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Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

A Timely Reminder!

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This double-page spread on "The New Story of Milk" appears in February Better Homes & Gardens . . . and will be seen by millions of readers.

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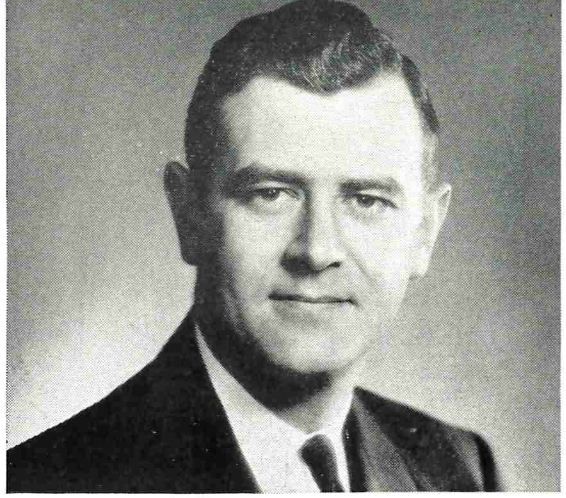

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NEW STORY OF MILK

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PROPOSALS FOR MODIFICATION OF THE ORDINANCE AND CODE REGULATING EATING AND DRINKING ESTABLISHMENTS[1]

John D. Faulkner, William C. Miller, Jr., and Donald K. Summers

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Plans for the preparation of a revised edition of the **Ordinance and Code Regulating Eating and Drinking Establishments — 1943 Recommendations of the Public Health Service** are presented. The major proposals for changes or modifications of the current edition which have been submitted to the Public Health Service are discussed. It is emphasized that no final decision has been reached on these proposals and that they will be submitted to the PHS Food Establishment Sanitation Advisory Committee for its consideration.

A discussion of the actual changes to be made in the next edition of the *Ordinance and Code Regulating Eating and Drinking Establishments* (1) is not possible at this time, since the development of a new edition has not progressed to a stage which will permit the presentaton of changes or modifications on which final decision has been reached. Therefore, it is proposed to present a brief summary of the history leading to the development of the current edition; plans for the preparation of either a revised or a completely new edition; the stage to which these plans have progressed; and some of the major proposals which have been made to the Public Health Service for the modification of the administrative procedures and technical provisions of the present edition of the ordinance and code.

The Public Health Service first became actively interested in the sanitation of eating and drinking establishments in 1934. In that year, in cooperation with the Conference of State and Territorial Health Authorities and the National Restaurant Code Authority, a draft of suggested minimum standards was prepared for the consideration of the National Recovery Administration. These were never published.

In 1935, at the request of a number of State and local health officers for a suggested restaurant sanitation ordinance which might be adopted locally, the Service initiated the development of minimum sanitary standards for eating and drinking establishments. At that time, a detailed study was made of existing municipal ordinances and State regulations, and comments were obtained from health agencies and restaurant operators. Following this, a tentative ordinance and code was issued in 1938 for trial use. This edition was critically reviewed by the PHS Milk and Food Sanitation Advisory Board, and a revised edition was issued in 1940, which was soon adopted by several hundred communities as well as by several States.

Experience in the enforcement of the 1940 ordinance brought additional suggestions for its improvement, and these suggestions were considered by the Advisory Board in 1942. As a result, the first printed edition of the *Ordinance and Code Regulating Eating and Drinking Establishments* was published in 1943. This is the current edition. It has been adopted by, or serves as the basis for the regulations of 30 States, 2 Territories, the District of Columbia, 692 municipalities, and 357 counties.

The need to revise the 1943 edition of the ordinance and code, or to prepare a completely new edition, has been apparent since the termination of World War II. In the last 12 years, there have been a number of technical advancements, as well as improvements in public-health practices, which must be recognized if the ordinance is to be kept up-to-date. Also, the additional experience gained by health agencies and restaurant operators during this period has brought to light needed modifications. In this connection, the first National Sanitation Clinic, held in Ann Arbor, Michigan, in 1948, under the auspices of the National Sanitation Foundation, considered the question of modifying the ordinance and code in light of technical developments and experience, and submitted a number of worthwhile recommendations.

