of can washing efficiency. The visual examination of cans was employed only as an auxiliary method in the study.

The first part of the investigation was devoted entirely to the daily study of the operation of the twelve can per minute straight-away can washer employed in the milk receiving operation. With the aid of a positive displacement pump, which injected a measured quantity of concentrated solution of the can washing compound into the wash tank, a constant alkalinity was maintained. To minimize contamination of the wash solution by milk solids and extraneous matter, approximately one-half pint of wash solution per can washed was permitted to overflow from the wash tank. By means of a float control valve, fresh water

[1] Now associated with The Wm. S. Merrell Company Cincinnati 15, Ohio.

was fed automatically into the rinse tank which, in turn, overflowed into the wash tank to replace the volume lost. The wash solution, rinse water and hot air temperatures were mechanically controlled. The alkalinity and temperatures were checked hourly during the daily can washing operation to determine the constancy of these factors. The alkalinity was maintained at the recommended level of 0.05 to 0.10 percent as Na_2O. This temperature of the wash tank solution and rinse water was maintained from 140° to 150° and 180° to 190° respectively and the hot air from 250° to 270° F.

The alkalinity of the wash and rinse tank solutions was determined by titrating 10 ml. of the solution with 0.3226 N HCl using phenolphthalein as the indicator. This normality of HCl was used in order that the percent alkalinity as Na_2O could be read directly on a Nafis burette. If phenolphthalein is used as an indicator instead of methyl orange, the change from a pink-red to a colorless solution when a titration is made indicates the amount of sodium oxide available above pH 8.2. Manufacturers of alkalies refer to the percent Na_2O determined in this manner as the "active alkalinity" of an alkali.

It was felt that can-rinse counts made at periodic intervals on the same group of cans would be more significant than can-rinse counts on washed cans chosen at random from the can line. Approximately 130 cans were chosen from one milk route. Each patron had a duplicate set of cans so that each day approximately 65 cans of milk were received. For this reason, can-rinse counts were made on two successive days each week. The cans were coded with a heat and alkali resistant paint so that each can could be individually identified and a record maintained. This particular group of cans was chosen because it represented a good cross-section of the 3000 cans washed daily in the receiving operation. The cans were visually inspected before and after the test period for any particular can washing compound.

The can rinsing machine and the method of rinsing as described in *Standard Methods for the Examination of Dairy Products* (1941) was employed. After each can was rinsed, the rinse water was transferred to a wide mouth sterile bottle and plated in duplicate transferring 1 ml. and 0.1 ml. of the rinse solution to Petri plates. Difco tryptone glucose extract skimmilk agar was used in pouring one set of plates while a special thermophilic agar was used in the duplicate set. The plates were incubated at 98.5°F. (37°C.) and 131°F. (55°C.) respectively for 48 hours and then counted. Proteolytic types of colonies were counted separately when present in appreciable numbers.

Considerable thought was given to the standards to be followed throughout the survey. *Standard Methods* suggests that "cans and covers developing not more than 40,000 colonies per 40 quart can, 20,000 per 20 quart can, 10,000 per 10 quart can, or 5,000 per 5 quart can as determined by the method described are generally considered to be satisfactory." It would be most desirable to have cans bacteriologically sterile; this, however, is rather a stringent standard for mechanical can washing. For this study an arbitrary standard was used; *i. e.*, standard rinse counts should not exceed 10,000 colonies per can and all cans should be practically free of thermophilic organisms.

When this phase of the study was completed, several manufacturers of can washing compounds were contacted and materials for can washing tests were obtained. Thereafter, can-rinse counts were made each week on the test cans to determine the germicidal efficiency of any particular can washing compound. The test period ranged from five to ten weeks for each material under test. In all, six alkaline and one acid can washing compound were studied.

RESULTS

The first can washing cleaner employed was a simple mixture originally proposed by Phillips, Mack, and Frandsen (1928) and composed of 60 percent sodium carbonate (Na_2CO_3) and 40 percent tri-sodium phosphate ($Na_3PO_4 \cdot 12H_2O$). An alkalinity of 0.05 to 0.10 percent as Na_2O was maintained in the wash solution tank, as generally recommended. Can-rinse counts made on the test group of cans over a two week period showed that little to no germicidal power was exhibited by the alkaline wash solution. When the alkalinity of the wash solution was increased and maintained at 0.15 to 0.20 percent as Na_2O, the can rinse counts were materially lowered. The results are shown in table 1.

TABLE 1

GERMICIDAL ACTION OF A SODIUM CARBONATE AND TRI-SODIUM PHOSPHATE WASH SOLUTION

	Wash Tank Solution				*Rinse Tank Solution*						Av.
Date	Alk. % Na_2O	Temp. °F.	Std. Plate count per ml.	Therm. count per ml.	Alk. % Na_2O	Temp. °F.	Std. Plate count per ml.	Therm. count per ml.	No. cans	Av. can rinse count	Therm. can rinse count
Feb. 26	0.05-0.10	140	3000	500	0.02	195	1300	300	125	1,200,000	500,000
Mar. 2	0.05-0.10	150	2500	2000	0.02	195	6000	100	125	1,000,000	500,000
Mar. 24	0.15-0.20	150	1200	1000	0.03	185	400	100	120	500,000	100,000
Mar. 30	0.15-0.20	140	500	1000	0.02	195	100	0	125	40,000	10,000
Apr. 9	0.15-0.20	150	1300	100	0.03	200	300	100	125	10,000	3,000

The use of a can counter on the washer and the record of the exact amount of cleaning compound used in the washer, permitted the estimation of the cost of washing 1000 cans at the alkalinity levels employed. The average cost of washing 1000 cans at the lower alkalinity level was $0.30 while at the higher alkalinity level, the cost was $0.70.

The importance of increasing the alkalinity of the wash solution was further emphasized in the study of a cleaner containing a high percentage of complex phosphates and recommended for use at a low alkalinity. The results shown in table 2, reveal a gradual increase in both the standard can-rinse count and the numbers of thermophiles over a thirty day test period. The average can-rinse count at the start was 47,000 and the average thermophilic can-rinse count 9,000. The can-rinse counts increased from week to week until the average can-rinse count was 509,000 and the average thermophilic count 88,000. It was notable that the majority of colonies appearing on the standard can-rinse count plates at the end of the test period were proteolytic.

Fortifying the complex phosphate cleaner with caustic soda (NAOH) so that the alkalinity of the wash solution was increased from 0.05-0.10 percent to 0.15-0.20 percent as Na_2O resulted in a gradual decrease in the can-rinse counts over a nine day period. The increase in alkalinity likewise resulted in a gradual decrease in the numbers of the proteolytic types of organisms. The complex phosphate cleaner with the added caustic soda was then replaced with the regular cleaner which was used at the higher alkalinity level for one week. This resulted in a further decrease in the can-rinse counts and the diminution of proteolytic types of organisms.

Sherman (1927) found that certain washing powders were not sufficiently alkaline to be germicidal although they were good cleaners. This appeared to be the case with the cleaner

TABLE 2

RELATIONSHIP OF ALKALINITY (%Na_2O) TO GERMICIDAL EFFICIENCY

Date	Cleaner	Alk. of wash solution % Na_2O	Average std. can-rinse count	Average thermophilic can-rinse count
Sept. 29	Complex phosphate	0.04-0.06	47,000*	9,000*
30	base	"	58,500	2,000
Oct. 5		"	63,000	9,300
6		"	70,000	6,000
7		"	123,000	11,400
12		"	217,000	71,000
13		"	341,000	134,000
14		"	164,000	56,000
20		"	103,000	20,000
21		"	60,000	22,000
27		"	133,000	28,000
28		"	509,000	88,000
Nov. 9	Complex phosphate	0.15-0.20	437,000	173,000
10	base plus 5% caustic	"	255,000	107,000
17	soda (NaOH)	"	132,000	38,000
18		"	110.000	19,000
23	Regular cleaner	0.15-0.20	72,000	7,000
24	sodium carbonate	"	37,000	3,500
Dec. 1	tri-sodium phosphate	"	39,000	1,000

*Each average represents 35-65 individual can rinse counts.
Wash solution — Temperature 140-150° F. Average standard plate count 500 per ml.
Rinse water — Temperature 180-190° F. Average standard plate count 100 per ml.
Hot air — Temperature 250-270° F.

containing a high percentage of complex phosphates. It was an excellent cleaner and chemically removed lime and milkstone deposits after several days use in the can washers. It might be assumed that the increase in the can-rinse counts was due to the chemical removal of the lime and milkstone deposits from the inside surfaces of the cans and the resultant liberation of organisms from the deposits. If this assumption were true, new milk cans free from lime or milkstone deposits should be sterile or near sterile after being washed with the cleaner, providing the cleaner exerted any germicidal power. Ten new milk cans were acid treated, hand-washed with an alkaline cleaner, rinsed and then chlorinated. Can-rinse counts showed that the cans were sterile. The cans were filled with raw milk, placed in a water cooler, and held overnight to simulate farm conditions. The following morning the cans were emptied and washed in the can washer. In this particular experiment, a thermostatically controlled sterile rinse (clear water at 200°F.) was used on the washer as an added precaution. Can-rinse counts were made on each can and the procedure repeated daily. Variations were made in the cleaner and alkalinity level. The results are shown in table 3.

The results show that the cleaner under test lacked germicidal power at the low alkalinity level recommended in its use for can washing. The cleaner possessed excellent cleaning properties but was not sufficiently alkaline at the recommended concentration to exert any germicidal action despite the fact that new cans, free of any deposit, were used. When the alkalinity was raised from a range of 0.05-0.10 percent to 0.15-0.20 percent as Na_2O by the addition of caustic soda there was a decided decrease in the can-rinse counts. The use of the regular highly alkaline cleaner composed of soda ash and tri-sodium phosphate further lowered the can-rinse counts.

In regard to the other alkaline can washing powders tested under the same conditions, the results obtained, likewise indicated that their germicidal efficiency was definitely related to the alkalinity level (percent Na_2O) at which they were used in the wash solution.

In the survey only one acid cleaner was tested. The wash solution was charged with the acid cleaner to a pH of 6.0 to 6.5. However, preliminary electrometric pH determinations of the wash solution revealed that the acid was dissipated in a few minutes and the pH of the wash solution was on the alkaline side of neutrality. The washed cans were slightly alkaline in reaction and as a result the germicidal property was decreased. The hardness of the water employed ranged from 30 to 35 grains per gallon. Apparently, the acid in the cleaner had been neutralized by the calcium and magnesium salts in the hard water.

When both the wash solution and rinse water were further acidified and the acidity maintained with a special feeding apparatus so that the cans were acid in reaction after drying, satisfactory rinse counts were obtained. However, acidifying both the wash and rinse tanks doubled the cost of the operation.

TABLE 3

RELATIONSHIP OF CLEANING PROPERTIES TO GERMICIDAL EFFICIENCY AND THE EFFECT OF ADDED ALKALINITY WHEN TESTED ON NEW CANS

Date	Cleaner	Alkalinity wash solution % Na_2O	Average std. can-rinse count	Average thermophilic can-rinse count
Nov. 1	Complex phosphate	0.06	292.000*	88.000*
2	base	0.07	267.000	96 000
3		0.06	320,000	95,000
4		0.10	288.000	95,000
5		0.07	414.000	109 000
6		0.05	496,000	51 000
8	Complex phosphate	0.15	390 000	59.000
9	base plus 5% caustic	0.19	50.000	5 000
10	soda (NaOH)	0.15	101.000	19 000
11		0.15	76.000	5,000
12		0.13	79,000	6.000
13		0.17	195,000	20.000
17		0.18	51.000	1.000
18		0.15	13,000	2,000
19		0.15	16.000	2,000
29	Regular cleaner	0.19	8.000	400
30	sodium carbonate	0.19	7,000	900
Dec. 1	tri-sodium phosphate	0.15	4,000	400

*Each average represents 10 individual can rinse counts.
Wash solution — Temperature 140-150° F. Average standard plate count 500 per ml.
Rinse water — Temperature 180-190° F. Average standard plate count 100 per ml.
Hot air — Temperature 250-270° F.

DISCUSSION

The intent of the study was to improve the efficiency of the washing of milk cans so that they would be relatively free of microorganisms. It was noted that in several instances little to no germicidal action was exhibited by the wash solution used in washing the cans and as a result they were heavily contaminated with bacteria. As a result of this observation, studies on the germicidal properties of a number of can washing powders were initiated.

The wash solution alkalinity recommended for can washing by most manufacturers of washing powders and by a number of state dairy statutes is 0.05 to 0.10 percent as Na_2O. With some alkaline can cleaners alkalinities even lower than this range are recommended. Can rinse counts made over an extended period of time on a coded set of 120 to 130 cans washed with alkaline solutions of six cleaners at various alkalinity levels showed that little to no germicidal action was exhibited at an alkalinity of 0.05 to 0.10 percent as Na_2O. When the alkalinity was increased to 0.15 to 0.20 percent as Na_2O with two of the cleaners the germicidal efficiency was increased. These results confirm those of Sherman (1927) who reported that certain washing powders tested were not sufficiently alkaline to be germicidal although they were good cleaners. This was confirmed in the case of one can washing powder which was an excellent cleanser but lack germicidal properties because of its low alkalinity. Raising the alkalinity by the addition of caustic soda increased its germicidal properties. For the purposes of the experiment, caustic soda was employed although other compounds may be added to increase the alkalinity. In compounding cleaners for can washing and other purposes, the properties of cleansing and germicidal efficiency should be considered carefully in addition to rinsability, wetting, emulsification, water conditioning, etc. Since no disinfectants or germicides are routinely employed in the mechanical washing of cans the problem of a highly germicidal cleaner becomes most important. Too much dependency should not be placed on the temperature of the rinse water, sterile rinse and temperature of the steam and hot air for drying.

A study of one acid can washing compound revealed that the type of water employed in the operation must be given careful consideration. Where hard water is employed the calcium and magnesium salts rapidly neutralize the acid so that it is removed from active participation in the cleaning operation.

SUMMARY

1. A study of the germicidal efficiency of six alkaline and one acid can washing compounds was made on a coded set of milk cans over an extended period of time.

2. At the recommended alkalinity level of 0.05 to 0.10 percent as Na_2O, little to no germicidal action was exhibited by any of the cleaners.

3. When the alkalinity level of the wash solution was increased to 0.15 to 0.20 percent as Na_2O with two of the cleaners, the germicidal efficiency was markedly increased.

4. The study of an acid can washing compound revealed that the acidity of the wash solution was rapidly neutralized by the calcium and magnesium salts of the hard water and the cans were found to be alkaline in reaction. When the amount of acid cleaner was maintained at a point so that the washed cans were acid, there was an increase on the germicidal property.

ACKNOWLEDGMENTS

The authors wish to thank the officials of the Pet Milk Company for releasing this report for publication and especially Dr. E. A. Louder, Technical Director, for his helpful suggestions and guidance.

(Continued on page 299)

A Study of the Corrosion of Tin Plate by Can Washing Compounds

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INTRODUCTION

ALTHOUGH the problem of corrosion of producers' milk cans by cleaning materials has been recognized for many years, few specific investigations relating to the problem have been presented in the literature. General studies dealing with the attack on a variety of dairy metals by numerous alkalies, strong and weak acids, and other materials have been conducted by Hunziker, Cordes, and Nissen (1929), Prucha (1930), and Parker (1940, 1942). Unfortunately, only a limited amount of data directly related to the factors affecting corrosion of tin plate were presented by these investigators.

For the most part, experiments specifically concerned with corrosion of tin and tin plate have been limited primarily to those performed by the English workers, Kerr (1935, 1940), Hoar (1934, 1937), and MacNaughtan and Hedges (1936). Kerr (1935) observed that the rate of corrosion of tin and tin plate was influenced more by the temperature and dissolved oxygen content of an alkaline solution than by the concentration of alkali. He also revealed that the use of a reducing agent, such as sodium sulfite, greatly minimized alkaline corrosion of tin.

In view of the scarcity of information relating to milk can corrosion, the object of this investigation was to obtain additional data on the relative corrosiveness of can washing compounds and to review the role of oxygen in alkaline corrosion of tin.

EXPERIMENTAL METHODS

While consideration was given to several methods for making the corrosion tests, no attempt was made to duplicate actual conditions encountered in mechanical can washers. Laboratory reproduction of actual operating conditions would have been too time consuming and tedious to be practical. The method selected was one which was easily controlled and which would yield reproducible, relative corrosion values. Justification of the procedure lies in the fact that relative corrosion values, when interpreted as such, can be equally as informative as absolute corrosion values.

Strips of hot-dipped tin plate, each having a total surface area of ten square inches, were used for the tests. The bare edges of the strips were coated by dipping them into pure molten tin. The tin strips were thoroughly washed, degreased with ether and finally dried to constant weight. Duplicate tin strips were used in the various concentrations of each cleaner tested, both for total immersion and partial immersion tests. Partial immersion tests were made to determine the combined action of oxygen and the cleaner at the air-solution interface.

Various concentrations of each cleaner were employed so that the concentration recommended by the manufacturer would fall within the test range. Eight commercial alkaline

[1] Now associated with The Wm. S. Merrell Company, Cincinnati 15, Ohio.

cleaners, two commercial acid cleaners and four alkalies were subjected to test. The four alkalies were sodium carbonate (soda ash), sodium meta silicate (metasilicate), tri-sodium phosphate (t.s.p.) and sodium hydroxide (caustic soda). All of the alkaline cleaners contained at least one of these basic alkalies.[2]

Since some of the cleaners, when used in hard water, precipitated lime salts, distilled water was used in preparing the test solutions, in order to prevent deposition of the salts on the tin strips. Beakers of 250 ml. capacity, containing 200 ml. and 100 ml. amounts of the solutions, were used for the total and partial immersion tests respectively. In the partial immersion tests the tin strips were placed so that approximately one half of each strip was in contact with the solution and the remaining half exposed to air.

In determining the exposure time it was estimated that a can would remain in contact with the wash solution for about 12 seconds in the standard 12 can per minute can washer. Thus the equivalent of one year's washing was found to be about 73 minutes, assuming that the can was washed each day in the year. The temperature of 160°F. was used for the tests, since it was the highest temperature recommended for use in the wash tank with any of the commercial cleaners. The solutions were heated to 160°F. before immersing the tin strips and this temperature was maintained by means of a thermostatically controlled oven. After 73 minutes exposure to the solutions at 160°F. the strips were removed, rinsed with tap and distilled water, and then dried to constant weight. The solutions were neither agitated nor aerated during the tests.

To determine the influence of oxygen on the corrosion of tin in alkaline solutions, corrosion tests were made, according to the method described previously, using sodium hydroxide solutions ranging in concentration from 0.0 percent to 30.0 percent. Sodium hydroxide was selected because it was considered the most corrosive alkali. Oxygen determinations of the sodium hydroxide solutions, selected from the lowest to the highest concentrations, were made, using the method described by Van Slyke and Neill (1924) for the determination of gases in blood and other solutions. Inasmuch as the Van Slyke-Neill method made it necessary to run the oxygen determinations at room temperature, the sodium hydroxide solutions after preparation were heated to 160°F. and subsequently cooled under a layer of mineral oil to room temperature. This made it possible to determine the oxygen solubility of the solutions at the temperature employed in making the corrosion tests. The mineral oil layer (about one-half inch in depth) was used on the solutions to prevent re-absorption of air by the solutions during the cooling process.