In considering plans for development of the next edition, it was strongly felt that it would be desirable to broaden the base of advisory assistance to the Service, so that the ordinance and code would reflect to a higher degree the experience and viewpoints of State and local health agencies, the food-service industries, and national public health organizations. To broaden this base we thought that the

[1]Presented at the 42nd Annual Meeting of the *International Association of Milk and Food Sanitarians, Inc.*, Augusta, Georgia, October 2-6, 1955.

following actions should be taken: (a) that the present PHS Advisory Board structure should be reorganized to provide broader representation from all of the groups mentioned above; (b) that throughout the development of the new ordinance and code, we should seek the views and assistance of the food-service industries concerned; and (c) that all States, and a representative number of cities and counties, should be requested to submit their views and recommendations on changes needed in the present edition, as well as their comments on the draft of the proposed new edition.

These matters were discussed with the Advisory Board, which recommended that the present board be dissolved and that separate categorical committees be established for milk, food establishments, and shellfish. Accordingly, preliminary steps have been taken to organize a Food Establishment Sanitation Advisory Committee consisting of 15 members—4 to represent State and local health agencies, 5 to represent national public-health and sanitation organizations (including a representative of the International Association of Milk and Food Sanitarians), 4 to represent the food service industries most directly concerned, and 2 members from educational institutions offering courses in public health or engaged in food sanitation research. The first meeting of this new committee will be held during the spring or summer of next year (1956). One of the first matters on which its advice will be sought will be whether the approach to the new edition should be through the development of a completely new ordinance and code, or the revision of the 1943 edition.

As regards industry assistance and support, a significant development took place in 1953. In that year, at the invitation of the National Restaurant Association and the National Sanitation Foundation, the Public Health Service joined with these groups in sponsoring a meeting of food-service industry and public health representatives to explore the possibilities of developing a national program for food protection. Two such meetings have been held, one in 1953 and another in 1954. As a result, a National Food and Beverage Council has been formed. One of the stated objectives of this Council is to stimulate the development of an ordinance and code which would provide uniformity in eating-place sanitation throughout the nation, and which would be mutually acceptable to industry and public health groups. The Executive Committee of the Council has expressed its willingness to help the Public Health Service in the development of such an ordinance and code and, if a satisfactory code can be developed, to support its nationwide utilization. The Public Health Service is glad to have the assistance of this group.

Preliminary work on the development of a new edition was initiated in 1954. As would be expected, many proposals for changes had been received since the ordinance and code were published in 1943. These included proposals submitted by State and local health agencies, the food-service industries, national health and sanitation organizations, and the National Sanitation Clinic. The first step was to collate and codify these suggestions.

The next step taken was to request the food-service industries, all of the States, and, through the States, a small but representative number of municipalities and counties, to review the current edition and to submit their suggestions and recommendations for modifications. In view of the questions which had been raised in earlier comments covering the use of grading as an enforcement procedure, and the need for an interpretive code section, we specifically asked the States and communities for their comments on these two matters.

The response was most gratifying in that replies were received from 38 States, the Territories of Alaska and Hawaii, and 122 municipalities and counties. While many proposals were submitted, the majority of them related to the need for clarification and the need for incorporation of additional information based on research and technological progress. It was of interest that a large number of these comments related to a relatively few items, and that no changes at all were requested in many of the present provisions.

The time alloted for this paper will not permit the presentation of all proposals received. Therefore, mention will be made only of those calling for major changes or modifications, or those advocated by a majority of persons submitting comments. Wherever possible, the reasons for the changes, as submitted by the health agency, organization, or person submitting the proposal, will be given. It is reemphasized that these are proposals only, and that no final decision has been made on any of them.

Organization and Scope:

Four major proposals were received relative to the approach to be followed, organization, and scope. The first of these was that no attempt be made to revise the 1943 edition, but that an entirely new ordinance and code be prepared. The Executive Committee of the National Food and Beverage Council, and some representatives of the food-service industries, favor this approach. They have advocated the development of a new document based on an over-all exploration of the total public-health problems as they exist today; evaluation of those activities which can best be controlled by law enforcement, as contrasted with education and self-supervision; specification of practical methods for preventing undesirable conditions, rather than the development of a list of conditions to be checked for satisfactory compliance; and the utilization of industry for the regular checking of sanitary conditions.

The second proposal is that, in the new edition, the interpretive code section, which now provides details as to "satisfactory compliance," be either omitted or restricted to recommendations only. As previously mentioned, we specifically requested the views of the States and selected communities on this point. Of the replies received, 29 States and 105 municipalities and counties favored retention or expansion of the interpretive material. No State advocated its deletion; however, three communities did so.