RESULTS

The results of the corrosion tests on all of the alkaline and acid cleaners as well as the alkali components appear in table 1. In the first column, the letters A to H inclusive were used to represent the eight commercial alkaline cleaners, and the letters J and K were used to represent the two commercial acid cleaners. The four basic alkalies were identified by their chemical names.

All of the commercial alkaline cleaners were found to attack tin quite readily. As was to be expected, the pure alkalies were somewhat more corrosive than the majority of the commercial cleaning mixtures. Negligible attack on tin was noted in the tests using two commercial acid cleaners.

Manufacturers of cleaning mixtures have generally referred to concentrations in terms of ounces per

[2]The term "basic alkalies," as used here and elsewhere in this paper, refers to the four alkalies tested.

TABLE 1

CORROSION OF TINPLATE

73 Minute Exposure (Equivalent to 365 Exposures for 12 sec. or 1 Year's Can Washing)
Exposure Temperature 160° F.

			Total Immersion			*Partial Immersion*		
Cleaner or Compound	Alk. as % Na_2O	Concentration ounces/gallon	Ave. wt. loss-mg.	Average % loss of tin	Corrosion rate mg./dm. 2/day	Ave. wt. loss-mg.	Average % loss of tin	Corrosion rate mg./dm. 2/day
A	0.03- .12	0.22- .89	2.65	3.19	81.0	1.59	3.80	97.2
B	0.05- .20	0.42-1.66	3.38	4.07	103.3	2.04	4.91	124.7
C	0.07- .15	0.40- .90	3.52	4.24	107.6	2.08	5.02	127.2
D	0.05- .20	0.37-1.50	3.60	4.34	110.1	2.19	5.27	135.0
E	0.10- .25	0.61-1.52	3.68	4.43	112.5	2.14	5.15	133.9
F	0.07- .15	0.35- .75	3.82	4.60	116.8	2.63	6.34	160.8
G	0.10- .25	0.64-1.60	4.10	4.94	125.4	2.99	7.20	182.8
H	0.16- .22	0.70-1.00	4.72	5.68	144.3	4.05	9.76	247.7
I pH	4.0 -5.5	......	0.22*	...	....	0.19*	...	....
J pH	4.0 -5.5	......	0.05*	...	....	0.05*	...	....
Sodium carbonate	0.05- .20	0.23- .91	5.50	6.63	168.2	3.53	8.50	215.8
Sodium metasilicate	0.05- .20	0.23- .93	5.68	6.84	173.7	3.60	8.74	220.1
Tri-sodium phosphate	0.05- .20	0.29-1.18	5.78	6.96	176.7	4.28	10.30	261.4
Sodium hydroxide	0.05- .20	0.09-0.36	6.30	7.59	192.6	4.35	10.48	266.0

*Within range of experimental error for the exposure time employed.

gallon. Therefore, the solution concentration ranges were expressed in those units for all corrosion tests. The alkalinity ranges of the solutions were expressed as percent Na_2O, the solutions having been titrated to a phenolphthalein end-point. Exception was made in the use of the acid cleaners; the reactions of these solutions were determined in terms of pH using a Beckman pH-meter.

The deviations in weight losses of the strips from different concentrations of the same cleaner were for the most part small. Therefore, average weight losses were determined for all totally immersed strips and for all partially immersed strips exposed to each cleaner. While only half as much surface area was exposed to the test solution in the partial immersion tests as in the total immersion tests, the percentage loss of tin and the corrosion rates were higher for partial immersion. This was probably due to the increase in the corrosive activity of the solution by oxygen at the solution surface. The percentage loss of tin was calculated from the average weight of tin per unit area for the type of tin plate used.

McKay and Worthington (1936) expressed corrosion rates in terms of milligrams of metal lost per square decimeter per day (mg./dm.^{2}/day). Inasmuch as these investigators considered corrosion rates near or above one hundred milligrams per square decimeter per day to be "serious," all corrosion rates appearing in table 1 would thus be considered "serious." McKay and Worthington advised, however, that when using these or other units consideration must be given to the "form of corrosion" and to the relative effect on corrosion by the experimental conditions as compared to conditions encountered in commercial practice.

Corrosion data and oxygen solubilities on sodium hydroxide solutions ranging from 0.0 percent to 30.0 percent concentration appear in table 2 and figure 1. While it was to be expected that increasing alkali concentrations would result in decreasing oxygen solubilities of the solutions, it was interesting to note that oxygen influenced tin corrosion to a greater extent than did the alkali content. Increasing the sodium hydroxide concentration caused increased corrosion only in the 0.0 percent to 0.01 percent concentration range. Further increases in alkali concentration had no apparent effect on the corrosiveness of the solutions except in lowering the oxygen solubilities of these solutions.

It was noteworthy that the can washing alkalinity range, 0.05 percent to 0.20 percent Na_2O, which is equivalent to 0.65 percent to 0.27 percent NaOH, fell precisely within the concentration range where maximum corrosion occurred.

An inspection of figure 1 reveals that at high sodium hydroxide concentrations, the oxygen content of the

TABLE 2

RELATION OF WEIGHT LOSS OF TIN TO OXYGEN CONTENT OF SODIUM HYDROXIDE SOLUTIONS

Temperature 160° F.

Solution conc. %	Tin wt. Loss—mg.	Vol. % oxygen
0.000	0.0	0.411
0.001	0.2	0.411
0.003	0.9	....
0.005	2.0	....
0.008	2.9	....
0.01	5.1	0.401
0.05	6.2	....
0.065	5.6	....
0.10	...	0.352
0.14	6.4	....
0.20	6.6	....
0.27	6.6	....
0.50	6.5	....
0.75	6.6	....
1.0	6.2	0.329
2.0	4.6	....
3.0	3.3	0.281
5.0	3.0	0.234
10.0	2.0	0.162
15.0	1.1	....
20.0	1.2	0.054
30.0	0.9	0.018

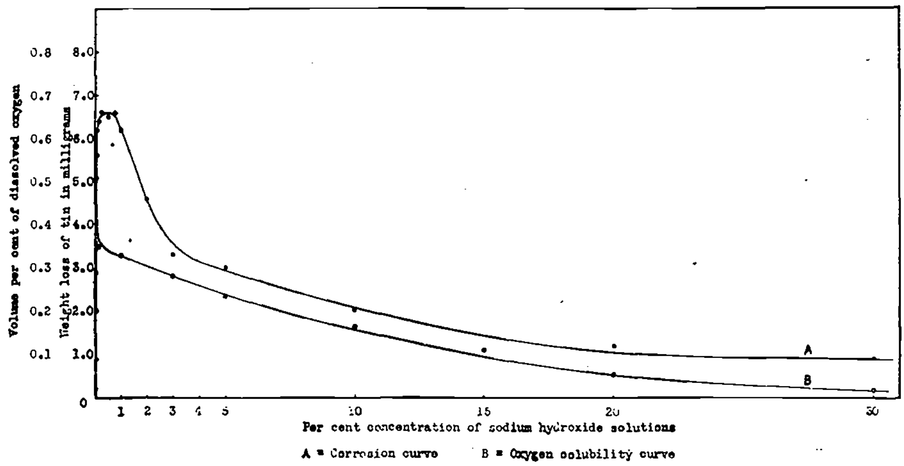

FIGURE 1. *Oxygen-Corrosion Relationships*

solutions approached zero whereas the tin corrosion values approached a constant. This probably can be attributed to the dissolution of the oxide surface film on the tinplate by the alkaline solutions. Insufficient oxygen was present to reform the oxide film and thus further weight loss was prevented.

DISCUSSION

Although the results indicate that the basic alkalies were somewhat more corrosive than commercial alkaline cleaners, corrosion rates for all the compounds tested were in the range considered "serious" by McKay and Worthington. It should be noted that the seriousness of can corrosion cannot be determined by visual inspection of cans in actual practice. No correlation was found in comparing the visual appearances or "spangling" with the weight losses of the tin strips.

It was shown previously that the acid cleaners in the concentrations employed did not appreciably attack tin. However, limited tests using iron revealed that the acid cleaners caused localized corrosion with the formation of pits. Iron, as it is used in can washers, is relatively immune to attack by the alkaline solutions, although in the presence of oxygen it is rapidly pitted by neutral or weakly acid solutions. Since the acid cleaners belong to the weakly acid group, the iron corrosion tendency should be considered.

Since the partial immersion tests revealed greater percentage losses of tin and greater corrosion rates than did the total immersion tests, the oxygen at the air-solution interface apparently caused the greater corrosive action. The importance of oxygen was again demonstrated by the corrosiveness of sodium hydroxide solutions through a wide concentration range. These results did not indicate that alkali concentration had any significant relation to tin corrosion except when the concentrations were very low. Furthermore, the data revealed that alkali concentrations low enough to produce negligible attack on tin would be too low to possess any detergency.

It is doubtful if the problem of alkaline corrosion of milk cans can be solved by varying the combination of alkalies in commercial washing compounds or by raising or lowering the concentrations of these compounds in wash solutions. Apparently, elimination of oxygen from alkaline wash solutions is the best corrosion remedy. According to Kerr (1935) the reducing agent, sodium sulfite, was an effective corrosion inhibitor and it was most effective in alkali concentrations where maximum corrosion occurred. The results of a few tests in which sodium sulfite was added to the alkaline solution were in close agreement with those of Kerr.

In view of the above results and the findings of Kerr, it appears that the prevailing idea regarding corrosion of tin by alkalies has been over emphasized. Although sodium hydroxide was considered so corrosive that it has been eliminated from most of the can washing compounds, its elimination has not appreciably decreased the corrosion rates of these compounds. The work of Levine and his associates (1927), Lowman *et al.* (1931), and Arnold and Levine (1942) indicated that sodium hydroxide exhibited more germicidal potency than any of the other alkalies. Therefore, it would seem that the use of a corrosion inhibitor, such as sodium sulfite, in alkaline can cleaners would be beneficial not only in minimizing corrosion but also in permitting more effective use of the more germicidal alkalies.

SUMMARY

1. An investigation was made to determine the relative corrosiveness of eight commercial alkaline cleaners, two commercial acid cleaners, and four basic alkalies on tin plate.

2. All of the commercial alkaline cleaners and basic alkalies readily attacked tin. The corrosion rates were within the so called "serious" range (near or above 100 milligrams per square decimeter per day). The two commercial acid cleaners did not appreciably attack tin during the time of exposure. These acid cleaners did cause localized corrosion of iron with the formation of pits.

3. A study of the corrosiveness of sodium hydroxide solutions through a wide concentration range revealed that concentration, except when very low, had relatively little effect on the corrosion of tin. The oxygen content of the alkali solution was found to be the primary factor affecting tin corrosion.

4. The alkalinity range, normally used in can washing (0.05 percent-0.20 percent Na_2O which is equivalent to 0.005 percent to 0.27 percent NaOH) fell within the sodium hydroxide concentration range where maximum corrosion occurred.

5. It seems logical from the results of this investigation that a satisfactory corrosion inhibitor, such as sodium sulfite, should be incorporated in alkaline can washing compounds. Such an inhibitor would not only minimize alkaline corrosion of milk cans but would also permit more effective utilization of the more germicidal alkalies in the cleaning compounds.

ACKNOWLEDGMENTS

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REFERENCES

Arnold, C. R., and Levine, Max. Evaluation of germicidal properties of sodium hydroxide and alkaline washing compounds. *Iowa State Coll. Sci.*, **16**, 519-538, (1942).

Hoar, T. P. The electrochemical behavior of the tin-iron couple in dilute acid media. *Trans. Faraday Soc.*, **30**, 472-482, (1934); *Tech. Publ. Internat. Tin Res. and Dev. Council*, A, No. 5.

Hoar, T. P. The corrosion of tin in nearly neutral solutions. *Trans. Faraday Soc.*, **33**, 1152-1167, (1937); *Tech. Publ. Internat. Tin Res. and Dev. Council*, A, No. 63.

Hunziker, O. F., Cordes, W. A., and Nissen, B. H. Metals in dairy equipment—metallic corrosion in milk products and its effect on flavor. *Dairy Sci.*, **12**, 140-181, (1929).

Hunziker, O. F., Cordes, W. A., and Nissen, B. H. Metals in dairy equipment—corrosion caused by washing powders, chemical sterilizers, and refrigerating brines. *Dairy Sci.*, **12**, 252-284, (1929).

Kerr, R. The use of sodium sulfite as an addition to alkaline detergents for tinned ware. *Soc. Chem. Ind.* **54**, 217-221T,

(Continued on page 302)

Observations on the Use of a Modified Direct Microscopic Method for Estimating Bacterial Quality of Raw and Pasteurized Milk*

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THE adaptability of the microscope to the quality control of raw milk supplies has long been recognized but the limitations of the microscopic method, as set forth in *Standard Methods for the Examination of Dairy Products* (12), have been brought into rather sharp focus by the numerous modifications which have been suggested in the literature. The microscope examination of pasteurized milk for bacterial quality has also been advocated by several health departments, in spite of these limitations and notwithstanding the somewhat meager experience with its use for this purpose.

It is not the purpose of this paper to attempt a review of the literature relative to the modifications which have been suggested for the improvement of the direct method of estimating the bacterial population of milk. Nevertheless, certain proposed procedures and modifications have appeared deserving of attention and further study.

The direct method, as outlined by "Standard Methods," is specific in recommending the minimum number of fields to be observed with standard objective diameters. The technician, however, is not instructed as to which portions of the smear area should be examined. Hank and James (5) showed that greater accuracy was obtainable by counting a series of equally spaced fields across the diameter of a circular film. Olsen and Warren (11), applying this principle, devised a simple means for obtaining equally spaced fields across two diameters of a circular film. Buck (3) reported that a somewhat similar device had been used in the Baltimore City Health Department laboratories for two years. Levowitz (6) has proposed a method of "strip counting" which requires no special microscopic equipment, and which has been used very satisfactorily in a few laboratories for several years.

The need for better staining of smears has received the attention of several investigators. Gray (4) reported the development of a two stain method for the microscopic count which was found to increase the accuracy. Mallman, Bryan, and Baten (7) applied to milk smears the acid stain developed by Mallman and Churchill (9) for use in detecting bacteria in egg meats and found that the microscopic fields were free of debris and that the organisms were more easily observed than with standard methylene blue stains.

The advantages derived from the use of the direct microscopic method for the examination of pasteurized milk have been set forth by Mickle and Borman (10), Tiedeman (13), and more recently Anderson (1). Some controversy, however, exists over the merits of the microscopic procedure for pasteurized milk. The center of this

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controversy is the contention of some (8) that dead bacteria are counted, while others (14) claim that bacteria killed by pasteurization are usually rendered unstainable. The truth of the matter probably is that ability to stain varies with different organisms as has been shown by Baker (2). Advocates (10) (12) have pointed out that duplication of plate count data is not the primary object of the direct microscopic procedure when used for pasteurized milk, but suggest that new standards, based on experience, should be established where this program for supervision of pasteurized milk is adopted.

METHODS

In the present study 406 samples of raw milk as received at a milk plant from approximately 55 farms were collected over a year. Plate and microscopic clump counts were obtained on these samples in both the raw and pasteurized state. Laboratory pasteurization at 145° F. for 35 minutes was employed, and plating methods in accordance with "Standard Methods," employing 32° C. incubation, were followed. The plates and smears for the pasteurized samples were made immediately after pasteurization was accomplished.

A modication of the Newman Lampert, Formula No. 2, stain having the following composition was used:

Methylene Blue powder, Certified..	2 gm.
Ethyl alcohol, 95%................	540 ml.
Tetrachloroethane	450 ml.
Acetic acid, glacial................	12 ml.

It will be noted that this stain contains only 20 percent of the amount of methylene blue dye and 20 percent of the glacial acetic acid recommended by Newman and Lampert. This was found to give a clear, light blue background, free of debris, with bacteria and other cells retaining the stain so well that identification was easily accomplished. The stain did not show precipitated dye particles at the end of one year.

The smears were made using a platinum loop calibrated to deliver 0.01 ml. of sample. A standard staining jar was employed, and the smears were immersed for exactly two minutes, followed by quick drying by the use of a slight amount of heat, or by holding the slides in a current of air from an electric fan. The dried, stained preparations were then washed by immersion and agitation in three successive portions of clean tap water and again dried quickly.

The microscopic procedure used was a modification of Levowitz's "strip counting" technique. For the purpose of this study, the technique was modified in that only one strip was counted in the case of milk having less than 500,000 bacterial clumps per milliliter and field counts were made in the usual manner when the count exceeded this range, inasmuch as strip counting loses its utility in the higher count ranges which exceed reasonable quality standards.

The oil immersion objective was brought into focus on the center of one edge of the smear. The smear was kept in continual movement with the mechanical stage using the right hand, meanwhile keeping a narrow band (the median strip) in focus with the left hand. Bacterial clumps were counted as they came into the median band. This procedure can be likened somewhat to motion picture film passing through a projector. The process was continued until a strip the width of the microscopic objective and the length of the smear was examined. In this way an aliquot portion of the smear area was examined and the bacterial clumps counted. The sketch shown in Fig. 1, similar to one presented by Levowitz, possibly helps to clarify this description.

The strip area examined was determined, and the factor to use in calculating counts was obtained as follows:

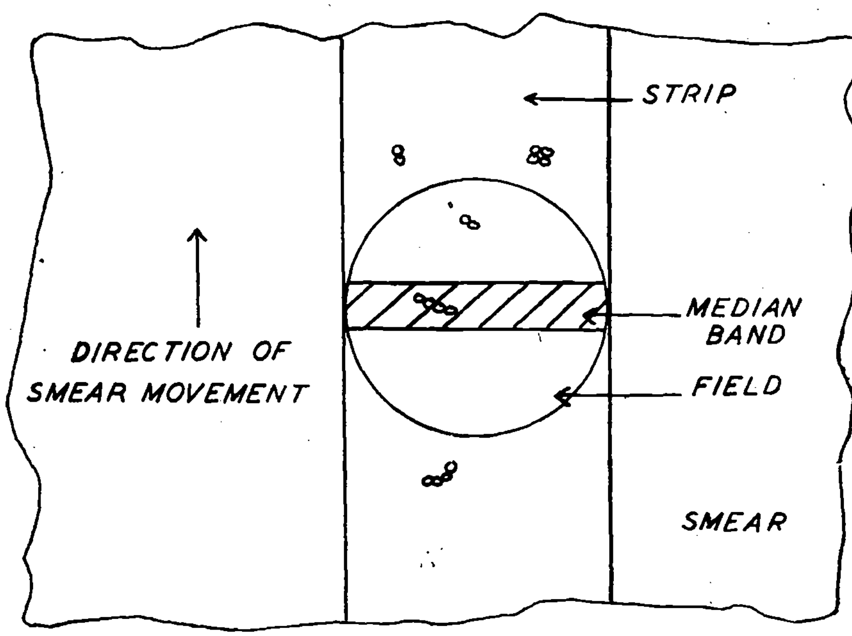

FIGURE 1

Diagram of oil immersion field showing median band and strip to be counted.

$$\text{Strip factor} = \frac{XY}{\text{Area of the strip}}$$

X = Number of 0.01 ml. portions in 1 ml. of milk.

Y = Number of square mm. in smear area

Area of the strip = (length of the strip in mm.) $\times$ (width of the strip in mm.)

Example: (Assuming objective diameter of 0.160 mm.)

$$\text{Strip factor} = \frac{100 \times 100}{10 \times 0.160} = 6250$$

The number of bacterial clumps observed in one strip multiplied by the strip factor is equal to the bacterial clump count per ml. of the sample.

EXPERIMENTAL RESULTS

The Relationship of Miscroscopic Clump Counts to Plate Counts of Raw Milk.

With the modified microscopic procedure used, it was found that when the direct clump count on raw milk samples was between 0 and 100,000 per ml., 40.91 percent of the samples gave a ratio of microscopic clump count to plate count between 0.6 and 1.4 to 1. As the microscopic clump count increased, the percentage of samples falling within this ratio range increased. This relationship is shown graphically in Figure 2. When the microscopic clump count was from 100,000 to 250,000 per ml.. 62.67 percent of the samples fell within the 0.6 to 1.4 to 1 ratio range; from 250,000 to 500,000, 77.78 percent; and over 500,000. 85.25 percent.

With the modifications employed, plate counts and microscopic clump counts on raw milk samples show a relationship approaching a one to one ratio, which is closer and more definite with high count milk than with low count milk.

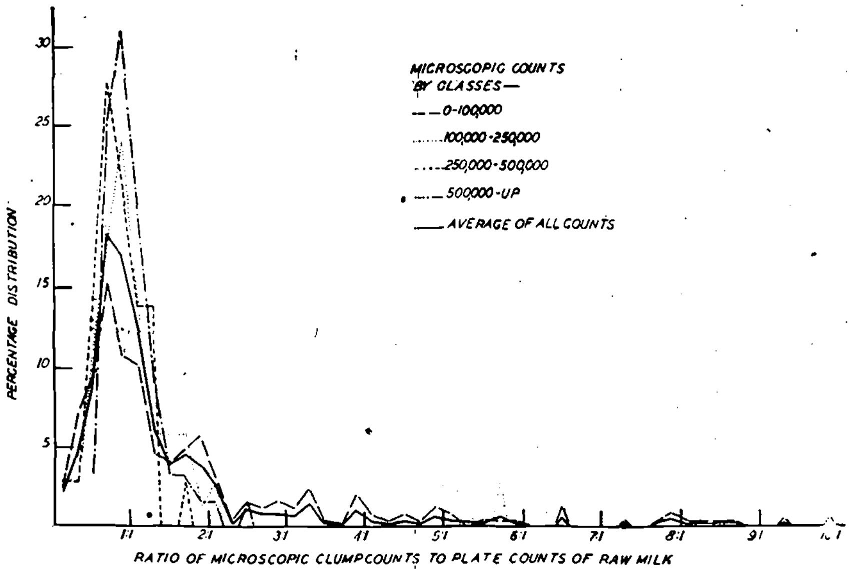

FIGURE 2

Percentage distribution of the ratios of microscopic clump counts to plate counts of 406 samples of raw milk.

The Relationship of Microscopic Clump Counts to Plate Counts of Pasteurized Milk

No significant correlation was found to exist between microscopic clump counts and plate counts on pasteurized milk. This is shown graphically in Figure 3. The microscopic clump counts obtained ranged from considerably less than the plate count, with very low count samples, to many times greater than the plate count. While all living bacteria will not grow on the media used and at the incubation temperatures employed in the plate count, the decided tendency for the microscopic counts to be higher than the plate counts, in contrast to the experience with the raw milk samples, would indicate that organisms other than viable or thermoduric types are included in the counts made by the microscopic method. Furthermore, since there is no tendency toward a constant ratio between the two counts, non-viable organism apparently manifest varying degrees of stainability.

No observations were made in this study relative to the influence of the time interval after pasteurization at which the microscopic counts were made. Subsequent observations, however, have not indicated significant differences when samples were held up to six hours at 32° C. following pasteurization.

The Relationship of Microscopic Clump Counts of Raw Milk to Miscorscopic Clump Counts after Pasteurization

Inasmuch as a comparison of the plate and the miscroscopic clump counts on pasteurized milk revealed that the latter, without doubt, include some non-living organisms, a comparison of the microscopic clump counts

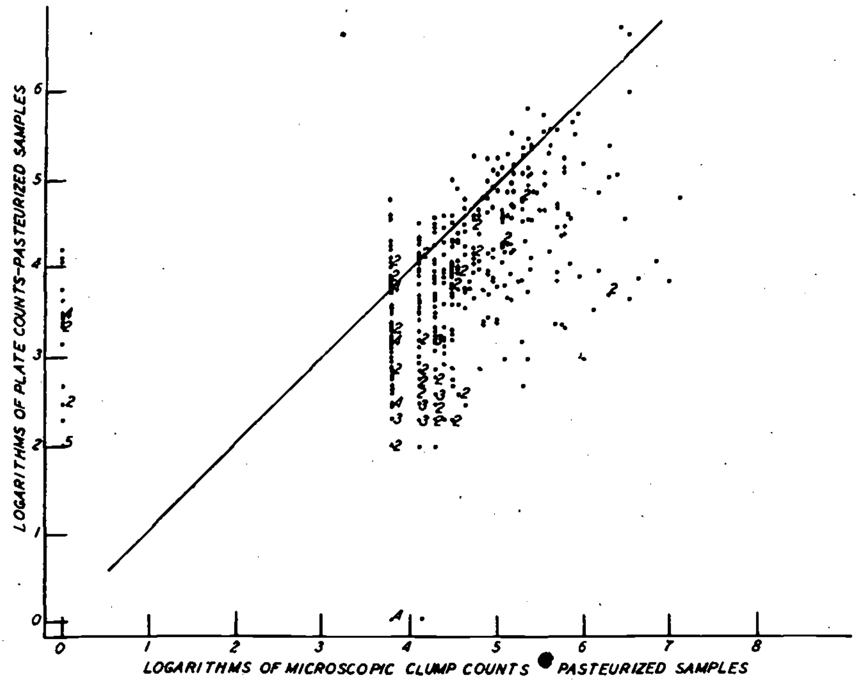

FIGURE 3

Relationship of microscopic clump counts to plate counts of 406 samples of pasteurized milk.

on raw milk and on the same milk after pasteurization should give further information concerning the matter and evidence relative to the proportion of organisms that are lysed and no longer capable of taking the stain.

The data obtained, plotted graphically in Figure 4, present an entirely different pattern from that exhibited in Figure 2 for the relation of microscopic and plate counts with raw milk. The ratios between the counts on the raw milk samples and the counts on the pasteurized milk samples are much higher indicating that an appreciable number of cells do not retain the stain following pasteurization. The proportion, however, is not constant as shown by the spread in the ratio distribution, again pointing to the fact that bacteria are variable in their ability to stain after being heat killed.

These results indicate that it is not possible to judge the bacterial count of the original raw milk from a microscopic clump count after pasteurization, with any degree of accuracy. However, they do suggest that almost invariably a high microscopic count on a sample of pasteurized milk is the result of an unsatisfactorily high count in the milk prior to pasteurization unless other causes (contamination or growth after pasteurization) are known to be operative. In over 79 percent of the instances where the microscopic clump count on the raw milk exceeded 400,000 bacteria per ml., the same method after pasteurization of the milk indicated over 200,000 bacteria per ml.

DISCUSSION

The modified stain employed in this study has certain advantages over the

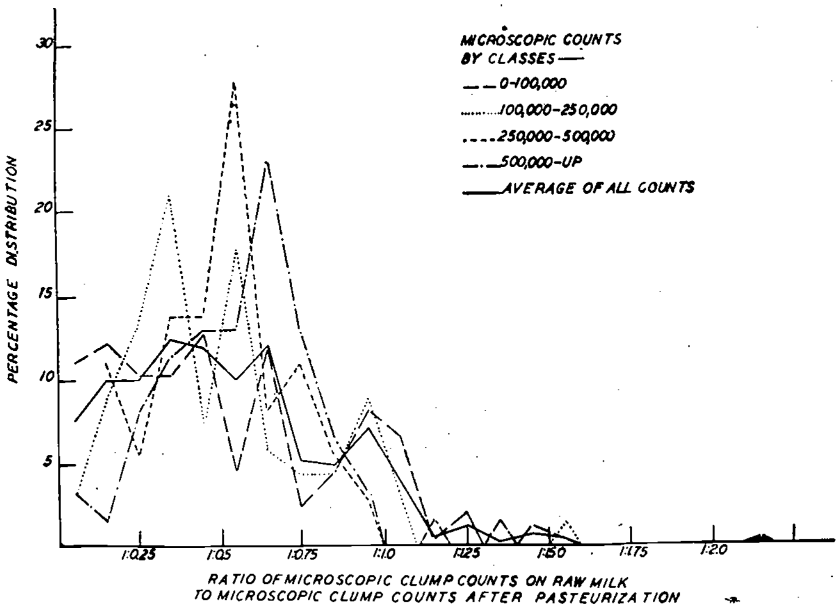

FIGURE 4

Percentage distribution of the ratios of microscopic clump counts on 406 samples of raw milk to the microscopic clump counts after pasteurization.

methylene blue stain or the Newman Lampert, Formula No. 2, as given in "Standard Methods". The stain is easily prepared and shows no precipitation of dye particles for at least one year. The background intensity of milk smears is such that organisms are readily discernible and unlikely to be confused with any debris present.

The microscopic technique used has certain advantages which deserve mention.

The bacterial clump dispersion in a milk smear is dependent on several factors. The usual assumption that cellular dispersion is more or less uniform is obviously untrue and easily refuted by actual study of milk smears. Bacterial clump dispersion is affected by gravity, surface forces, and Browian movement. A smear, when drying, tends to assume a "crested" or thicker portion near the edges. Obviously, the concentration of organisms per unit area in the thicker, crested portion will differ from that of the rest of the smear. The deposition in the smear of small bacterial units will be largely governed by Browian movement, while larger clumps will be more affected by gravity. Thus, the selection of fields without regard for irregular distribution cannot be expected to yield reproducible data, particularly with low count milks. The variations found on the same low count sample by different technicians using "Standard Methods" are readily understood when the variable dispersion of bacterial clumps is taken into account and when the natural tendency to count cells rather than empty fields is appreciated. Levowitz's procedure of "strip counting" recognizes the uneven distribution of organisms, and applies an automatic correction which theoretically would be expected to yield much more accurate data than the hit or miss selection of fields allowed by "Standard Methods".

The decided correlation, approaching a one to one relationship, found between the plate and microscopic clump counts of raw milk when the described modifications were employed, emphasizes a statement made in "Standard Methods". This is to the effect that carefully and properly made microscopic counts on raw milk can, with experience, be made to agree with plate counts reasonably well. It would appear that the modifications suggested in this study aid considerably in attaining this end. It should be noted, however, that the use of 32° C. incubation of the plates undoubtedly contributed in some measure to these results.

The data presented in this study reveal that a much greater reduction in the bacterial population of milk as a result of pasteurization is noted when measured by the plate method than when measured by the direct microscopic method. This indicates that some cells incapable of growth on the plate (presumably dead) are still stained and counted with the microscope. Since the correlation between these two counts with pasteurized milk is poor compared with the correlation between them noted with raw milk, it is evident that some cells stain after heat destruction though staining ability varies considerably with different bacterial flora. On the other hand, it is evident from a comparison of the microscopic count on raw milk with the same count on pasteurized milk that more organisms are stained and countable in the raw milk than are counted after pasteurization. Thus, some organisms must be lysed to such an extent that they no longer acquire the stain.

CONCLUSIONS

A modified stain and staining procedure is described for the microscopic method which permits more certain recognition and counting of bacterial clumps in milk smears.

When this stain is employed with the described modifications of Levowitz's strip counting technique, the microscope yields results on raw milk which show a relationship to the plate count approaching a one to one ratio, which is closer and more definite with high count milk than with low count milk.

There is no significant relationship between this microscopic clump count and the plate count of bacteria in fresh laboratory pasteurized milk samples. Non-viable organisms are capable of stain retention to a varying degree, apparently depending on the microflora of the individual sample of milk.

Microscopic clump counts on fresh laboratory pasteurized milk are lower than those obtained prior to pasteurization indicating that by no means all cells destroyed by pasteurization are capable of staining. The correlation between counts on raw and pasteurized samples is poor but improves as the total count increases.

In practically all cases where the microscopic count of the raw sample is objectionably high, a similar count after pasteurization is also higher than can be considered satisfactory.

REFERENCES

1. Anderson, C. W. Use of the Direct Microscopic Test on Raw and Pasteurized Milk. *The Milk Dealer,* 35, (12) 49 (1946).

2. Baker, M. P. The Direct Microscopic Count as a Method for Counting Bacteria in Pasteurized Milk. *J. Dairy Sci.,* **29**, 506, Abst. M24. (1946).

3. Buck, T. C., Jr. A Microscopic Field Spacer. *J. Milk Tech.* 7, 341 (1944).

4. Gray, P. H. H. Two Stain Method for Direct Bacteria Count. *Ibid.,* 6, 76 (1943).

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A Modified Resazurin Color Grader*

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IN reading the resazurin test, removal of test tubes from the darkness of the water bath may appreciably affect reduction, and it is desirable to read tubes as quickly as possible if they are to be incubated for additional readings. In making readings it was noted that the Munsell grader†, (Figure 1, above) did not lend itself to quick color comparisons, whether it was held vertically or horizontally.

A modification of the Munsell grader (Figure 1, below) was made by inserting the standard color papers into vertical glass tubes and mounting these on a metal strip to slide along the top of the test-tube rack.

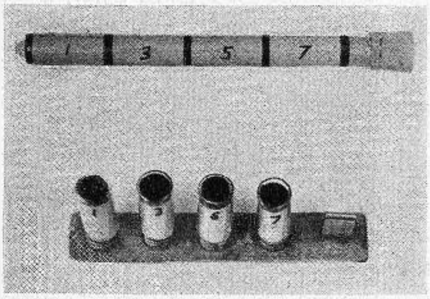

FIGURE 1

The glass tubes should have the same optical characteristics as the test tubes holding the milk, and they should be spaced so that most of one test tube is visible between two color tubes. A strip of metal serves as a handle to slide the grader back and forth and to turn it end for end. This grader was found to speed up the color matching process appreciably.

* Excerpt from "The Resazurin Test in Milk Sanitation" a thesis presented to Iowa State College in partial fulfillment of the requirements for the degree of M.S. in Veterinary Hygiene.

† Resazurin color grader, manufactured by the Munsell Color Co., Inc., Baltimore, Md.

(Continued from preceding page)

5. Hank, J. H., and James, D. F. The Enumeration of Bacteria by the Microscopic Method. *J. Bac.*, 39, 297 (1940).

6. Levowitz, D. Reproducible Data by Microscopic Method. *Assoc. Bul. Int. Assn. Milk Dealers,* 36th year, No. 10 (1940).

7. Mallman, W. L., Bryan, C. S. and Baten, W. D. A Study of Methods for the Examination of Raw Milk with Suggested Improvements. *J. Milk Tech.* 7, 315 (1944).

8. ——— Bryan, C. S. and Fox, W. F. A New Microscopic Procedure for the Detecting and Locating of the Source of Thermoduric Organisms in Milk. *Ibid.*, 4, 195 (1941).

9. ——— Churchill, E. A. A Rapid Test for Determining Bacteria in Liquid Eggs. *U. S. Egg and Poultry Magazine,* 48, 406 (1942).

10. Mickle, F. L. and Borman, E. K. Connecticut Three-Point Laboratory Program as an Aid to Control of Pasteurized Milk. *J. Milk Tech.*, 6, 231 (1943).

11. Olsen, C., Jr. and Warren, F. G. Mechanical Aids in the Direct Microscopic Method of Counting Bacteria. *J. Bact.*, 47, 495 (1944).

12. *Standard Methods for the Examination of Dairy Products,* Eighth Edition (1941).

13. Tiedeman, W. D. Laboratory Control of Milk under War Conditions. *Amer. J. Pub. Health,* 33, 401 (1943).

14. Ward, A. R. and Myers, C. E. Influence of Dead Bacteria on Microscopic Counts of Pasteurized Milk. *J. Bact.*, 34, 565 (1937).

Sanitary Standards for Weigh Cans and Receiving Tanks for Raw Milk

Formulated by

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS,
UNITED STATES PUBLIC HEALTH SERVICE,
THE DAIRY INDUSTRY COMMITTEE

As of June 23, 1947

It is the purpose of the IAMS, USPHS, and DIC in connection with the development of the 3A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Weigh Can and Receiving Tank specifications which are developed and which so differ in design, material, construction, or otherwise, as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of IAMS, USPHS, and DIC.

3A Standards for Weigh Cans and Receiving Tanks to Be Used for Raw Milk

(The standards apply equally to weigh cans and receiving tanks, exceptions being expressly indicated.)

A. Capacity of Receiving Tank:

1. The maximum capacity of the receiving tank, when receiving milk from a single compartment weigh can, shall not exceed three times the capacity of the weigh can, but in no case shall it exceed 3,000 pounds.

2. The maximum capacity of the receiving tank, when receiving milk from a double compartment weigh can, shall not exceed twice the combined capacity of the two compartments of each of the weigh cans, but in no case shall it exceed 3,000 pounds.

Public Health Reason: The receiving tank should constitute a balance tank for the cooling operation — particularly for milk for consumption in the fluid state — so that warm milk receipts are cooled or processed without delay.

B. Material:

The material used for bodies, strainers (except punched plate), conduits, and covers shall be not less than 16 U. S. standard gauge, 18–8 stainless steel, with a carbon content of not more than 0.12 percent; except that when the capacity of the weigh can exceeds 700 pounds, or that of the receiving tank exceeds 1,400 pounds, the gauge of the body of the weigh can and/or receiving tank shall be not less than 14 U. S. standard. The weld area and deposited weld metal shall be as corrosion resistant as the parent metal.

The inside surface shall be at least as smooth as a No. 4 mill finish on stainless steel sheets.

Public Health Reason: Experience has demonstrated that 18–8 stainless steel with a carbon content of not more than 0.12 percent, and with No. 4 mill finish, can be cleaned and remains smooth, and that stainless steel plates must be 16 U. S. standard gauge, or heavier, to withstand distortions when fabricated into equipment of this shape and size.

C. Fabrication:

Welds: All joints and seams shall be welded. All joints shall be located so as to permit the grinding and polishing of the weld. The finish of the weld shall not be less than that of the adjoining metal.