The third proposal relates to broadening the coverage of the present ordinance to include other types of retail food establishments such as grocery stores, meat and vegetable markets, bakeries, locker plants. etc. The Conference of State and Territorial Health Officers, the National Sanitation Clinic, 5 States, and 8 communities advocated this expansion of coverage. Also, in this connection, it has been requested that more detailed sanitation standards be developed for itinerant restaurants, mobile canteens, and industrial caterers.

Another major proposal, submitted by several States, communities, and individuals, was that an appendix be included in the new edition similar to that now contained in the 1953 edition of the suggested *Milk Ordinance and Code*. In this connection, one of the objectives of the National Food and Beverage Council is the preparation of a looseleaf manual which would provide information on new techniques and methods, research findings, efficacy of new products and devices, and other relevant material which would be of value to industry and health agencies alike. The development of such a manual by the National Food and Beverage Council would, in all probability, obviate the need for an appendix.

Administrative Procedures:

The following proposals have been received with regard to modifying the administrative and enforcement procedures of the ordinance.

The current edition provides for two different forms of an ordinance—one, a grading type, which provides for enforcement by degrading or permit revocation, or both; the other a non-grading, minimum-requirements type, enforceable by permit revocation only. Some members of the food-service industry, and some health authorities, have recommended that the grading option not be included in the new edition. Of the 31 States submitting comments on this point, 20 favored retention of the opional feature, 7 favored a non-grading type of ordinance, and 4 preferred only the grading type. Of the 122 cities and counties which commented, 84 favored retention of the optional grading provision, 16 preferred a non-grading type, and 22 advocated that the enforcement procedures should be based solely on grading.

It has been proposed, also, that an additional method of enforcement be included which would permit the serving of a closing order due to failure to correct conditions detrimental to the public health concerning which the operator had already been advised by written notice.

Another suggestion of major significance relates to the inspection of establishments. It has been recommended that provisions be made to utilize, wherever possible, industry inspection as a supplement to official inspection.

The importance of training food-service personnel was recognized by many of those submitting comments, and some recommended that a new administrative procedure be included requiring food-handler training as a prerequisite for employment.

Two other suggestions received for modification of administrative and enforcement procedures were that a numerical scoring system be established as the basis for grading, and that the minimum number of official inspections per year be increased.

Wholesomeness of Food:

Because faulty methods of preparation, handling, storage, and refrigeration have been responsible for a considerable number of reported foodborne outbreaks, a number of recommendations were received to provide more specific requirements concerning these practices in relationship to certain foods. Among the most significant of these proposals are the following:

Requirements for refrigerated storage of perishable foods for daily use should be reduced from a maximum of 50° F. to 45° F. or less; and, where such food is to be stored for a period of more than four days, the temperature should not exceed 40° F. Also, it has been proposed that the new code specify optimum storage temperatures for those foods which potentially are the most hazardous.

To promote rapid cooling, it should be specified that sandwiches and salad mixtures, and chopped, cut, boned, or left-over food should be promptly stored in refrigerators in shallow containers not to exceed 3 inches in depth, or other satisfactory means should be employed to insure prompt cooling of the entire food mass.

The temperature ranges within which warmed foods may be safely held should be determined with respect to growth of pathogens and the development of bacterial toxins, and should be incorporated as a requirement in the code. It should be specified that sliced, boned, hashed, or other cooked meats, certain salad and sandwich mixes, and certain pastries should not be kept at room temperature for more than 1 hour after preparation.

Provisions should be included requiring the thorough cleaning of hands, as well as all contact equipment, following the dressing, evisceration, or other preparation of uncooked poultry.

More specific provision should be made to protect foods from exposure to coughing, sneezing, or dust.

Another proposal, which would have considerable bearing on current food control practices, is that bacterial indices be established for those foods most frequently involved in disease outbreaks. Concern was also expressed by a number of State and local health agencies regarding the potential hazards involved in the increasing utilization of precooked frozen food items, including complete meals, which may be served after only a perfunctory warming. Several requests were received that the new ordinance and code contain provisions for the proper handling of these products.

Cleaning and Bactericidal Treatment of Eating Utensils and Equipment:

A large number of proposals were received for changes in the technical provisions concerned with the cleaning and bactericidal treatment of utensils and equipment. Some of these proposals are as follows:

Where manual dishwashing methods are used, the immersion time for bactericidal treatment should be reduced from 2 minutes to 30 seconds.