Construction: For the purpose of this standard, the following definitions apply to the body of the can or tank:

(a) An inside corner is one formed by the junction of two or more plane surfaces, where the included angle(s) is less than 150°.

(b) An outside corner is one formed by the junction of two or more plane surfaces where the exterior angle(s) is more than 210°.

(c) The milk zone is the entire inner surface of the can or tank, and the under side of the cover.

1. Minimum radii: All inside corners of the bodies in the milk zone shall have radii of not less than ¾". Inside corners of strainers and covers shall have radii of not less than ⅛". All junctions of heavy bars or plates, as in grids, shall have radii of not less than ¼". Junctions of bars or rods, used as braces with the body of can, tank, or cover, shall have radii of not less than ⅛".

There shall be no sharp external edges.

2. Bracing: The material shall be of such gauge, or so braced, as to provide plane surfaces free from depressions, indentations, or bulges which prevent drainage when the pitch is not greater than 1" in 50".

3. Splash grids, levers, rods, etc.: All operating parts in the milk zone shall be made of stainless steel or dairy metal and shall be removable for cleaning. There shall be no threads in the milk zone.

4. Legs: Legs shall be adjustable and with rounded ends. If of hollow stock, they shall be sealed and shall be of sufficient size and spacing to carry the tank when full and to raise the lowest point of the milk outlet at least two inches above the floor. Leg and socket exteriors shall be corrosion resistant or painted, shall have no exposed threads, and shall be readily cleanable.

D. Outlet Valves:

The outlet valve(s) disk of the weigh can and its operating mechanism shall be entirely removable for cleaning, shall have no threads, and shall have no inside corners with radii of less than ⅛". The material of the outlet valve and seat shall be of stainless steel or dairy metal.

The outlet of the receiving tank shall be of sanitary construction, readily cleanable, and shall comply with 3A Sanitary Standards for Fittings.

The exterior body of a vertical outlet valve shall be protected with a sloping drip guard or skirt to prevent entrance of liquids or foreign matter into the receiving tank or into milk.

E. Conduit:

When a vertical conduit is used between the weigh can and the receiving tank, it shall be provided with a skirt or sloping drip deflector, of sufficient radius to extend over the opening in the cover of the receiving tank, irrespective of the position of the conduit with respect to the center of the said opening. In case of a close connection, the weigh tank valve deflector shall be considered sufficient if said deflector is not more than 6" from the receiving tank cover.

The drip deflector shall be located as near to the receiving tank cover as the maximum vertical travel of the weigh can permits without contact therewith and still provide room for removal of conduit. If the conduit consists of two vertical sections, both sections shall be provided with drip deflectors, the one on the upper portion being located effectively to protect the sleeve joint. If the location of the drip deflector interferes with the assembly of the conduit, the deflector may be removable, provided the design of the conduit is such that drip can at no time pass between the conduit and the removable deflector.

Conduits shall be designed and constructed so that the entire interior surfaces are accessible to sight and for cleaning; that is, that all bends are removable, and that no section is more than 36" long.

F. Weigh Can Strainer:

The weigh can strainer shall be removable, and the bottom shall be above the level of the rated capacity of the weigh can. The straining area shall consist of punched metal, of not less than 14 U. S. standard gauge, with a selvage of not less than ½", with no perforations within ½" of the edge. The perforations in the strainer shall be 3/16" in diameter, and the burrs shall be removed.

G. Covers:

Covers shall be provided and shall be designed and fitted to prevent the entrance of liquids or foreign matter into the weigh can, strainer hopper, or receiving tank; i.e. shall be sloped to provide drainage from the surface, and fit over the edges of the parts they cover. The cover of the weigh can shall be provided with an opening for sampling. All openings in the covers shall be flanged upward at least ⅜"; and if not continually in use shall be provided with covers which fit over the flanges.

Rods or other functional parts which operate through the cover shall be provided with drip deflectors located to provide maximum effectiveness.

The strainer hopper cover shall be separate from the weigh can cover.

Sanitary Standards for Pumps for Milk and Milk Products

Formulated by

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS,
UNITED STATES PUBLIC HEALTH SERVICE,
THE DAIRY INDUSTRY COMMITTEE

It is the purpose of the IAMS, USPHS, and DIC in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Milk pump specifications which are developed and which so differ in design, material, construction, or otherwise, so as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of IAMS, USPHS, and DIC.

3A STANDARDS FOR CENTRIFUGAL AND POSITIVE ROTARY TYPE PUMPS

A. Material:

1. All metal pump parts having any surface in contact with the product shall be constructed of dairy metal consisting of stainless steel, nickel alloy, or equally corrosion resistant material, that is nontoxic and nonabsorbent.
    a. All milk contact surfaces shall be finished to a equivalent of not less than 120 grit finish properly applied.
    b. All outside surfaces shall be smooth and easily cleanable.
2. Exteriors of structural parts not in contact with the product shall be of corrosion resistant material with a smooth finish; or shall be rendered corrosion resistant or painted, and shall be so constructed as to be easily cleanable.

B. Construction:

1. All milk contact surfaces shall be readily removable or accessible for cleaning and inspection. All exterior surfaces shall be self-draining.
2. The parts forming the space between the motor and the pump body shall be constructed in such a way that they are easily accessible for cleaning, and drain freely.
3. If legs are used, they shall be smooth with rounded ends and no exposed threads. Legs made of hollow stock shall be sealed. On pumps with legs designed to be fixed to the floor the minimum clearance between the lowest part of the base and the floor shall be four inches.
    a. Readily portable pumps not permanently attached may have leg heights of 2 inches. (Readily portable pumps are defined as those having a base area of not more than one square foot, or, in the case of motor mounted pumps, an area encompassed by the legs that does not exceed one square foot.)
    b. Bases when used shall be constructed without ribs or flanges and shall have a smooth top and bottom surface.
4. Pumps which because of their size and type cannot be mounted on legs, shall be mounted on a base designed for grouting and sealing.

5. The driving means between the impeller or rotor and the pump shaft shall be so arranged as not to form a pocket or crevice that is not readily cleanable.

6. Threads shall not be in contact with the product.

(Until January 1, 1949, manufacture of 3A Standard pumps with threads in the milk zone shall be permitted when open type nuts are used.)

7. All surfaces in contact with the product shall have smooth, rounded corners and shall be readily accessible for cleaning.

C. Openings:

1. Inlets and outlets shall conform with the 3A Sanitary Standards for Fittings.

D. Shaft Seal:

1. Seal shall be of the sanitary type, easily removable for inspection and cleaning, and shall be constructed of material not injurious to milk.

E. Gaskets:

1. Single service gaskets of the sanitary type, or removable rubber type gaskets that can be easily cleaned, shall be used.

F. Mountings:

1. Mountings of motor, pump, and drive shall be of sanitary construction and shall be either sealed to the base or mounted to permit easy cleaning with minimum clearance of not less than one inch.

G. Sealing:

1. Timing pumps used in connection with high temperature short time pasteurizing equipment shall be provided with an easily accessible or externally visible seal or seals to limit the maximum capacity of the pump. The seal or seals shall prevent the changing of the maximum speed of the pump, either by adjustment of the drive or replacement of pulleys or belt. (This shall be effective not later than January 1, 1949.)

Report of Committee on Frozen Dessert Sanitation

There should be and in many instances there is a great revival in ice cream and frozen dessert sanitation. During the War, sanitation, like a great many other things was neglected. Along with sanitation went the high quality of the products. Anything would sell at a good profit so why bother with quality. This was a mighty tempting situation for the company with weak moral fiber. It likewise was hard on the manufacturer who placed quality first for he had to suffer at the hands of the unscrupulous manufacturer in many different ways. However, the wise and far-seeing company maintained their quality and built for the future.

Every health department should, if they have not already done so, start an intensive campaign to correct the bad habits of sanitation that were tolerated during the War. Make them clean up, and replace old, rusty, delapidated and antiquated machinery and equipment with modern machinery and equipment. Make them clean up and stay clean. They will appreciate it and thank you for it.

Industry Ahead of Inspectors

It has been my observation over a period of 30 years or more that industry is always ahead of the sanitary inspector. The reverse should be true if the inspector knows his business and keeps up-to-date on all the latest developments not only in machinery and manufacturing but in sanitation. For example, how many inspectors know what industry plans for the future? How these plans will affect the product?

The chief concern of the ice cream industry at present is to increase per capita consumption of ice cream. Their goal is one billion gallons per year within the next ten years (1955). This is a big increase in consumption when you consider that they sold less than half that amount in 1945. Their program as outlined by the Executive Secretary, R. C. Hibben, is (a) Quality of Products, (b) Aggressive but intelligent merchandising, (c) Good public relations, (d) Sensible industry relations, (e) Meeting competition outside the industry, (f) Intelligent handling of detrimental legislation, and (g) Taking advantage of new inventions and new economic conditions. The above doubtless represents the thinking of the frozen desserts industry at the moment and their plans for the next few years.

It is interesting to note that their first consideration is quality. In discussing quality, they point out that quality should not be confused with richness in ice cream. The average ice cream before the war contained 12.5 percent butterfat and 10.5 percent total milk solids. If properly made with quality products as basic ingredients, no finer ice cream can be produced than made under the above average formula.

Future Developments in Ice Cream Mixes

Will the dry ice cream mix replace the fresh liquid mixes? The answer is No, both will be used. The dry mix was developed as a war time measure, and fulfilled a great need since it occupied small space and could be shipped great distances. However, it must now compete with fresh liquid mix on more even terms. The best opinion at the moment is that the future acceptance of dry mix in this country depends upon its cost, convenience, and quality. Its greatest acceptance in any event will be by the housewife and the manufacturer-retailer. Dr. Krog in his report discusses some of the sanitary implications and problems of control of dry mix.

Frozen cream, plastic cream, and unsalted butter will be used in many parts of the country due to the scarcity of fresh cream. Each year progress is made in improving the quality of these products. They are usually used to supplement fresh cream in making ice cream. None make as fine an ice cream as good quality fresh cream. If over 50 percent frozen cream is used, a stale flavor often results. These are some of the more important problems in the ice cream industry.

Reports of other members of the Committee follow: These are always interesting since they reflect the problems and thinking from a wide variety of places.

ICE CREAM IN CANADA

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Due to the continuation throughout the year of government orders respecting the composition of ice cream and the volume of mix manufactured, there have been no material changes in the Canadian ice cream industry. Ingredients, such as fruits, dried skimmed milk, and gelatin are still in relatively short oveall supply, and although slight increases were made in sugar quotas the trade is still restricted to seventy per centum of their 1941 usage. Sufficient supplies of glucose, corn syrup, etc. were not always available as substitutes. Such conditions have affected the quality of ice cream, with the result that in some districts, quality is below that of last year. At times, some firms were obliged to use fairly large proportions of sugar substitutes (up to 50 percent of total sweetening agents), and it was found that some brands of glucose imparted undesirable flavors to the finished ice cream. Thus some vanilla ice cream had almost a butterscotch color due to the use of poor quality glucose and partially caramelized roller process skimmilk powder. It has also been noticed that when the serum solid content of ice cream was over 12½ percent and one half of the sweetening agent was glucose, the finished ice cream had almost a chalky texture. This is very noticeable when the ice cream has been held in storage for any length of time.

The ice cream manufacturer today is quite concerned about the increase in cost of his basic mix. The recent (1st October) increases in the price of milk to producers supplying all fluid markets has caused corresponding increases in the price of surplus milk and fat from such markets. Prices of imported ingredients are, in many cases, somewhat higher, and as the retail and wholesale ceiling prices of the finished ice cream are still in effect across Canada, the manufacturer has been endeavoring to lower the initial cost of his finished mix. Reductions have been made in several ways, such as (1) reduction of dried egg yolk content, (2) lowering the fat content to a figure closer to the legal minimum of 9.5 percent, (3) lowering the total solid content to a figure closer to the legal minimum of 34 percent, instead of being 35 percent and upwards, and (4) closer overrun control with a maintenance of 110 to 115 percent on bulk ice cream.

The amount of new equipment available for distribution to the trade was not as large as anticipated, due largely to shortage of raw materials and labor difficulties. However, reports from all parts of Canada indicate that both large and small manufacturers are anxious to improve their facilities and install modern equipment, all of which augurs well for future progress.

As would be expected, ice cream has continued in short supply throughout the year, but consumers generally appear to have accepted this condition quite readily. The overall production of ice cream in Canada has been slightly lower during 1946 compared with the previous year, due largely to almost complete demobilization of the armed forces. However, the industry as a whole is still optimistic as to the future, for it feels that as soon as government restrictions are removed and ingredients are in plentiful supply, there will be a decided increase in production and marked improvement in the quality of all products manufactured.

SOME PROBLEMS CONFRONTING THE EAST

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POWDERED MIXES

Ice cream mix, complete except for flavoring, is becoming increasingly available in powdered sterile form. These powders, merely on incorporating water, yield mixes of standard fat, serum solids, sugar, and stabilizer percentages.

Powdered mixes have stimulated freezing equipment installations by soda fountains and roadside stands. Powdered mixes have brought back into use small freezing equipment made idle when limitation orders decreased the ice cream mix manufactured during wartime. Such mixes permit freezer operators to be stocked against heavy and unusual demands when liquid mix is used the plant supplying it is usually not in a position to ship promptly enough to take care of emergency requirements.

The small freezing units are generally accompanied by hardening cabinets and frequently by 'tempering boxes', though many roadside stands and retaurants omit them because other 'above freezing' refrigeration facilities are available.

A mix must be cold, preferably between 30° and 35° F., before it is placed into the ice cream freezer to obtain a product of satisfactory texture and body. Warm water disperses the mix powder more efficiently than cold but takes longer to cool to freezing temperature.

Since mix powders are hygroscopic, they are generally purchased in tins which make only enough for four to ten freezer batches; most users are discouraged from ordering bulk-packed mix powders after noting the 'caking' of powder in opened containers.

Single freezer operators are dependent on the weather to a greater degree than the larger ice cream plants since their mix tempering and ice cream hardening facilities are more limited. 'Freezer Fresh' ice cream is a favored feature. The unflavored, tempered mix must be 'ready'. A few days of inclement weather may find the operator with a cabinetful of tempered mix, and the lack of opportunity to freze it because of a hardening box which is also full.

To stimulate sales, a variety of flavors is kept on hand. One tin of powder, enough for a number of batches, may be used to prepare single freezer batches of a half dozen flavors. Flavoring materials are more economical when purchased in sizes large enough for a few batches. The opened flavoring containers are customarily stored in the 'above freezing' compartment until the contents are used up. The pH of fruit flavors favors mold growth on the surfaces if the flavoring is not utilized promptly.

THE CONTROL ASPECT OF ICE CREAM FROM POWDERED MIXES

Let us assume that the commercial mix powder in the sealed container is sterile; let us assume further that the dilution water is sterile. The reconstituted mix is just as good a growth medium for microorganisms as any other ice cream mix.

In developing control systems for dairy products we have tried to impress milk producers with the need for rapidly cooling the milk from all cows, even the healthiest; we may not have used the terms but we have pointed out that the mammary is a modified ectodermal gland; that as such, it can be expected to harbor staphylococci; that these organisms, permitted to grow in a medium containing carbohydrate and protein, will form enterotoxin which is not destroyed by pasteurization heat and will yield gastroenteritis—whose symptoms become more violent in the younger human user.

In our restaurant and bakery sanitation codes we have required the boiling of cream and custard type puddings and fillings, careful handling of the freshly boiled materials, and prompt refrigeration of the completed articles. We have warned against the extended storage of salads, stuffings, etc. because of their carbohydrate and protein content. We have arranged food handlers' courses to teach the elements of 'safe' food production and handling. We have been stymied by the flash outbreaks of gastroenteritis brought on by picnics and socials where foods, prepared in homes beyond reproach from the domestic aspect, have become dangerous through the extended growth of these staphylococci—recoverable from anybody's skin.

It has taken years to get some large ice cream plants to the point of bringing vanilla and chocolate bulk-packed products to market in a satisfactory coliform-free condition. It will probably take more years before the fruit and nut-flavored bulk and the various packaged products reach the same status. We want to achieve this goal, since if a processing temperature high enough to inactivate staphylococcus enterotoxin is used, the absence of coliforms or their presence in only limited number, indicates that enterotoxin-forming staphylococci have not been reintroduced either and the health-promoting characteristics of dairy protein, carbohydrate, fat, and minerals will not be accompanied by health-retarding symptomology.

The powdered mix in the household size package may be a boon to the busy mother, but the "commercial size" is destined to complicate dairy products control.

Any milk producer knows that it is stupid to try to cool milk by merely letting a can sit in air; the milk in the center of the can would go sour. "Souring" organisms would be absent in the lukewarm mix made from sterile powder; staphylococci introduced by careless handling or careless washing would not. The slow cooling of the can of mix would give the staphylococci opportunity for luxuriant growth. Their metabolism would not be inhibited by the competitive lactic flora—and you can't taste enterotoxin.

In a single day, one counter freezer operated continuously might make twenty or thirty batches of ice cream, and the bacterial characteristics of each of the batches might be completely different because of the tempering intervals involved after dispersing the mix powder and the flavoring materials employed.

If we consider the limited ice cream control programs of even our advanced municipalities, it is clear that present approaches will not insure satisfactory products to consumers. It is time to examine the reasoning which led to the present system.

DAIRY PRODUCTS CONTROL DEVELOPMENTS

When the milk, cream, and ice cream sheds were defined by the municipality limits (when ice cream was a sweetened flavored cream stirred until frozen) and families gave up their cows to buy dairy products from nearby farms, the taxpayers appointed representatives to visit the farms to see that only products from "decent" places were permitted to enter the market.

When a farm supplying one municipality began supplying another, it came under a dual inspection. When farmers began selling their milk to processing plants, more municipalities became involved. Each individual municipality attempted its own control program.

Uniformity of regulations and interpretations were, of course, impossible; the municipality of 5,000 population could not afford to implement a system constructed for an area of 500,000.

Science established that the quality of products could be measured by much more critical methods than visual inspection of production and processing facilities; but the dairy products control program of even some of our largest municipalities and states do not yet go beyond this.

What is most remarkable is that one of the governmental agencies recognized that in dairy control, the consumer (through his representative—the government) was attempting to render a service which in the case of less perishable food commodities, was always regarded as the merchandiser's responsibility, namely, that the burden of proving that his wares are suitable for market rests on the merchandiser.

With further development of urban areas, farms adjacent to them were assessed at higher land values than those at some distance. Transportation costs from distant points offset the higher taxes to a degree but milk produced at nearby farms went primarily into fluid milk channels while that from distant points went into cream and other products.

If cream is not processed at a temperature high enough to inactivate staphylococcus enterotoxin, it is obviously as potentially dangerous as milk with a history of similar production and handling. The practice of dividing cream into products for "fluid" and "manufactured" utilization grew on the assumption that the cream for manufacturing would be processed at the higher temperatures.

Farms located at the greatest distances from market had no choice but to have their milk converted ultimately to butter and other products where processing sublimated the characteristics of the raw materials quite completely. Municipalities did not even attempt to inspect farms located in the area from which such products were drawn.

While some advanced municipalities demanded that the merchandisers of milk and other dairy products prove that the raw supplies adhered to certain definite standards before being utilized and that the finished materials also subscribed to definite levels, the law of supply and demand was ignored. These municipalities were able to provide their consumers with fully satisfactory products when surpluses forced the industry to compete for markets. When supplies went short, however, these same municiaplities were forced to accept merchandise which admittedly did not meet regulations because no common floor covered the codes of adjacent areas and the first requirement of the agency under pressure was to get products, regardless of quality.

At the fringe of the milk shed, the cream producers entered the milk market when supplies were short; in the same way, producers for the butter market entered the cream zone. The drastic increase of the milk shed brought on by the war influenced other areas as well.

Before the war, the ice cream shed might have been considered the world —Danish, Argentinean, and Australian butter were regularly imported for utilization by the ice cream industry as well as for table use by consumers. The transportation differential never made it profitable to ship cream from these lands. (If it had, probably some municipalities would have sent their inspectors to examine the foreign farms.)

THE PRACTICAL SOLUTION

Years of experience have established that regardless of the state of the market, it is the condition of the product as it reaches the consumers that is important; that pathogens, the flora of udder infection or of diseased handlers and readily inactivated by pasteurization are less significant in milk for pasteurization than enterotoxin; that where definite control of fluid milk production and processing is not practiced, the products must be submitted to high enough heat treatment to inactivate enterotoxin, as well as pathogens, then kept uncontaminated in any way until they reach consumers.

The size of the milk shed alone makes it impossible for municipal or even state governments to check on the efficiency of the control systems maintained by producing and processing organizations; only a system country wide in scope and fully standardized to provide a definite quality floor, could function. Such a system, if advocated by individual government agencies, would break down in "short" periods just as its predecessors did. A system, to be practical, would have to be established and maintained by an organization in which industry and government (consumers') representatives cooperate.

Temperatures adequate to inactivate enterotoxin positively would destroy the cream line and alter the flavor, so that to continue fluid milk as we know it, supplies for that product would have to meet more stringent standards than that for others. The merchandisers would have to provide data developed by units they operate and to be licensed and supervised by the industry-government agency to establish the adequacy of their products at various stages, as well as at the final point, before being permitted to enter the market.

The calibration methods would have to be made definite and really employed. Personnel would have to be fully qualified and subject to definite supervision. L. H. Black's report on "official" control laboratories shows that even at this plane the lack of equivalent resources and the absence of standardization have resulted in completely ineffective work.

If merchandisers are made uniformly responsible for the caliber of their products, regardless of where marketed, the large ice cream plant whose products may be distributed in several states, will be forced by the regulation floor to improve those items which have been ignored up to now. The practice of manufacturing a large assortment of varieties would be discouraged. These are never subjected to official scrutiny at present because the limited facilities of health departments permit examination usually of only the fastest moving staples. The small powdered-mix, single freezer installation would have to meet the identical standards.

The dairy industries and consumers would both benefit tremendously by this method of control. The variable demands of different health departments through overlapping jurisdictions have discouraged the industry from repeating their requests for standardization, they will continue to assume that anything permitted to enter an area as human food is safe and health promoting. Raw milk availability in many markets shows how ridiculous is this assumption.

THE MIX INGREDIENTS

When the federal government revoked its set aside orders, milk which entered powder channels was attracted to the cream market instead of returning to butter use from which it was drawn originally by the government price policy. O.P.A. policing kept butter manufacturers from competing for these "liberated" supplies. Cream was short, and ice cream manufacturers had just been released from their limitation orders. While the laws of most states require that the cream used for the ice cream mix would be of "fluid grade", a review of cream shipments of last year will show that if government agencies attempted to control quality, industry pressure soon discouraged them.

It is no wonder, then, why milk and cream producers and processors have come to the conclusion that government controls up to now have fluctuated with supply and demand. Because of the pricing situation more ice cream was made last year using cream than during preceding periods.

It is particularly grotesque to find that many of the health departments which did not object to substandard cream going into either their fluid or ice cream channels denied the use of butter oil to ice cream plants. This latter product is a fat concentrate in which processing eliminates flora that require moisture for their metabolism and also undesirable materials which are water soluble.

Milk, cream, and condensed skim milk are only some of the ingredients which may be used in ice cream manufacture. From the chemical aspect, except for sweetening, flavoring, and stablizing materials, the solids should come from dairy origin. The sterile protein of washed curd is as desirable as c.p. edible casein, and from the nutritional angle more desirable than the same protein from a poor condensed skim milk. A review of present dairy products formulae shows that fat can be supplied through cream (fresh, frozen, sweetened, or concentrated plastic), butter or butter oil, or whole condensed (fresh, frozen, sweetened) milk or powder. Protein can be derived from equivalent forms; even washed curd prepared during flush seasons and frozen until use has been employed successfully.

An ice cream mix derived entirely from "fresh fluid products" will certainly cost more than one made entirely from concentrates prepared during flush seasons. Our ice cream labelling laws should possibly demand for the consumers' economic protection the clear identification of the materials and the formulation employed; but from the health aspect, what must be demanded is the inactivation of enterotoxin by processing methods, regardless of the source of ingredients and the prevention of any contamination following that heat treatment.

The utilization of protein from other than whole or skim milk concentrates will make more nutritious ice cream available. The lactose concentration is what limits the quantity of dairy protein which may be incorporated into the ice cream mix.

When lactose percentages exceed certain limits the product becomes 'sandy'. Nutritionists will confirm that the prime value of dairy products lies in the concentration of tryptophane and other essential amino acids present in casein. Why not, then, permit washed curd as a satisfactory ice cream ingredient to the consumers' definite benefit?

In order to increase mix solids, the practice has developed of adding to the mix materials not yet classiled as fillers. Thus, while starch is definitely frowned on and stabilizers are not permitted beyond the 0.5 percent level, and vegetable proteins are considered adulterants, sugars, instead of representing merely the sweeteners (sucrose, dextrose, invert, and maltose) now include hydrolysis products—dextrins and dextrans—whose sweetening properties are insignificant.

Ice cream manufacturers vary their mixes depending on market conditions. Ice cream technology has elevated pasteurization temperatures primarily to accommodate the use of recently developed stabilizers. The range has has been reached by some plants already where enterotoxin is automatically inactivated. But what health department has attempted to check the holdover practices at even milk plants?

Certainly, checking the storage methods at large ice cream plants or the powdered mix freezers is beyond the ability of the municipal departments.

Eggs in fresh, frozen, and powdered form are accepted constituents of the ice cream mix. Egg products in powdered form whose solids are only partially derived from eggs now are available to the industry. The non-egg materials are not clearly defined as to their origin or percentage. When milk solids or sweeteners are not the egg diluents, these egg products may introduce solids beyond the legal definition of ice cream. Possibly this committee can form a unit to check on the acceptability of such materials.

MIX PROCESSING

The past few years have brought no drastic changes to basic processing. The old style permanent piston packing homogenizer has largely been replaced by the sanitary head models. Low pressure machines and sonic vibrators developed a number of years ago but have not yet been accepted to very great extent by the industry. Butter and butter oil mix processing have generally necessitated the use of higher speed agitators in pasteurizer vats; in some plants the butter is processed to a cream by a step-homogenization and check-valve system. Since in ice cream plants homogenization usually follows the pasteurization process, many plants have, to insure the non-introduction of coliforms from homogenizers, arranged to circulate the hot mix through the homogenizer and back to the mix tank for five minutes before directing it over the cooler.

Pasteurization temperatures were elevated as noted above, to take advantage of the newly developed stabilizing materials. Elevations as high as 180°F. for thirty minutes are commonly employed by many large installations. Such temperatures can be expected to affect staphylococcus enterotoxin appreciably.

Plate equipment for regeneration and cooling has not come into great use in ice cream plants as yet. The viscosities of stabilized ice cream mixes of 35 percent or higher solids has led to the assumption that plate equipment could not handle such materials efficiently, but some plants have found this type of equipment particularly advantageous because of its regeneration features. Some installations employ surface coolers for the final temperature drop.

Refrigerated storage tanks are rapidly becoming prominent, and by maintaining a storage temperature in the range of 30°–35°F., bacterial development is retarded quite completely.

With respect to the mix powder users, when they have been taught the essentials of cleaning and sterilizing and of proper refrigeration practice, very satisfactory products have been obtained. Some have installed "wet boxes" of the type used by dairy farmers for tempering the prepared mixes. Others have set cans of mix into tubs containing ice and water. These methods are not satisfactory, unless stirring or agitation is employed, until the mix has been reduced to the desired temperature.

The claims of sterilizer manufacturers continue to bewilder. Too few disclose that adequate cleaning must precede the successful use of the most potent preparations. If an equipment surface has not been cleaned completely, only heat is fully reliable as a sterilization agent.

In conjunction with the sterilizers, too few regulatory agencies recognize the variation of activity of hypochlorites buffered at different levels. The quaternaries, too, have limitations, and should not be accepted as a substitute for cleansing agents and elbow grease.

Our Committee was formed to promote the consumers' welfare, and we can be of greatest service by focusing attention on the problems discussed above to accelerate the development of a uniform, country-wide, industry-maintained, and industry-government policed, practical control system which, by permitting only satisfactory products to come to market, will give consumers the nutrients and high degree of sanitary protection that they are entitled to.

REGULATORY CONTROL OF FROZEN DESSERTS

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Department of Agriculture, Sacramento, California

Laws dealing with the control of frozen dairy desserts have been on the California statutes for several years, ever since the first requirements covering dairy products were drawn up. It was not until 1927, however, that ice cream and similar frozen products came in for specialized legislation, having to do with requirements pertaining to quality, food value, composition, and sanitation. At that time the legislature passed laws setting a bacterial limit on frozen dairy products requiring ice cream to contain 1.6 pounds of food solids in each gallon, and raising the annual factory license fee of one dollar to the minimum of twenty-five dollars. The legislature not only set up the new and almost revolutionary ice cream standards, but through a license fee provided funds to carry out the enforcement of the standards. Credit for raising the fees sufficient to enable proper enforcement goes to the ice cream industry which requested such legislation and proper enforcement. The funds were sufficient to provide for the services of two full-time men who devoted their time to this program. As the number of ice cream manufacturers increased and the volume increased it was possible to double the personnel and at present four men are employed in ice cream control work in addition to the clerical and laboratory staff.

LEGAL STANDARDS

California thus became one of the first states to adopt a bacterial standard for frozen desserts and to require a definite amount of food solids in each unit of frozen dessert. The food solids standard indirectly controls the amount of air or overrun permitted in ice cream. I believe California was also the first state to establish a statewide comprehensive system of control work pertaining to frozen desserts. The entire program is patterned after the market milk control program, which has developed into a comprehensive program.

The problems which attend the production of quality frozen desserts differ somewhat from those having to do with market milk quality, but there are certain fundamentals common to both products which form a basis upon which to build a constructive frozen dessert control program.

Our first task was to work out a suitable technique for making bacteriological determinations since no standard method existed at that time. Bacteria in milk is reported on the milliliter basis, but this method was not adaptable to ice cream with any degree of accuracy. By a series of tests it was determined that a milliliter of ice cream weighed as much as 1.0553 grams and as little as 0.7804 gram. Therefore, when the bacterial standard was adopted, the gram was used as a basis and not the milliliter. Our first bacteria standard on frozen desserts was 150,000 per gram maximum. The standard has since been reduced and is now 75,000 per gram. Special equipment has been devised by our laboratory staff for weighing the one gram charges.

At this point it might be well to provide a table giving the legal standards on frozen desserts in California. The standards listed in table 1 are now in effect with the exception of the standards for food solids per gallon, which, as a wartime measure, have been reduced to 1.4 pounds per gallon for ice cream and 1.1 pounds per gallon for ice milk. The minimum milk fat content for plain ice cream has been reduced to 8 percent.

Ignoring for the time being the wartime standard, ice cream is required to contain 1.6 pounds of solids in each gallon. This figure is determined by multiplying the percentage of total food solids by the average weight of ice cream. For instance, if several quarts of ice cream were weighed and found to average 4.5 pounds per gallon and the laboratory analysis showed the product to contain 36 percent total solids, the ice cream would contain 1.62 pounds of total food solids per gallon. This standard is rather unique in that it combines the features of a minimum weight standard with a total solids standard. Therefore, an ice cream with a high milk fat and food solids content may weigh less per gallon and still meet the requirements, whereas ice cream with a lower percentage of food solids must weigh more to meet the standard. For example, an ice cream with 40 percent food solids would only need to weigh 4 pounds per gallon, while one with 36 percent of food solids must weigh 4.5 pounds per gallon to meet the standard.

While the operation of this standard has done much to bring about an improvement in the texture, body, and weight of ice cream, we still receive complaints from consumers who do not understand how the standard works. Some consider only the weight of ice cream when making a purchase and give no thought to its richness and food solids content. Naturally in the absence of proper standards the weight can be made up with water or other ingredients having no food value. After all, the food value is the thing that counts and the one factor that determines the true value of the product. Without this standard there would be no limit on the amount of air that unscrupulous manufacturers may incorporate into ice cream.

Since the milk fat requirement is an old established standard, it probably is not necessary to comment upon its im-

TABLE 1

LEGAL STANDARDS FOR FROZEN DESSERTS IN CALIFORNIA

Product	Milk fat	Bacteria count	Stabilizer	Fruits	Nuts	solids per Food gallon	Eggs	Acid as Citric
Ice cream (plain)	10%	75,000	Not over 0.6 of 1%	...	...	1.6 lbs.	...	...
Ice cream (fruit)	8%	75,000	Not over 0.6 of 1%	3%	...	1.6 lbs.	...	...
Ice cream (nut)	8%	75,000	Not over 0.6 of 1%	...	1%	1.6 lbs.	...	...
Ice cream (French or custard)	10%	75,000	Not over 0.6 of 1%	...	...	1.6 lbs.	5 doz. Yolks to 90 lbs. Mix	...
Ice cream mix	10%	75,000	Not over 0.6 of 1%	...	...	...		
Ice milk	4%	75,000	Not over 0.6 of 1%	...	...	1.3 lbs.	...	...
Ice milk mix	4%	75,000	Not over 0.6 of 1%	...	...	...	... ...	... ...
Sherbet	Less than 4%	75,000	Not over 0.6 of 1%	10%	...	...	...	.2 of 1%

portance or necessity. Milk fat has been the yardstick for measuring the value of dairy products for years. It is an expensive ingredient and one most likely to be curtailed in the event of a price war or during periods of intense competitive activity. No one, therefore, can question the wisdom of a milk fat standard for frozen desserts. Milk fat also influences to a great extent the quality of frozen desserts. The industry realizes this fact, and to their credit it must be said that frozen desserts with a few minor exceptions contain milk fat in excess of the minimum required by law.

SAMPLING PROCEDURE

When the frozen dessert control program was started it was necessary to devise methods for taking samples and equipment for keeping the samples frozen until they reached the laboratory. Naturally a bacteria count would be of no value on a sample which was allowed to become warm from the time it was taken until it arrived at the laboratory. A two-ounce screw cap bottle has been adopted for samples of frozen desserts. These bottles are fitted with a metal screw cap, lined with a pulp and oil board gasket which is replaced after each use. The bottles, caps, and gaskets attached tightly are sterilized in a hot air oven in accordance with the requirements set forth in *Standard Methods for the Examination of Dairy Products*.

In taking samples in the field, the inspector sterilizes a spatula (a one piece, stainless steel, steak knife, ground square across the point in the shape of a chisel, makes a good instrument) by flaming over an alcohol lamp. The top one-half inch or so of the product to be sampled is removed and the bottle filled. This is enough sample for bacteria, milk fat, and solids determinations. After the sample is taken, the cap is placed tightly on the bottle and an identification label giving essential information is attached. The bottles are then sealed and placed in an insulated shipping case. These shipping cases are similar to those used for transporting frozen desserts by express or baggage to distanct places. Three brine pads (metal discs about 1½ inches thick with diameter to fit the case) are frozen and placed in the case. Two pads are on top and one pad on the bottom of the container with two layers of sample bottles in between. Each night the inspector removes the samples and brine pads from the case and places them in a subzero hardening room. This freezes the brine in the pads solid and prepares the case for use the next day. When a full case of samples is obtained (54 samples), it is shipped by express to the laboratory for analysis. These shipments are timed so that they leave in the evening and are delivered at the laboratory in Sacramento not later than the afternoon of the following day. These shipping cases when fitted with three, well-frozen brine pads, will preserve the samples in a frozen condition for twenty-four hours or more even under the most severe summer weather.

SAMPLING FOLLOW-UP

When the inspector takes the sample a specially devised laboratory description blank is used to identify the bottle and its content. These blanks are arranged in a series of three copies, that is, an original, duplicate, and triplicate. There are single service carbons attached so that any information written on the original automatically registers on the other two copies. It also has a work sheet attached for the purpose of providing space for the bacteriologist and chemist to record their mathematics. Also attached by means of perforations are three labels which are easily torn out and attached to the sample bottles. Each label, description blank, and work sheet contain identical numbers which identify the sample in line with the description blank and work sheet. Space is provided on the blank for the inspector to indicate what the sample is to be tested for, that is, milk fat, solids not fat, bacteria, etc. After the inspector has taken the sample, he signs the description blank and has the factory operator or interested party sign it also. The blanks are then forwarded with the samples to the laboratory. The laboratory personnel who take part in making the determinations, as well as the Chief of the Bureau, sign the reports after tests have been recorded. The original is filed at the headquarters office, the duplicate goes back to the inspectors who took the samples, and the third copy goes to the plant operator if he requests a copy.

When the results of tests on samples are received by the inspector, he reviews them and studies those which indicate the product failed to comply with standards. He then prepares to take whatever action as may be indicated and necessary to bring about compliance. In many instances this calls for follow-up work. In case of a high bacteria count, a general inspection of the factory is made which, among other things, includes checking on the methods of cleaning and sterilizing equipment; checking recording thermometers for temperature, accuracy, and holding time; checking the temperature of the mix as it comes off the cooler; checking the storage temperature and the length of time mix is held in storage; checking the ingredients used in the manufacture of the mix; and other items which may contribute to a high count. The sterility of the equipment is determined by the swab test, and each inspector is equipped to make these determinations. Many of our inspectors make swab tests as a matter of routine as well as for checking the cause for excessive bacterial contamination. The rinse test is used on containers. This consists of the introduction into the container of sterile water containing enough sodium thiosulphate to counteract the action of any chlorine which may be present and following the standard procedure of shaking the rinse water around the container. The samples of rinse water are sent to the laboratory for plating. Quite frequently when looking for the cause of high bacteria counts, the inspector takes samples of the mix and the frozen product at each different phase of the processing operation. The information thus obtained is helpful in determining which piece of equipment or which process is faulty. Ingredients which are added to the freezer after the mix has been pasteurized (the California law requires the pasteurization of all milk and milk products used in frozen desserts), such as fruits, nuts, and flavors, are frequently sampled to check on their quality.