Three compartment vats should be required for hand dishwashing regardless of whether chemical germicides or hot water is used for bactericidal treatment. This change was advocated because of problems encountered in maintaining proper temperatures in the hot-water-treatment compartment, the carry-over of organic matter and detergent, and to provide for tempering to reduce breakage.

Time, temperature, pressure, and volume requirements, for the various operational cycles of dishwashing machines of both the spray and immersion types, should be specified. Wash water temperatures of 140° F. to 160° F., and rinse water temperatures above 170° F., were recommended. In this connection, since the National Sanitation Foundation has developed standards covering the sanitary design, construction, and operation of spray-type dishwashing machines, it has been proposed that the basic criteria set forth in these standards be incorporated into the new code.

Additional information as to methods for effective cleaning and bactericidal treatment of large utensils and equipment, such as steam kettles, meat blocks, blenders, grinders, slicers, etc., has also been requested.

In addition, it has been requested that specific information be incorporated in the code on chemical bactericides and detergents suitable for use in both manual and mechanical dishwashing. It was also proposed that information be included on tests for evaluation of new proprietary compounds of these types, and for rapid field determination of the residual concentrations present in the use solutions.

Sanitary Design and Construction of Equipment:

A number of suggestions have been made to expand the present coverage of the code relating to sanitary design and construction criteria for utensils and equipment. In this connection, the NSF Joint Committee on Food Equipment and, to some extent, the 3A Sanitary Standards Committee for Dairy Equipment and the Baking Industry Sanitation Standards Committee are developing standards for specific items of equipment used in the food-service field, and it has been proposed that appropriate references to these standards be incorporated into the new code.

Physical Facilities:

Comments received with respect to such items as floors, walls, ceilings, ventilation, and cleanliness of premises appear to indicate the existence of two points of view. One view is that most of these items are of little public-health significance and are primarily an aesthetic consideration. The other view is that these items are necessary to the maintenance of cleanliness, and to control insects and rodents. A suggestion has been made that these differences in viewpoints might be resolved by specifying requirements for these items for kitchens, cafeteria lines, and similar food preparation and service areas, and by modifying such provisions as they relate to dining and other areas.

The number of comments received on certain physical items, namely, lighting, toilet vestibules, and handwashing facilities, definitely indicate a preponderance of opinion for changes in these items.

It was recommended that the new code specify a lighting intensity of 20 to 25 foot-candles for all working surfaces, and a minimum of 10 foot-candles in all storage areas.

As regards handwashing facilities, many States and communities proposed that such facilities be required in the kitchen or food-preparation areas, as well as in, or convenient to, the toilet rooms.

In view of improved methods of fly control, many suggestions were made to eliminate the requirement for an intervening room or a vestibule, between toilets and rooms in which food is prepared, served, or stored.

In conclusion, I would like to take this opportunity to express the sincere appreciation of the Public Health Service to those of you who submitted comments and recommendations for changes in the 1943 edition of the *Ordinance and Code Regulating Eating and Drinking Establishments.* The assistance which you have provided will be of great value in the development of the new edition. Also, as previously mentioned, the new edition will be submitted in draft form to all States, and to a representatve number of municipalities and counties, for review and comment, in order that the PHS Food Establishment Sanitation Advisory Board may have the benefit of your experience and thinking before the new ordinance and code is finalized.

REFERENCES

1. *Ordinance and Code Regulating Eating and Drinking Establishments—1943 Recommendations of the Public Health Service,* PHS Publication No. 37.

WASTE TREATMENT BY OPTIMAL AERATION—THEORY AND PRACTICE IN DAIRY WASTE DISPOSAL[1]

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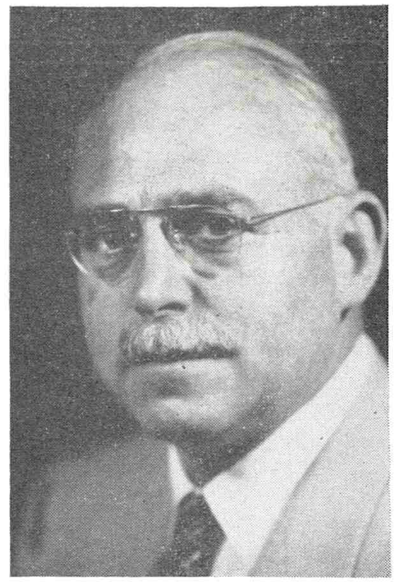
The activities of microorganisms on milk and other food products are well known. The activities of these same microorganisms when under control are of major importance for the disposal of fluid wastes from the food processing industries. Increasing demands for clean streams, rigorous legislation to counter pollution, dissatisfaction with existing waste disposal systems, and other factors led to an intensive study of the dairy waste disposal problem. The information obtained, the procedures developed, the principles involved, and the simplified dairy waste disposal unit which evolved from this research may be applicable to various organic wastes obtained during food processing. Table 1 compares various wastes, the concentrations varying with dilution.