Any deficiency in milk fat content is carefully checked to ascertain if possible whether the illegal test is the result of carelessness, deliberate or accidental. In checking milk fat deficiency, the inspector must have the ability to make mathematical calculations and figure formulas to see that they are correctly balanced and will meet legal standards. It often becomes the inspector's job to teach factory operators how to calculate and proportion a batch of mix.

Samples which show a food solids content below the legal requirement are followed up in the same general manner as outlined for a low milk fat product. Since, as previously explained, this standard combines a weight and total solids content, it is necessary to check on the foods solids content. Some of these calculations and investigations have brought to the plant operator's attention the importance of checking the weight of the finished product. Very often the difference of a few ounces of ice cream in each gallon is the factor which decides between success and failure.

ICE MILK

Ice milk as defined by the California law is a frozen dessert similar to ice cream but containing less milk fat and less food solids per gallon. Its principle use is in the form of chocolate-coated bars usually on a stick and to take the place of ice cream in the preparation of fountain drinks, such as milk shakes. The same problems encountered in the control of ice cream are applicable to ice milk, and the enforcement program is carried out in a similar fashion. Ice milk, because it is almost indistinguishable from ice cream in appearance, finds its way into the hands of retailers who attempt to substitute it for ice cream. It therefore becomes necessary for the inspectors to make purchases from suspected retailers of frozen desserts to determine if ice milk is being substituted for ice cream. To safeguard the public from misrepresentation, ice milk sold in packaged form must be labeled with the words "Ice Milk". A popular use for ice milk is the so-called "frosted malt" or "frostie". This is simply an ice milk mix flavored with a variety of extracts, chocolate and malt, frozen to a semi-hard condition, and dispensed directly from the freezer into cake cones or cups. When the words "frosted malt" or "frostie" appear in connection with the labeling and advertising of ice milk, the words "ice milk" are required to appear along with such trade terms or trade names.

Sherbets in California are required to contain at least 10 percent of fruit or fruit juice. Any milk or milk products used must be pasteurized and there is a limit of 75,000 bacteria per gram. Sherbets must be so labeled. To prevent the misrepresentation of sherbet as ice milk, its production is confined to fruit flavors and a definite percentage of fruit acid is required.

LICENSING PROCEDURE

Every manufacturer before engaging in the business of manufacturing, freezing, or processing frozen desserts must apply for a factory license. Upon receipt of the application, properly filled out to give the required information, an inspection is made of the factory and if found satisfactory a license is issued. The factory is required to have floors of nonabsorbent materials, such as tile or cement, properly sloped to a trapped drain; walls of nonabsorbent material high enough above the floor to take care of any splash; and surface of walls and ceilings are to be sound and cleanable. Each factory must have adequate lighting and ventilation, running water, washing and sterilizing facilities, flyproof toilet, and laboratory facilities, and must score at least 80 percent on the milk products plant score card. These requirements apply to all factories regardless of their size and includes hotels, restaurants, boarding houses, and hospitals manufacturing frozen desserts. The so-called counter freezer installations are subject to the same requirements. Any one interested in installing a small freezer may secure a set of blue prints from our office giving details of construction and arrangement. These blue prints and plans have served as a very helpful guide to small freezer operators. Not only does the law require a factory to score 80 percent before operation, but it also makes it unlawful to operate a milk products plant which scores less than 80 percent. A sample of the score card is attached.

This score card was designed so that it can be used for all factories regardless of size and products handled. In using the score card for small frozen dessert factories where all the mix is purchased, such items as vats, cooling facilities, sanitary pipes and fittings, thermometers and charts, and transportation vehicles are stricken from the card; whatever value these items carry is deducted from the amount allowed for perfect score. This feature has made the score card flexible so as to be

MILK PRODUCTS PLANT SCORE CARD

STATE OF CALIFORNIA, DEPARTMENT OF AGRICULTURE, SACRAMENTO

DIVISION OF ANIMAL INDUSTRY—BUREAU OF DAIRY SERVICE

Trade Name...Owner or Manager...

Town...Business Address...

Products Manufactured or Processed...

Factory License No..............................Date...

Inspection Made: Before, during, after processing. (hour)..............................M.

ITEM NUMBER	PERFECT SCORE A	ALLOWED B
1. LOCATION: Surroundings clean 1; sanitary 4; orderly 1; attractive 1	7	
2. ARRANGEMENT: Rooms—adequate number 4; size 4; convenient 2; attractive 1; shafts, pulleys, pipes, ledges, clean 2	13	
3. FLOORS: Smooth 4; sound 5; properly sloped to trapped drain 5; non-absorbent 5; clean 4	23	
4. WALLS: Sound 4; smooth 4; light color 1; non-absorbent 4; clean 4	17	
5. CEILINGS: Sound 2; smooth 2; proper height 4; light color 1; clean 2	11	
6. DOORS, WINDOWS: Screened (or protected) 5; good repair 2; doors open out and self-closing 3; clean 2	12	
7. LIGHT: Adequate and evenly distributed 4	4	
8. VENTILATION: Adequate and evenly distributed 5	5	
9. WATER SUPPLY: Clean 2; approved source 5; sufficient outlets 1; hose satisfactory 1; abundant 1	10	
10. TOILET: Good repair 1; vestibuled 1; ventilated 1; self-closing door 1; lavatory 1; soap 1; towels 1; clean 2; fly proof 1	10	
11. DRESSING ROOM: Clean 2; ventilated 2; orderly 1	5	
12. HAND WASHING FACILITIES: Wash basin 1; convenient 1; warm water 1; soap 1; towels 1; clean 1; sufficient 1	7	
13. COLD STORAGE ROOMS: Proper construction 4; free of odors 2; proper temperature 1; clean 3	10	
14. WASTE DISPOSAL: Sewer facilities 5; covered waste containers 2	7	
15. WASHING FACILITIES: Wash tanks 2; condition 1; sufficient brushes 1; suitable 1; adequate 1; washing powder 1; clean 1	8	
16. STERILIZING FACILITIES: Adequate 5; efficient 5; convenient 1; temperature indicators accurate 1; clean 2	14	
17. CONTAINERS: Smooth 1; no open seams 2; rust-free 2; clean 5; sterilized 5; dried 5; protected storage 1	21	
18. VATS: Smooth 2; tight surfaces 4; free of exposed copper or rust 2; proper covers 2; clean 5; sterilized 5; dried 5	25	
19. COOLING FACILITIES: Adequate 2; smooth 1; sound surfaces 2; free of exposed copper or rust 2; clean 5; sterilized 5; dried 5; protected 2; proper temperature 5	29	
20. SANITARY PIPES, FITTINGS AND PUMPS: Proper type 1; smooth surface 2; free of dents 2; free of exposed copper 2; flush type valve 3; leak detector type valve 2; clean 5; sterilized 5; dried 5; protected 2	29	
21. THERMOMETERS: Approved type of mounting 3; accurate 5; sufficient 3; indicating thermometer 3	14	
22. THERMOMETER CHARTS: Proper 2; correctly recorded 3; filed 2	7	
23. OTHER EQUIPMENT: Adequate 2; good repair 7; clean 5; sterilized 5; dried 5; protected 2; (underline equipment examined) freezer, homogenizer, churn, separator, bottler, weigh tanks	26	
24. PROTECTION OF PRODUCT: From contamination 5, (flies, dust, odors, vermin, water); proper delivery temperature 2	7	
25. EXPEDITIOUS OPERATION: Celerity and dispatch 2	2	
26. LABELING: Of products—Legal 2	2	
27. LABORATORY CONTROL: Satisfactory 4	4	
28. PERSONNEL: Sufficient 1; clean habits 10; clothing 2	13	
29. TRANSPORTATION VEHICLES: Protected 1; clean 1; attractive 1; legal signs 1	4	
30. STORAGE OF SUPPLIES: Clean 2; orderly 1; properly protected 1	4	
TOTAL POINTS	350	
PER CENT	....	

Draw line through items in Column A which do not apply to this Milk Products Plant, and do not include such items in total for perfect score.

Duplicate copy received

....

Representative

DS FORM 30

87044 4-46 5M SPO

applicable to all processing plants. Each factory manufacturing frozen desserts is required to be scored at least once annually. Those falling below the required 80 percent are, of course, given additional scorings and instructions to correct the items which cause the factory to be substandard. It must not, however, be implied that only one inspection is made during the year. Only one score is required but several visits are made for the purpose of sanitary inspections and sampling of the products for analysis.

There are many provisions of the law pertaining to frozen desserts which do not receive much publicity and which are sometimes taken for granted. For instance, it is the inspector's job to see that all frozen desserts are properly labeled and that labeling and advertising do not carry misleading or deceptive terms. All packaged frozen desserts must be labeled with the name and address of the manufacturer, distributor, or retailer. Other miscellaneous enforcement problems include checking the quality of butter intended for use in the manufacture of such products; checking on the quality of eggs and egg products used and approving or denying permits for the use of eggs, egg products, or butter in frozen desserts; checking frozen desserts labeled "French" or "custard" to determine if the required amount of egg yolk solids is present (the law specifies at least 5 dozen egg yolks or equivalent in frozen or dried yolk to each 90 pounds of mix); checking and approving stabilizers, such as gums and gelatines for suitability in ice cream; checking products to detect any evidence of faulty or improper pasteurization; checking milk and cream for acidity; and other quality standards.

ENFORCEMENT PROCEDURE

There are three methods of bringing about compliance with laws dealing with frozen desserts, namely, prosecutions, hearings (where the plant operator is summoned to show cause why his license should not be revoked or suspended) and impounding any product suspected of not meeting legal standards. In the latter case if the analysis showed the product to be substandard, a hearing is held by the Director of Agriculture or some officer designated by him to determine the disposition of the products involved. The nature of the defect determines the disposition. The product is either ordered destroyed, permitted to be used as feed for poultry or livestock, or in some cases reprocessed for human consumption.

The California Department of Agriculture has been very fortunate in having the cooperation of the industry in its enforcement program. Manufacturers who have the interest of their business and the welfare of the consumer at heart realize the necessity of reasonable legislation. It is not only a protection to public health and general welfare, but also a protection to fraudulent and unfair competition. Fair and reasonable legislation has played its part in elevating the frozen dessert business to a high plane and common sense enforcement of laws will do much to maintain this reputation.

Committee on Frozen Desserts Sanitation:

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The Significance of the Coliform Test in Pasteurized Milk

P. D. DELAY
*Captain, VC, A.U.S.**

PRESENTED in this paper is a description of the use, the interpretation, and the limitations of the coliform test, an understanding of which necessarily precedes a consideration of the significance of the test as applied to dairy products.

Sherman and Wing (1) in 1933 wrote as follows: "The subject of coliform bacteria in milk has received so much attention that the topic is indeed somewhat threadbare." Nevertheless, there continues to be sufficient diversity of opinion to make this shopworn problem of vital concern to the dairy industry.

Since 1933 additional reports on the coliform test as a means of detecting post-pasteurization contamination have assisted in clarifying the purpose of the test. Several factors, however, have undoubtedly been responsible for the failure of the test to receive widespread adoption, namely:

1. The presence of heat resistant types of coliform organisms.
2. Some misunderstanding as to the significance of the presence of coliform organisms.
3. The failure to establish and accept any standard percentage positive level.
4. A tendency to consider it impractical to require a low percentage of positive coliform tests.

In view of the above factors, an attempt was made to determine what percentage incidence of coliform positives might be considered as a tolerance level.

Samples from 14 plants were submitted for coliform tests during a four month period. Prior to the four month testing period, samples from the plants had been submitted for coliform studies. As a result the positive percentages obtained, particularly during the first month of the testing period, were undoubtedly lower than would have been the case had the plants been unfamiliar with the coliform problem.

Four samples per week from each plant were collected during the testing period with modifications where line run samples were required.

Those plants characterized by intermittent occurrence of high percentage positive coliform tests were inspected and line run sample taken in an attempt to determine the source of contamination.

METHODS

Presumptive:

One ml. of milk was added to one tube of brilliant green lactose bile.

Confirmatory:

All positive presumptive samples were confirmed by the use of eosin methylene blue plates, lactose inoculation, and Gram staining. Heat tests were conducted at 143° F. for a period of 30 minutes. Prior to the heat test, the cultures were provided an 18 hour incubation period in milk previously heated to destroy other forms. The entire sample, after heating, was tested for the presence of viable organisms by inoculation in brilliant green lactose bile.

DIFFERENTIATION

The methyl red, Voges-Proskauer, indol, and citrate tests were used as a basis for classification of the coliform organisms. The Voges-Proskauer test

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was read after 2, 12, and 24 hours at 37.5° C. Ehrlich's method was adopted for the detection of indol producers.

RESULTS AND DISCUSSION

	Plants		Samples	
Months	*No.*	*%<1% Positive*	*No.*	*% Positive*
1st	14	50	255	6.6
2nd	14	50	301	4.6
3rd	14	50	315	6.6
4th	14	70	257	1.9

It will be noted that during the four month testing period, more than half of the plants submitted samples of which less than 1 percent were positive to the coliform test.

The plants were classified on the basis of the percentage positive tests as follows:

1. A small number with a high percentage of positive tests.
2. Those, including the majority of the plants, which remained consistently under 1 percent positive.
3. A few plants with percentages ranging from the high to low group from month to month.

There was no definite parallel between plate counts and the percentage incidence of coliform positive tests.

Coliform cultures resisting pasteurization temperature were encountered in samples from only one of the plants under test.

Seventy-three coliform cultures obtained from pasteurized milk samples following the four months' testing period were submitted to differentiation tests with the following percentage incidences: *Escherichia* 39.7, Intermediate 13.7, and *Aerobacter* 46.5.

In an attempt to explain varying levels of coliform positives from different plants, it was of interest to note that the equipment differences in the plants under the test were not marked. It was observed, however, that only a few plants were utilizing the facilities of their own laboratories and further that the samples from this group were, in general, characterized by a low incidence of coliform positive samples.

During the course of this project it became increasingly obvious that an understanding on the part of the plant personnel of the significance of the test is an essential prerequisite to a successful coliform control program.

The line run method of identifying sources of coliform organisms proved most useful, and usually second and third line run results were consistent with the original findings in instances where correction was not accomplished following the first line run. Defective or improperly cleaned coolers and lines were found to constitute the greatest problem, while on the other hand, there was little evidence to indicate that bottle fillers or washers were sources of coliform contamination. In a few instances the problem of correction was characterized by the necessity of making several line runs over a period of three or four weeks before locating the source of contamination.

From plants which were experiencing difficulty with a high percentage of positives, consecutive negatives were prone to occur. In such instances it was found necessary to require that consecutive negatives over a period of at least two weeks should be obtained before concluding that correction had been accomplished.

Although some coliform organisms bear a host relationship to certain pathogens the existence of such a relationship does not necessarily imply that all coliform positive milk samples constitute an immediate public health hazard. However, there does appear to be justification for giving consideration to the relative incidence of coliform positive milk samples, as a guide to possible post-pasteurization contamination.

CONCLUSIONS

It is concluded that the coliform test is of definite value as an aid in detecting faulty post-pasteurization handling.

On the basis of the results obtained in this project it is further concluded that well equipped plants can, without exceeding the limits of practicability, submit bottled milk samples of which less than 1 percent will be positive to the coliform test.

Although many plants are capable of submitting samples within the suggested 1 percent limit, no doubt considerable difficulty will be encountered if, at the present time, a maximum level of less than 5 to 10 percent is established.

Therefore, it is suggested that, although the 1 percent limit may be considered as the ultimate goal, an attempt to establish such a low level should be a gradual process with particular consideration afforded to conditions as they may exist in a given locality.

ACKNOWLEDGMENT

Appreciation is expressed for the assistance furnished by Sgt. Fred W. Carver, A.U.S.

REFERENCE

1. Sherman, J. M., and Wing, Helen U. The Significance of Colon Bacteria in Milk, with Special Reference to Standards. *J. Dairy Sci.*, **16**, 165 (1933).

A STUDY OF THE GERMICIDAL EFFICIENCY OF CAN WASHING COMPOUNDS

(Continued from page 262)

REFERENCES

Arnold, C. R., and Levine, Max. Evaluation of germicidal properties of sodium hydroxide and alkaline washing compounds. *Iowa State Coll. Jour. Sci.*, **16**, 519-538, (1942).

Levine, Max., Buchanan, J. H., and Toulouse, J. H. Influence of sodium chloride, sodium carbonate, and tri-sodium phosphate on the germicidal efficiency of sodium hydroxide. *Iowa State Coll. Sci.*, **2**, 19-29, (1927).

Levine, Max., Buchanan, J. H., and Lease, Grace. Effect of concentration and temperature on the germicidal efficiency of sodium hydroxide. *Iowa State Coll. Sci.*, **1**, 379-394, (1927).

Lowman, O. E. Buchanan, J. H., and Levine, Max. Effects of salt on alkali disinfection. *Iowa State Coll. Jour. Sci.*, **5**, 251-268, (1931).

Meyers, Robert P. The germicidal properties of alkaline washing solutions with special reference to the influence of hydroxyl-ion concentration, buffer index, and osmotic pressure. *Jour. Agr. Research*, **38**, 521-563, (1929).

Parker, M. E. When is "Cleaned" equipment really clean? *Food Industries*, **12**, No. 10, 39-42, (1940).

Parker, M. E., and Shadwick, Jr., G. W. The role of acid cleaning agents in dairy detergency. *American Butter Review*, June, (1941).

Parker, M. E. Acid detergents in food sanitation. *Ind. and Eng. Chem.*, **35**, 100-105, (1943).

Phillips, A. W., Mack, M. J., and Frandsen, J. H. Washing powders for dairy use. *Mass. Tech. Bull.* **13**, (1928).

Scales, F. M. Acid detergent makes cans more sanitary. *Food Industries*, **14**, No. 4, 51-53, (1942).

Scales, F. M. More results with an acid detergent but in a standard can washer. *The Milk Dealer*, November issue, (1942).

Scales, F. M., and Kemp, Muriel. A new group of sterilizing agents for the food industries. *Int. Assoc. Milk Dealers*, Bull. **19**, (1940).

Schwarzkopf, V. Conservation in sanitary practices with acid cleaners. *Proc. Inst. Food Tech.*, 37-42, (1942).

Sherman, J. M. Germicidal effect of washing powders. *New York Prod. Rev. and Am. Creamery*, May, 14-15, (1927).

Standard Methods for the Examination of Dairy Products (8th Edition), pg. 131, (1941).

New Qualifications in New York State for Public Health Engineers, Sanitarians, and Inspectors

The new requirements constitute a new Section G to Chapter XI of the New York State Sanitary Code, effective September 1, 1947.

Principal Public Health Engineer.

Duties: Responsible charge of planning, directing, and administering the public health engineering and environmental sanitation activities in a municipality having more than 350,000 population.

Qualifications: A principal public health engineer shall be licensed or eligible for examination for license to practice professional engineering in the state of New York and, in addition, shall have the following qualifications:

(a) Graduation from a university or school of recognized standing with a degree in sanitary or public health engineering and eight years of satisfactory public health engineering experience; or,

(b) Graduation from a university or school of recognized standing with a degree in civil or chemical engineering and ten years of satisfactory public health engineering experience; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Associate Public Health Engineer.