The low concentration of solids in dairy wastes, the relatively great oxygen demand and the biochemical availability of the major constituents of the waste suggested an aeration treatment. Biological oxidation is not novel. Waste disposal by aeration is an accelerated natural process converting soluble organic polluting substances to harmless material. The process hinges upon the activity of microscopic life that feed upon the organic matter present in the waste waters and that require oxygen to maintain this life activity.

Details of our studies on the disposal of dairy wastes are available in a number of articles listed and summarized in reviews and discussions (2,8,13,14,15). This presentation gives selected basic concepts and their application to a waste disposal problem.



Dr. Porges received the B. S. degree from the University of Massachusetts in 1924, and the M.S. and Ph.D. degrees in Microbiology from Rutgers University. He has been employed by the U. S. Department of Agriculture since 1937, except for a period of 3 years. Dr. Porges presently is a chemist at Eastern Utilization Research Branch at Philadelphia, Pa., and is leader of the Dairy Waste Unit. He is the author of numerous publications and is a member of the American Chemical Society, American Association for the Advancement of Science, the Society of American Bacteriologists, Iowa Academy Science, and The Society of Sigma Xi.

Threshold Experiments

Laboratory investigations using synthetic waste and conducted under vigorous agitation and adequate aeration showed that desirable changes take place rapidly. Aerobic treatment converted the much diluted high oxygen demanding materials to removable substances of lower oxygen requirement. Rapid chemical methods of analyses were necessary to follow the fast changes. A simplified chemical oxygen demand (C.O.D.) test became an important tool (17).

Repeated tests conducted in a 5-gallon fermentor on a fill-and-draw procedure in which 1/5 of the mixed aerated solution served as seed gave the results shown in Figure 1. About 50 per cent of the oxygen demanding material had disappeared in 6 to 8 hours yielding a supernatant solution containing less than 10 per cent of the original C.O.D. (5). Later, it was shown that by increasing the seed concentration to 1000 ppm, the change was completed in about 3 hours (3). Increasing concentrations of active sludge should have a direct bearing on the rate of removal and conversion of the waste.

Table 2 is a solids balance obtained during continuous flow studies. Practically all of the protein-nitrogen of the waste was found in the the sludge, and all of the lactose had disappeared. The sugar consti-

[1]Presented at the 42nd Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., Augusta, Georgia, October 2-6, 1955.

tuted all of the total organic matter that was destroyed (6).

Manometric studies gave further insight to the process. The rate and extent of oxidation were followed at 30° C., the temperature at which most of the laboratory studies were made since changes occur more rapidly at this temperature than at lower temperatures.

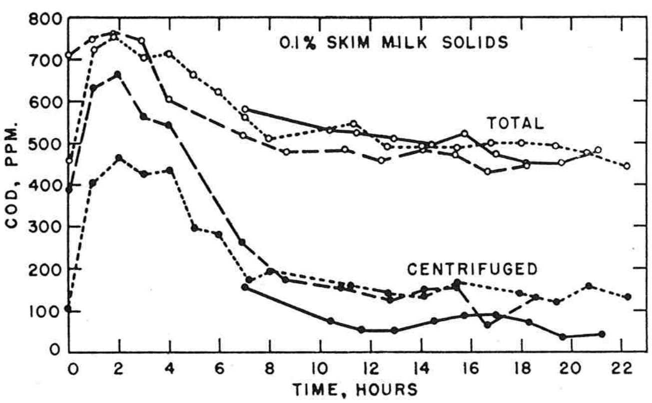


Figure 1. Changes in C.O.D. during filling operation. Seed, 1 gal. 500 ppm solutions. Feed, 4 gal. 100 ppm skim milk added in 4 hours.