Duties: (a) Responsible charge of planning, directing, and administering the public health engineering and environmental sanitation activities in a municipality having 150,000 to 350,000 population; or,

(b) Immediate charge of one or more of the specialized public health engineering or environmental sanitation activities in a municipality having more than 350,000 population.

Qualifications: An associate public health engineer shall be licensed or eligible for examination for license to practice professional engineering in the state of New York and, in addition, shall have the following qualifications:

(a) Graduation from a university or school of recognized standing with a degree in sanitary or public health engineering and six years of satisfactory public health engineering experience; or,

(b) Graduation from a university or school of recognized standing with a degree in civil or chemical engineering and eight years of satisfactory public health engineering experience; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Senior Public Health Engineer.

Duties: (a) Responsible charge of planning, directing, and administering as above in a municipality of less than 150,000 population.

(b) Immediate charge of a specialized activities as above for 150,000 to 350,000.

(c) Performance of public health engineering or environmental sanitation activities of more than ordinary difficulty and responsibility in a community of more than 35,000 population.

Qualifications: A senior public health engineer shall be licensed or eligible for examination for license to practice professional engineering in the state of New York and, in addition, shall have the following qualifications:

(a) Graduation from a university or school of recognized standing with a degree in sanitary or public health engineering and four years of satisfactory public health engineering experience; or,

(b) Graduation from a university or school of recognized standing with a degree in civil or chemical engineering and six years of satisfactory public health engineering experience; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Assistant Public Health Engineer.

Duties: Similar to above, at the level of ordinary difficulty and responsibility.

Qualifications: The qualifications of assistant public health engineer shall be:

(a) Graduation from a university or school of recognized standing with a degree in sanitary or public health engineering and two years of satisfactory public health engineering experience; or,

(b) Graduation from a university or school of recognized standing with a degree in civil or chemical engineering and four years of satisfactory public health engineering experience.

Junior Public Health Engineer.

Duties: To perform above duties of minor difficulty and responsibility.

Qualifications: The qualifications of junior public health engineer shall be:

(a) Graduation from a university or school of recognized standing with a degree in sanitary or public health engineering; or,

(b) Graduation from a university or school of recognized standing with a degree in civil or chemical engineering and two years of satisfactory public health engineering experience; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Associate Sanitarian.

Duties: Immediate charge of milk, food, or other phases of environmental sanitation not involving public health engineering in a municipality of not over 350,000 persons.

Qualifications: The qualifications of associate sanitarian, in addition to those prescribed for Grade I dairy and milk inspector in section D of this chapter if such sanitarian performs the duties of a Grade I dairy and milk inspector, shall be:

(a) Graduation from a university or school of recognized standing with a degree in agriculture, veterinary medicine or other branch of science, including successful completion of courses in chemistry, bacteriology, and biology, and six years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(b) Graduation from a university or school of recognized standing with a bachelor's degree, including successful completion of courses in chemistry, bacteriology, and biology, and eight years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Senior Sanitarian.

Duties: (a) As above but in a community of 150,000 to 350,000 persons.

(b) Specialized activities in milk, food, or other phases of environmental sanitation, except public health engineering, in a population of over 350,000.

Qualifications: The qualifications of senior sanitarian, in addition to those prescribed for Grade I or Grade II dairy and milk inspector in section D of this chapter if such sanitarian performs the duties, respectively, of a Grade I or Grade II dairy and milk inspector, shall be:

(a) Graduation from a university or school of recognized standing with a degree in agriculture, veterinary medicine, or other branch of science, including successful completion of courses in chemistry, bacteriology, and biology, and four years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(b) Graduation from a university or school of recognized standing with a bachelor's degree, including successful completion of courses in chemistry, bacteriology, and biology, and six years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Assistant Sanitarian.

Duties: (a) Similar to that of Senior but in community of less than 150,000.

(b) Specialized duties as above but in community of 150,000 to 350,000.

(c) Activities of more than ordinary difficulty and responsibility related to milk, food, or other phases of environmental sanitation not involving engineering, in a municipality of over 350,000.

Qualifications: The qualifications of assistant sanitarian, in addition to those prescribed for Grade I or Grade II dairy and milk inspector in section D of this chapter if such sanitarian performs the duties, respectively, of a Grade I or Grade II dairy and milk inspector, shall be:

(a) Graduation from a university or school of recognized standing with a degree in agriculture, veterinary medicine, or other branch of science, including successful completion of courses in chemistry, bacteriology, and biology, and two years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(b) Graduation from a university or school of recognized standing with a bachelor's degree, including successful completion of courses in chemistry, bacteriology, and biology, and four years of satisfactory experience in sanitation work related to milk, food or other phases of environmental sanitation; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

Sanitary Inspector.

Duties: Environmental sanitation inspections of a subprofessional nature.

Qualifications: The qualifications of sanitary inspector, in addition to those prescribed for Grade III dairy and milk inspector in section D of this chapter if such sanitary inspector performs the duties of a Grade III dairy and milk inspector, shall be:

(a) Graduation from high school, including successful completion of courses in general science, mathematics and chemistry, and two years of satisfactory sanitary inspection experience; or,

(b) Six years of satisfactory sanitary inspection experience. Each year of a successfully completed high school or general college course shall be accepted in lieu of one year of satisfactory experience; provided, however, that in any case at least one year of satisfactory sanitary inspection experience is required; or,

(c) Any combination of education, experience and training which in the opinion of the public health council is the equivalent of either of the above qualifications.

A STUDY OF THE CORROSION OF TIN PLATE BY CAN WASHING COMPOUNDS

(Continued from page 268)

(1935); *Tech. Publ. Internat. Tin Res. and Dev. Council*, A, No. 19.

Kerr, R. Protective films on tinplate by chemical treatment. *Soc. Chem. Ind.*, **59**, 259-265, (1940); *Tin. Res. Inst.*, No. 104.

Levine, Max., Buchanan, J. H., and Toulouse, J. H. Influence of sodium chloride, sodium carbonate, and tri-sodium phosphate on the germicidal efficiency of sodium hydroxide. *Iowa State Coll. Sci.*, **2**, 19-29, (1927).

Levine, Max., Buchanan, J. H., and Lease, Grace. Effect of concentration and temperature on the germicidal efficiency of sodium hydroxide. *Iowa State Coll. Sci.*, **1**, 379-394, (1927).

Lowman, O. E., Buchanan, J. H., and Levine, Max. Effects of salt on alkali disinfection. *Iowa State Coll. Sci.*, **5**, 251-268, (1931).

MacNaughton, D. J., and Hedges, E. S. Some recent investigations on the corrosion of tin. *Tech. Publ. Internat. Tin Res. and Dev. Council*, A, No. 34, (1936).

McKay, R. J., and Worthington, R. Corrosion resistance of metals and alloys. A. C. S. Monograph Series, No. 71, Reinhold Pub. Corp. (1936).

Parker, M. E. When is "Cleaned" equipment really clean? *Food Ind.*, **12**, 39-42, (1940).

Parker, M. E. Corrosion tests on acid cleaners used in dairy sanitation. *Milk Technol.*, **5**, 37-40, (1942).

Prucha, M. J. Corrosive action of sterilizers and washing powders. *Milk Dealer*, **19**, No. 5, (1930).

Van Slyke, D. D., and Neill, J. M. The determination of gases in blood and other solutions by vacuum extraction and manometric measurement. *I. Jour. Bio. Chem.* **61**, 523-573, (1924).

New Books and Other Publications

Milk and Food Sanitation Practice, by H. S. Adams. Published by The Commonwealth Fund, New York, 1947. 311 pages. 65 figures. $3.25.

Here is an excellent book written by a practicing food sanitarian for food sanitarians. The first 160 pages deal with milk sanitation, and carry 88 references to the literature; pages 161-245, with general food sanitation, especially restaurant practice, and carry 48 references. It tells how to administer a milk control program, and then covers milk production, undesirable flavors, and the pasteurization process, plans for milk plant and equipment layout, laboratory control procedure, and frozen desserts. The food section covers the essentials of food establishment sanitation, and instruction and training of food handlers. Supplementary source material is given in an appendix which carries a list of 30 publications on milk and food control, 10 general references on sanitary science, and publication addresses of 8 periodicals and journals of value to milk and food sanitarians, a partial list of organizations interested in this field, and the names and addresses of commercial firms which serve the industry. This is followed by useful compilations of essential field equipment for the food sanitarian, testing procedure of fluorine-containing insecticide powders, physical examination for signs of food spoilage, causes of food poisoning and infection, outlines of courses for the instruction of food handlers, suggestions for effecting corrections in sanitation, code of ethics for the employee, facts about DDT and its use, partial list of films relating to milk and food sanitation, and precision testing of high-temperature short-time pasteurizers.

The author has succeeded well in omitting much that might be considered detail, leaving to engineers, technologists, chemists, bacteriologists, and veterinarians many matters that the practicing food sanitarian must know something about. Possibly to keep the book within prescribed limits, there is no discussion of soda fountain or lunch counter inspection and operation, both of which need specific treatment in view of the increasing importance in this relatively neglected field. The journal *Food Industries* and the Institute of Food Technologists are not listed in spite of great activity in this field. However, the book covers the work of the milk and food sanitarian clearly, precisely, and reasonably completely. It is well arranged for teaching, and its content, when supplemented by outside reading and demonstration could be used as a beginning text in a college course.

This is the first manual which, to this reviewer, combines the whole subject of milk and food sanitary control in a single volume, arranged as a practical guide for the fieldman, and especially adapted to those who do not have more specialized training. It is a valuable addition to our growing literature in milk and food sanitation control. The author and publisher did a good and useful job.

JOURNAL OF MILK AND FOOD TECHNOLOGY

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Membership and Dues: Active membership in the Association is $3.00 per year, and Associate membership is $2.00 per year, including respectively all issues of the JOURNAL OF MILK AND FOOD TECHNOLOGY. All correspondence concerning membership in the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, including applications for membership, remittances for dues, failure to receive copies of the JOURNAL OF MILK AND FOOD TECHNOLOGY, and other such matters should be addressed to the Secretary of the Association, J. H. SHRADER, 374 BROADWAY, ALBANY 7, N. Y., OR 23 EAST ELM AVE., WOLLASTON 70, MASS.

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Association News

Missouri Association of Milk and Food Sanitarians

The Missouri Association of Milk and Food Sanitarians participated in the Fifteenth Annual Milk and Food Control Short Course held at Columbia, Missouri, April 21, 22 and 23, 1947. This meeting was presented under the auspices of the Division of Health of Missouri, the University of the Missouri Association of Milk and Missouri College of Agriculture and Food Sanitarians.

The registration for the meeting totaled 162, a record attendance for the fifteen consecutive years that these meetings have been held. Those in attendance represented many of the cities in this State, County Health Departments, pasteurization and milk processing plants and individuals interested in milk and food sanitation practices.

The general program procedure consisted of registration during the first morning with the first afternoon session devoted to milk inspectors and their problems. The second day consisted of a joint session of milk and food sanitarians with the banquet and business meeting in the evening. The third morning was devoted to restaurant sanitarians and their problems while the afternoon of the third day was given over to a laboratory session. This laboratory session represented a new innovation and was held this year on an experimental basis to determine if sufficient interest would be shown to justify a more detailed laboratory session at subsequent meetings. Laboratory procedures for the reductase, phosphatase, sediment test, plate counts and direct microscopic counts were enumerated, after which those registrants who desired were invited to participate in these laboratory procedures. Participation in the laboratory demonstrations and problems was very gratifying and the interest shown was such as to warrant the continuation of this particular program at ensuing short courses.

Another innovation undertaken this year was the procedure of opening each session with a sound movie film. The thought was that during the showing of such a film the late arrivals could enter the meeting room and become settled with a minimum of disturbance and lack of embarrassment, both to the late arrival and the first speaker on the program. The films used for this purpose were the new milk sanitation films recently released by the USPHS, namely, "Milk Processing," "Cleaning Equipment and Containers" and "You and Your Job" and the film entitled, "Hash Slinging or Food Handling." Many of the persons in attendance were particularly desirous of seeing the new movie films on milk, and as a result the meeting room was generally well filled for the start of each session.

CHARLES E. CARL
Secretary-Treasurer

Wisconsin Association Loses Valued Members

The Wisconsin Milk Sanitarians' Association has recently lost by death three valued members.

Ward M. Totman, Oconomowoc, dairy inspector for the Wisconsin State Department of Agriculture for the past eleven years, died May 9 at the age of 59. A graduate of the University of Wisconsin Dairy School, he had served as instructor and extension worker there, and had operated creameries at Jackson and Vicksburg, Mississippi.

William G. Kaeser, Madison, district plant manager and member of the board of directors of the Pet Milk Co., died August 6 at the age of 64. He graduated from the University of Illinois in 1904, and joined the Pet Milk Co. at the age of 22. He traveled throughout Wisconsin as district manager of the condenseries and of the Meier Ice Cream Co., Waukesha, a subsidiary of the Pet Milk Co., of which branch he was president. He was a member of Christ Presbyterian Church, of the Greenville, Ill. Masonic Lodge, and of the Illinois Consistory and Shrine.

Clarence Sontag, Milwaukee, fieldman for the Luick Dairy Co., died August 11 at the age of 48. He had been associated with the company for 25 years.

Ross Goes to State Health Department

Dr. R. G. Ross has resigned from the Tulsa Health Department after eighteen years of service to accept a position with the Oklahoma State Department of Health. He will be in charge of milk control work for the State Department. This work will be principally of an advisory capacity as he will be working with sanitarians all over the state.

Button Dies

Forrest Clifton Button, secretary of the Metropolitan Dairy Technology Society, succumbed to a heart attack at his home on May 27, 1947, at the age of 52. He was working in his garden when he became ill.

He was president of the New Brunswick Scientific Society, member of Rutgers Club, Highland Park Chapter F. & A. Masons, Valley of Trenton Consistory, and Scottish Rite 32nd Degree Masons; Kappa Phi, Delta Sigma Phi, Sigma Xi, and Sigma Chi fraternities; treasurer of the Metropolitan Dairy Technology Society and a member and elder of the First Presbyterian Church of New Brunswick, N. J. During World War I he was with the U. S. Health Department, stationed at Newport News, Va.

Preliminary Program of Thirty-Fourth Annual Meeting

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

Milwaukee, Wisconsin, October 16–18

Thursday, October 16

Morning

8:30 Registration.
9:30 Address of Welcome and Reply.
10:00 L. A. Black, "Effect of Changes in Analytical Methods for the Bacteriological Examination of Milk Required by the Next Edition of Standard Methods".
10:30 J. H. Steele, D.V.M., "The United States Public Health Service Veterinary Public Health Program".
11:00 H. G. Hodges, D.V.M., "The New York State Mastitis Control Program".
11:30 C. H. Pals, D.V.M., "The United States Meat Control Service".
12:00 Russell Fifer, "Quality Control in the Butter Industry".

Afternoon

2:00 W. L. Mallmann, "Studies on Dishwashing".
2:30 E. M. Searls, "Modern Methods of Insect Prevention in Dairy Plants".
3:00 Israel Weinstein, "The Restaurant Sanitation Program in New York City".
3:30 C. A. Abele, "Report of Committee on Sanitary Procedure".
4:00 Business Meeting of the Wisconsin Milk Sanitarians' Association.

Evening

Local entertainment and refreshments.

Friday, October 17

Morning

9:00 Industry Quality Control
E. H. Parfitt, "Quality Control in the Evaporated Milk Industry".
J. C. Walsh, "Dry Milk Industry Quality Development Work".
E. L. Reichert, "Quality Control Program in the Cheese Industry".
10:00 F. E. Uetz, "Sanitary Technology in the Ice Cream Industry".
10:30 H. F. Judkins, "Quality Control in the Milk Industry".
11:00 J. L. Barron, "Sanitation in a Modern Bakery".
11:30 T. F. Wisniewski, "The Chemistry and Biology of Dairy Waste Disposal".
12:00 L. S. Sandholzer, "Some General Aspects of Sanitation in the Seafoods Industry".

Afternoon

2:00 G. P. Sanders, "Present Status of the Phosphatase Test for Dairy Products".
2:30 C. B. A. Bryant, "Surveying Sediment Controls".
3:00 A. H. Robertson and J. C. Marquardt, "A Laboratory and Field Trial Study on Farm Filter Aids".
3:30 H. B. Robinson and C. M. Moss, "The Time Factor in High Temperature-Short Time Pasteurization".
4:00 Annual Business Meeting of the International Association of Milk Sanitarians.

Evening

6:30 Banquet.

Saturday, October 18

Morning

9:00 W. E. Krauss, "Factors Affecting the Nutritive Value and Quality of Dairy Products".
9:30 J. R. Perry, "Some New Ideas on Cleaning Plant Equipment".
10:00 P. H. Tracy, "Some Factors Affecting the Efficiency of Milk Can Washing Machines".
10:30 W. D. Tiedeman, "Report of the Committee on Ordinances and Regulations".
11:00 A. W. Fuchs, "Recent Amendments to the United States Public Health Service Milk Code".
11:30 J. R. Sanborn, "Proposed Program of Paper Packaging Sanitation and Control".
12:00 K. G. Weckel, "A Study of the Temperatures of Milk in Possession of Intermediate Handlers, and Pertaining Regulations".
12:30 Adjournment.

Headquarters: Hotel Schroeder.

Room reservations: Rooms will be engaged directly by writing to Hotel Schroeder. The management will route the overflow to neighboring hotels. When writing for room, please indicate the number of persons per room, the price range, and the date of arrival.

Ladies' accommodations: The ladies are cordially invited to come. A special committee has been working on entertainment that will be particularly interesting to ladies. Please write to Miss Norma DeLoria, 1445 North Fifth Street, Milwaukee, Wisconsin, giving the names of the ladies in your party.

Program: The preliminary program, printed in this issue, indicates the broad scope of the subjects which are the concern, these days, of milk and food sanitarians. You cannot afford to miss them. There may be a few cancellations and additions.

All meetings will be held in single sessions, as heretofore. There will be no section meetings.

Concurrent with the presentation of papers in the regular sessions, there will be a showing of motion picture films in a nearby room. These will illustrate various subjects of interest in the field of milk and food sanitation.

Banquet: The banquet will be informal, with no speeches, and will terminate as near 8:00 as possible. This will leave the evening free. Those who would like to engage tables for special groups may make arrangements therefor at the Registration desk. The cost of the banquet will be in addition to the membership fee and the registration fee.

Registration fee: A registration fee of one dollar will provide all registrants with information folder and badge. Badges *must* be shown for entrance to all meetings, including the evening of "Gemutlichkeit".

Registration: The registration desk will be ready to register guests at 8:30, with J. H. Shrader, J. J. Donovan, and W. H. Wallis in attendance for the International Association of Milk Sanitarians. Dr. K. G. Weckel and Dr. L. W. Brown, for the Wisconsin Milk Sanitarians' Association.