TABLE 1 - COMPOSIITON OF WASTES (APPROXIMATED FROM LITERATURE)

Type of waste	C.O.D.	B.O.D.	Nitrogen
	(ppm)	(ppm)	(ppm)
Dairy	1050	700	59
Tomato	1180	800	15
Food	1150	780	22
Brewery	1330	890	74

TABLE 2 — ORGANIC SOLIDS BALANCE DURING AEROBIC ASSIMILATION

	Protein units	Carbohydrate units	Total units
Influent feed	35	53	88
Effluent			
Cell solids	34	7	41
Solubles	1	2	3
Organic destroyed	0	44	44

TABLE 3 — ANALYSIS AND EMPIRICAL COMPOSITION OF WELL-AERATED SLUDGE

	Analysis	Ratio of atoms	
	(per cent)	(%/atomic weight)	
C	47.26	3.94	4.9
H	5.69	5.65	7.0
N	11.27	0.81	(1.0)
O	27.0	1.69	2.1
Ash	8.61	------	----

Empirical formula = $C_5H_7NO_2$

The data in Figure 2 were obtained when 3 mg. skim milk, or 1.5 mg. lactose, or 1.05 mg casein were agitated in Warburg respirometers containing 500 ppm well aerated sludge (4). Oxygen removal was very rapid, tapering off by the 6th hour, when it approached the rate of oxygen consumed in the flask containing no added nutrients (endogenous respiration). Analyses made at that stage showed that all of the organic substances were removed from solution. Yet, the actual amount of oxygen utilized failed to show complete oxidation. Many such tests showed that on the average about 37 per cent of the C.O.D. was destroyed by oxidation. Apparently the remainder of the organic matter was assimilated by the growing cells since the oxygen used was equivalent to the CO_2 evolved. Thus this oxidative conversion may be stated as follows: Organic wastes + $O_2 \xrightarrow{\text{organisms}}$ Cells + CO_2 + H_2O

EQUATIONS OF CONVERSION

The ultimate cell or sludge results from many intricate steps, but for practical purposes cell synthesis was expressed in a simple manner (7). Analysis of aerated sludge gave the empirical composition shown in Table 3. The complex system of a microbial cell is graphically simplified by the formula $C_5H_7NO_2$ which is of use for determining its relationship to available nutrients.

Lactose is completely oxidized to carbon dioxide and water: $C_{12}H_{22}O_{11}.\ H_2O + 12\ O_2 \rightarrow 12\ CO_2 + 12\ H_20$, or $CH_2O + O_2 \rightarrow CO_2 + H_2O$

Five of these sugar fragments and nitrogen are needed to produce a "mole" of cell:

$$5\ (CH_2O) + NH_3 \rightarrow C_5H_7NO_2 + 3\ H_2O$$

The Warburg studies showed that 3 out of 8 carbons were completely oxidized while 62.5 per cent or the remaining 5 carbons were assimilated. The following equation satisfied these conditions and agreed with the respiration quotient (R.Q.) showing that the CO_2 evolved was equivalent to the O_2 used. The 240 atom units of sugar yield 113 units of cell or 124 units when ash is included. This is 52 per cent by weight and approximated yields obtained in earlier experiments.

$$8\ (CH_2O) + 3\ O_2 + NH_3 \rightarrow C_5H_7NO_2 + 3\ CO_2 + 6\ H_20$$

Casein gave a like relationship. The casein analyzed $C_8H_{12}N_2O_3$ (omitting P and S) giving a "mole" weight of 184. Upon complete oxidation the following is obtained:

$$C_8H_{12}N_2O_3 + 8\ O_2 \rightarrow 8\ CO_2 + 2\ NH_3 + 3\ H_2O$$

But, manometric results showed only 3 carbons were

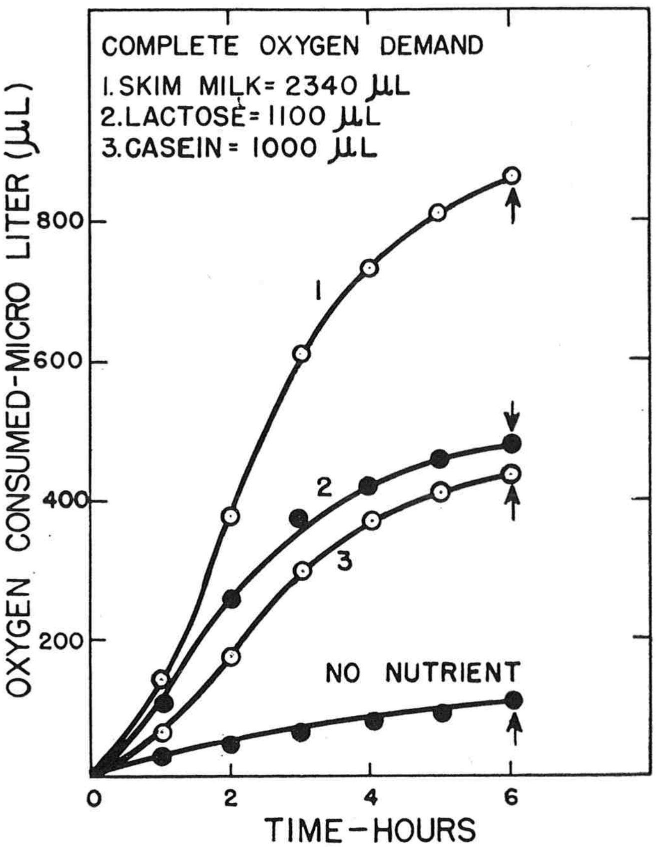


FIG. 2

Figure 2. Manometric studies for period of 6 hours showing immediate high oxygen demand and incomplete oxidation of substrate.

oxidized while 5 carbons were assimilated, thus protein conversion may be written:

$C_8H_{12}N_2O_3 + 3\ O_2 \rightarrow C_5H_7NO_2 + NH_3 + 3\ CO_2 + H_2O$

One mole of cell is produced from 240 units of sugar or from 184 units of casein. Fortuitously, lactose and casein occur in our synthetic waste in the same proportions. The nitrogen liberated in the oxidation of casein satisfies the nitrogen required for the assimilation of sugar. The equations were added together giving:

$8\ (CH_2O) + C_8H_{12}N_2O_3 + 6\ O_2 \rightarrow 2\ C_5H_7NO_2 + 6\ CO_2 + 7\ H_2O$

Endogenous respiration or the oxygen requirement of the unfed cell was also determined and may be expressed:

$C_5H_7NO_2 + 5\ O_2 \rightarrow 5\ CO_2 + NH_3 + H_2O$

One "mole" of cell weight 113 (or 124 with ash) requires 160 units of oxygen for complete oxidation. Endogenous respiration proceeds at a much slower rate than assimilative oxidation. Experiments showed that oxygen demand during endogenous respiration is about 1/10 the demand during assimilation. Cell breakdown occurs at the slow rate of one per cent per hour.

The laboratory results may be gathered and plotted as in Figure 3, where one dose of 1000 ppm milk is acted upon by 500 ppm sludge. For about 6 hours the organic waste is used and converted to cell material. At this time oxygen demand is very high. Then the oxygen demand decreases to about 1/10 the rate and the sludge cells are used up at the rate of 1 per cent per hour requiring about 100 hours to attain the weight of the original seed.

TABULATION OF DATA

Complete combustion of a pound of moisture-free and ash-free skim milk requires 1.214 pounds of oxygen. In other words, a pound of oxygen must be supplied to oxidize a pound of oxygen demand. This amount of oxygen must be dissolved in the waste for each 8 pounds of fresh milk that is spilled.

A pound of skim milk solids dissolved in 1000 pounds of water (*ca.* 120 gallons) yields a 1000 ppm concentration. When this is aerated and agitated in the presence of 500 ppm sludge, the following occurs. During assimilation:

Portion of O_2 required	37.5%
Amount of O_2 used	0.453 lb.
Time elapsed	6.0 hr.
Hourly O_2 utilization	0.075 lb.