Mr. E. C. Kleffen, General Chairman of the Local Committee has arranged for some one to be in constant attendance at the registration desk to care for the needs and interests of all registrants.

Projection equipment: Lanterns and equipment for motion films will be provided for those who indicate their need therefor by October 1.

Meeting of Associate Editors of the Journal: There will be a special luncheon meeting of the Associate Editors of the JOURNAL OF MILK AND FOOD TECHNOLOGY on Friday, October 17. See notice at time of registration.

Maryland Dairy Technology

The third annual Dairy Technology Conference will be held at the University of Maryland on December 2, 3, 4. Steps are being taken to obtain a group of guest speakers who are authorities in various fields of the dairy industry.

The Conference is being arranged to cover subject matter of interest to milk and ice cream plant owners, managers, technicians and superintendents; to public health representatives, inspectors and sanitarians; and to dairy fieldmen.

C. Olin Ball Opens Consulting Service

Dr. C. Olin Ball, well known in food technology circles for his work with the National Canners Association and immediately as medallist of the Institute of Food Technologists announces the opening of a food technology consulting service, specializing in the field of processing and packaging of foods and other products. His business will be located at 408 East Broadway, Maumee, Ohio.

BREED IS HONORED FOR HIS STUDIES IN THE DAIRY AND CHEESE FIELD

Dr. Robert S. Breed, Professor of Bacteriology at the New York State Experiment Station (Cornell University), Geneva, New York, was guest of honor of the National Cheese Institute at a banquet at the Hotel Continental in Chicago, Tuesday, May 6, 1947.

Mr. N. R. Clark, Vice-president of Swift and Company, presided and the group was greeted by Mayor Martin H. Kennelly, a Director in Wilson and Company. After remarks by J. L. Kraft, widely known as the Dean of the cheese industry, Dr. A. C. Dahlberg, Professor of Dairy Industry at Cornell University, addressed the group, saying in part: "Dr. Breed will long be remembered for his work in bacteriology and in dairy science.

"In 1913, Dr. Breed came to work in the dairy building at Geneva where much fundamental research had been done on cheese. Here the relationship of the composition of milk to the yield of cheese was also established. The value of paraffining and cold curing of cheese was also shown. Dr. Breed worked on the bacteriology of cheese curing and particularly on the microbiology of surface-ripened cheese, such as limburger.

"If I were to select those contributions for which he is best known, I would first mention the direct microscopic method of estimating bacteria in milk. The method is often referred to as the 'Breed Method', and it is known and used throughout the world wherever the quality of milk is intensively studied.

"He has played a leading role in the development of standard methods for the examination of dairy products as published by the American Public Health Association. He has been chairman of the committee which prepared these methods since 1934.

"Then he is editor of Bergey's *Manual of Determinative Bacteriology* which is the accepted text on the classification of bacteria. Both of these publications—the Standard Methods and Bergey's Manual—require the cooperation of a large number of scientists of the world who are specialists in the various subjects included in these volumes.

"It is Dr. Breed's responsibility to assemble and correlate this information and prepare it for publication. These contributions will continue to serve science and the dairy industry for many years to come."

Following these remarks, Mr. Harry I. Hoffman of J. S. Hoffman and Company and President of the Institute, presented Dr. Breed with a travelling bag, noting his plan to travel in the Carribean after his retirement on November first. Mrs. Breed, who was present, was given a beautiful green jade brooch by Mr. J. L. Kraft.

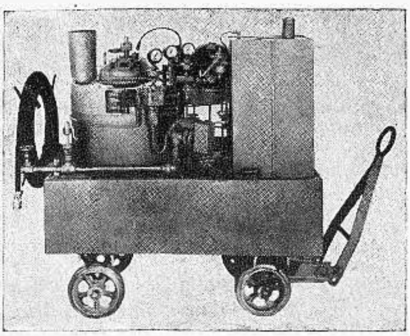
—Geneva Daily Times
Geneva, New York.
May 6, 1947.

Vaccenic Acid in Butterfat*

Of a number of fats analyzed by Geyer, Nath, Barki, Elvehjem and Hart of the University of Wisconsin, butterfat was found to have the highest content of vaccenic acid. Vaccenic acid was recently reported by Boer, Jansen, and Kentie to possess *growth-stimulating properties*. Of the fats studied by Geyer et al., fats from ruminants had the highest content of vaccenic acid—0.50 to 0.70% in butterfat and 0.16 to 0.213% in beef fat. Lard contained 0.071 to 0.127% while mutton fat contained 0.16 to 0.195%. The vegetable oils studied, corn oil, cottonseed oil, soy bean oil, and coconut oil, contained no vaccenic acid.

* From Service Bull. No. 1039, American Butter Institute, July 9, 1947.

Industrial Notes

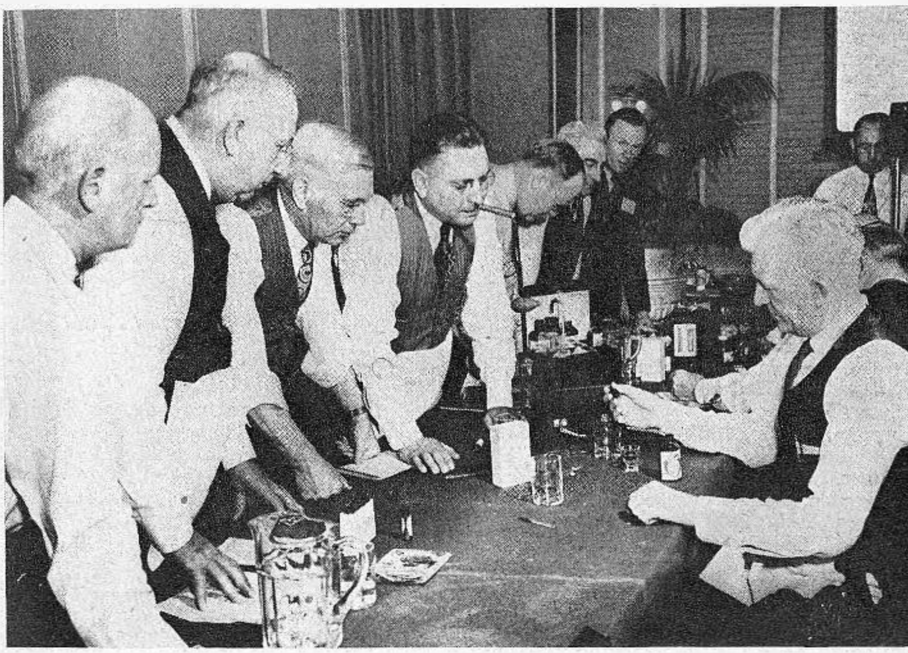


New Oakite Booklet

A special, 12-page illustrated booklet, describing the new, improved Oakite-Vapor Steam Cleaning Unit has just been issued by Oakite Products, Inc., New York.

Data on unit construction, engineering specifications, types of models available and job applications of this latest model, A.S.M.E. approved, steam generator for multiple-duty industrial steam-cleaning and paint-stripping operations, are all factually presented in concise form in this new booklet. For greater clarity the text has been augmented by a series of clear-cut illustrations of operating, control and mechanical features; types of models available to meeting varying job requirements; and interesting views of the Unit in actual steam-cleaning operations of various kinds.

Readers desiring a free copy of the booklet should address their requests to Oakite Products, Inc., 138A Thames St., New York 6, N. Y.



Both representatives and managers take an active part in the Wyandotte Chemicals Refresher Clinics now being held in the eight sales regions of the J. B. Ford Division of the Wyandotte organization. This photo, taken at the Northwestern Region Clinic in Chicago shows representatives from the Minneapolis, Milwaukee, and Chicago offices of the Wyandotte organization.

New Members

ACTIVE

Burlage, Clarence A., 1437 Xanthia St., Denver, Colorado.

Cleveland, David C., County Health Dept., Durant, Okla.

Gallier, John, 1800 N. Edison St., Arlington, Va.

Howell, R. L., Health Dept., McAlester, Okla.

Kinney, F. G., City Health Dept., Sioux City, Iowa.

Merkel, Paul P., City Hall, Reading, Pa.

Miller, Wm. C., 2210 South 9th Ave., Maywood, Ill.

Reed, F. I., 425 Main St., East Aurora, N. Y.

Scheldrup, C. J., 5014 West Superior St., Chicago 44, Ill.

Strait, M. L., City Hall, Hastings, Nebraska.

ASSOCIATE

Anderson, J. S., 1200 West 15th Ave., Gary, Indiana.

Arnold, Richard N., 2125 E. Philadelphia St., York, Pa.

Bergsma, James, City Hall, Waterloo, Iowa.

Bland, Harvey E., 101 Ninth Ave., N.W., Mandan, N. D.

Bradshaw, Ammon, 415 Chamber of Commerce Bldg., Denver, Colorado.

Brownley, Dorthy, Curles Neck Dairy, Richmond, Va.

Brubaker, L. E., State Dairy & Food Division, Richmond, Va.

Burg, S. J., Model Dairy, Clintonville, Wis.

Calhoun, Wesley R., Champaign Sanitary Milk Co., 5th & University Ave., Champaign, Ill.

Campbell, M. S. A., State Board of Health, 1098 W. Michigan St., Indianapolis, Indiana.

Campbell, W. A., Richmond Health Dept., Richmond, Va.

Cohn, William, c/o Jersey Milk & Cream Co., LaFargeville, N. Y.

Coss, Harold S., 112 West Everett St., Dixon, Ill.

Enebach, Henry, City Hall, Rock Island, Ill.

Fawell, W. R., 33 N. LaSalle St., Chicago 2, Ill.

Gilliam, R. B., State Health Department, Buckingham, Va.

Groves, Don, McDonald Dairy, Flint, Mich.

Hallett, H. M., State Health Dept., Leesburg, Va.

Hamann, Charles, 901 Cable St., Streator, Ill.

Hanger, C. F., 110 Montgomery Ave., Staunton, Va.

Haymes, P. L., 2000 West 14th St., Cleveland 13, Ohio.

Hawthorne, H. Y., Piedmont Sabatorium, Burkeville, Va.

Herrmann, M. W., Elseco, Inc., Elkhorn, Wis.

Hillery, Homer, 129 N. Race St., Urbana, Ill.

Honer, C. J., Box 272, State College, Mississippi.

Hunziker, Otto F., 103 Seventh Ave., LaGrange, Ill.

Ireland, W. D., 435 E. Henrietta Road, Rochester, N. Y.

Kendall, A. W., 302 Allegheny St., Hollidaysburg, Pa.

Kincaid, E. F., Cherry-Burrell Corp., Midlothian, Va.

Kinzer, Elmore, Champaign-Urbana Public Health Dist., Champaign, Ill.

Kite, G. D., V. P. I. Extension Service, Blacksburg, Va.

Lawson, Lyle J., 310 Genoa St., Genoa, Ill.

Lundstedt, Erik, Sante Foods, Inc., 16 Parkway, Goshen, N. Y.

Mall, Franklin Louis, 112 West Church St., Sandwich, Ill.

Marcoux, Wayne, Armour Laboratories, 1425 West 42nd St., Chicago 9, Ill.

Mason, William, Route No. 4, Ottawa, Ill.

Miles, Harlan F., 301 Elizabeth St., Pekin, Ill.

Morgan, F. J., Middletown Milk & Cream Co., 38 St. Johns St., Walton, N. Y.

Pease, B. M., Elgin Health Dept., City Hall, Elgin, Ill.

Polfer, Joseph, Hi-Acre Dairy, 1550 Wood St., Dubuque, Iowa.

Petro, Louis, Box 554, Ithaca, N. Y.

Pope, Dr. E. J., Norfolk Health Department, Norfolk, Va.

Quartier, E. B., c/o Producers Dairy, Danville, Ill.

Rank, Tony, Westfield Co-op. Dairy Assoc., Westfield, Wis.

Reed, Samuel I., Bremerton-Kitsap County, Sixth and Marion, Bremerton, Wash.

Rice, Frank, City Health Dept., Sioux City, Iowa.

Riehl, Herbert, 5061 Collingwood St., Vancouver, B. C., Canada.

Riley, H. C., 106 Courtney Ave., Roanoke, Va.

Rothrock, Mrs. Goldie, Champaign Sanitary Milk Co., 5th & University Ave., Champaign, Ill.

Schafroth, Ed., City Health Dept., Des Moines, Iowa.

Scott, Robert Marshall, Illinois Dept. of Public Health, Division of Sanitary Engineering, Springfield, Ill.

Shelley, P., Klein's Chocolate Co., Inc., 245 W. Bainbridge St., Elizabethtown, Pa.
Sizemore, W. C., State Health Department, Smithfield, Va.
Sherbock, John, Bay City Health Dept., Bay City, Mich.
Smith, Wesley, Charlotte, Iowa.
Soldwedel, Henry A., 301 Elizabeth St., Pekin, Ill.
Stafford, Paul, Denison, Iowa.
Stanton, John D., 7715 South Shore Drive, Chicago 49, Ill.
Thompson, H. E., State Health Department, Williamsburg, Va.
Tipsword, Mrs. Winifred, Beatrice Foods, Co., 14th St. at Broadway, Mattoon, Ill.
Toomey, Edward J., 10215 South Vernon Ave., Chicago, Ill.
Tripper, B. M., 828 Windsor Ave., Roanoke, Va.
Williams, W. J., State Health Dept., Richmond, Va.
Wilson, R. A., 952 Benton Ave., Janesville, Ill.
Woods, D. L. S., State Health Department, Box 26, Harrisonburg, Va.
Wright, William J., 512 Brooklyn Ave., Jacksonville, Ill.

CHANGES IN ADDRESS

Bullard, Earl D., Cooperstown, N. Y., to Mexico, N. Y.
Cole, G. S., 4817 N. Hamilton Ave., Chicago, to 2063 Lawrence Ave.
Cunningham, Mrs. Elizabeth, Union Dairy Co., to Beatrice Creamery Co.
Dart, Raymond, Chicago, Ill., to Goodland, Indiana.
Davenport, Dr. R. F., 1528 N. 26th St., Philadelphia, to 4035 Chestnut St.
Elliker, Dr. P. R., Purdue University, to Oregon St. College, Corvallis, Ore.
Fox, A. J., Amerst, Mass., to 120–130 Francis St., Pittsfield, Mass.
Hannen, Otto J., P. O. New York, to 1250 Sedgwick St., Chicago, Ill.
Hummer, Dr. R. L., New Castle, Pa., to Prov. Sqdn. 88, A.P.O. 703, San Francisco, Cal.
Lindsey, R. R., Champaign, Ill., to Beatrice Foods Co., Rantoul, Ill.
Miller, J. R., 1007 S. Wright St., Bloomington, Ill., to 810 N. Madison St.
Perry, Dr. Benjamin, 6221 University Ave., Chicago, to 156 W. 57th St.
Propst, Erhardt, Watertown, Wis., to Box 243, Juneau, Wis.
Quencer, Arthur, 19th St. and Ave. B, N. Y. C., to 620 12th Ave.
Zulkowski, Edward, 1036 W. 32nd St., Chicago, to 3344 South May St.

HONORS TO DAHLE

A gold medal, emblematic of the highest award in dairy manufacturing circles, was presented to Dr. C. D. Dahle, of the Pennsylvania State College faculty, as a highlight of the recent meeting of the American Dairy Science Association held at Guelph, Ontario, Canada. Dr. Dahle is head of the dairy manufacturing staff at Penn State, and the Borden Award medal was accompanied by a check for $1,000.

Sixteen points were gleaned from Dr. Dahle's busy career in the citation, including reports on many of his recent contributions to the dairy industry through research. He has published over 95 scientific articles and is widely known for his work in the field of ice cream manufacture.

Dr. Dahle discovered a method for greatly reducing the time required in making grating cheese, is inventor of the Duo-Visco Homogenizer valve for two-stage homogenizing with a single valve, has developed a new process for making cream cheese without the use of draining bags, and worked out a new method of curing cheddar cheese.

A graduate of the University of Minnesota where he was given his bachelor's degree in 1920, master's degree in 1921 and his Ph.D. in 1937, Dr. Dahle has been on the Penn State faculty since 1925. In addition to his membership in the American Dairy Science Association, he is also a member of Sigma Xi, Gamma Sigma Delta, Alpha Zeta, and Delta Tau Delta fraternities. He is technical editor of the *Ice Cream Field* and chairman of the statistical research committee of the International Association of Ice Cream Manufacturers.

"Dr. Jones" Says—*

We were speaking, here last time, about these outbreaks of food poisoning and food infection: the really important thing being to prevent 'em. Maybe we'd better hammer a little more on that "iron" while it's hot—if it is. Anyway, it won't be long now before the weather'll be hot. That's the time when we're most liable to have 'em.

An outbreak I was reading about the other day: they had 400 cases. That's a lot of people to be griping all at the same time. These big ones: they happen, as you'd expect, when a lot of people are eating the same thing. When you get something like that from a hotel banquet or, we'll say, a church supper—well, it ain't what you'd call real good advertising. And when they're handling more food'n they've got facilities for handling right, it's such times we're most apt to get 'em.

Bacteria being responsible for most of 'em, it's the kind of food germs grow well in we've got to look out for especially. That means protein foods, like meat, fish, eggs, milk and so on: dishes that're soft and moist. Put a few staphylococcus bugs, for example, in a combination like that and let it stand three or four hours at room temperature and—boy! You're setting 'em right up in business. They'll supply enough toxin to poison a sizeable party. But keep it in the refrigerator and it's the germs and not the customers that're out of luck.

Where these various germs come from: well, most often it's people but rats and mice and so on can do a lot of germ-sowing in a short time. Folks with boils and other skin infections or with colds or that're having bowel trouble 'emselves—they'd better let somebody else handle the food. The rats and mice and vermin—that's a matter of having it shut up so they can't get at it.

But a few germs may get in, notwithstanding the ordinary safeguards. Cooling'll chill 'em; cooking'll kill 'em. If the food is the kind that can be heated, it's safer to cook it up again, at a boiling temperature, before it's eaten.

It's only occasionally that these things happen. But when it comes to wholesale mollegrabbles, occasionally is much too often. So it's well to remember the three big C's: Clean, Cold, Cook.

PAUL B. BROOKS, M.D.

* *Health News*, New York State Dept. Health, Albany, May 19, 1947.

FORTHCOMING MEETINGS

International Association of Milk Sanitarians, Oct. 16–18, Milwaukee

Intl. Assn. of Ice Cream Mfrs.	Oct. 27–29	Miami Beach, Fla.
Iowa Milk & Ice Cream Assn.	Nov. 12–14	Des Moines, Iowa
N. Y. State Milk Distributors	Nov. 12–13	Binghamton, N. Y.
Indiana Dairy Products	Nov. 17–19	French Lick, Ind.
American Butter Inst.	Nov. 18–19	Chicago, Ill.
Wash. Dairy Assns.	Nov. 19–21	Vancouver, B. C.
Wisconsin Milk Dealers Assn. & Ice Cream Mfrs. Assn.	Dec. 9–11	Milwaukee, Wisc.
Illinois Dairy Products Assn.	Dec. 15–17	Chicago, Ill.