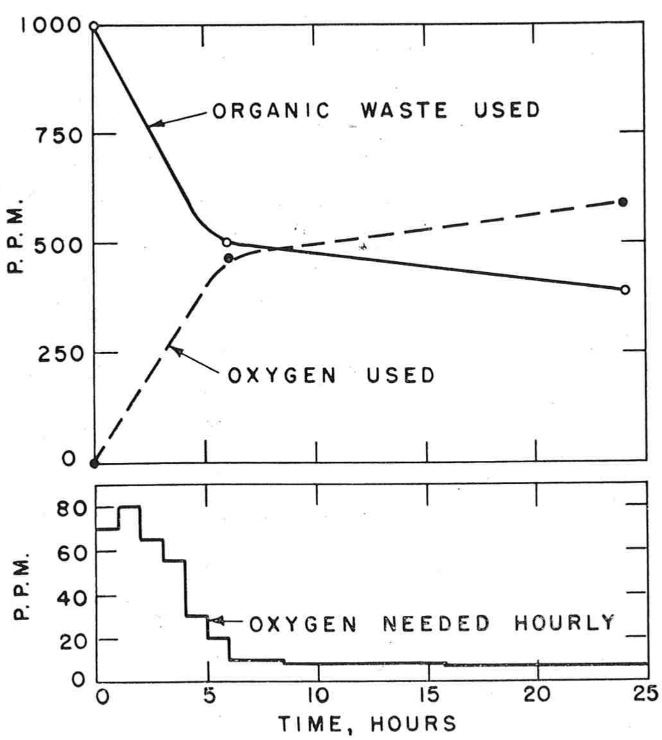


Figure 3. Compilation of laboratory experiments when 1000 ppm skim milk are aerated with 500 ppm sludge.

New cells (sludge) produced .... 0.5 lb.
During endogenous respiration:
Portion of O_2 required 62.5%
Amount of O_2 used .... 0.761 lb.
Time required to oxidize cells, *ca.* ....100.0 hr.
Hourly O_2 utilization .... 0.007 lb.

TREATMENT ON PILOT PLANT AND INDUSTRIAL SCALE

These data were applied to pilot plant studies by Kountz under a research project sponsored by the Department of Agriculture at the Pennsylvania State University. After 20 months of operation, treating 10,000 gallons of waste daily from the University Creamery, he reported that the original laboratory research data have been fully substantiated (10). Milk solids were oxidized in a few hours without any odor when sufficient oxygen was available. Oxygen was supplied by direct aspiration from the atmosphere by means of the Penberthy Ejector, type XL-96 size 7A (steam nozzle) which he selected after evaluating a number of non-mechanical proprietary aerating devices (11).

Excess sludge was no problem as it was oxidized. Since about 20 per cent of the sludge was destroyed by endogenous respiration daily, conditions were established wherein new cells produced from the milk solids in the waste replaced the amount oxidized.

Through the efforts and interest of Levowitz (12) the first commercial prototype was designed and put into operation by Kountz (9). The waste volume treated daily is 25,000 gallons in a tank of 37,500 gallons capacity with an effluent pipe at the 9,000 gallon level. The C.O.D. of the waste is about 2,000 ppm, the sludge concentration 5,500 ppm. Aeration is stopped for 6 hours to allow the cells to settle and the 25,000 gallon clear supernatant to drain out.

Endogenous respiration requires 9.4 pounds dissolved oxygen per hour and burns up 150 pounds of cells. During the 8 hours of waste flow containing 300 pounds of milk waste, 17 pounds of oxygen are required per hour during assimilation. Hence, a total of 26.4 pounds oxygen are supplied during the first 8 hours, and then only 9.4 pounds per hour for the remaining 10 hours. The 150 pounds of cells produced replace the 150 pounds destroyed.

The process is practically automatic and, if not tampered with and if left undisturbed, works to the satisfaction of all concerned. It must be emphasized that decreasing the air, or decreasing the periods of aeration, especially when overloading, produces conditions both undesirable and unnecessary in a waste disposal plant. (One pound of oxygen demand requires one pound of oxygen to be dissolved in the oxidation system.)

DISCUSSION

Non-odorous treatment of dairy and other food wastes is not only a possibility but an actuality. Inoffensive conditions are maintained when sufficient oxygen is supplied in solution to satisfy the oxygen demand. This accelerated aeration process satisfied the high oxygen demand during the short assimilation period and utilizes endogenous respiration with its low rate of oxygen demand for sludge digestion. Information obtained from these laboratory studies has been of value not only in designing units for the disposal of dairy waste but also in designing facilities for the aerobic biological treatment of other organic wastes (1).

Since complete oxidation has been stressed, waste removal or purification has not been discussed, although the rate of purification can be 10 times that of oxidation (8). Sludge can store large quantities of C.O.D. as glycogen-like substances in a very short while (16). These stored products then go through the process of assimilation and endogenous respiration. Cells may be removed in the early stages, but must be disposed of by means other than endogenous respiration.

A one-tank fill-and-draw, rapid aeration system, properly designed is a simple method of waste disposal with no disagreeable end products. A continuous process incorporating these principles is under development.

REFERENCES

1. Eckenfelder, W. W., Jr. and O'Connor, D. J., Aerobic biological treatment for organic wastes, Proc. 9th Ind. Waste Conf., Purdue Univ., 512. 1954.
2. Hoover, S. R., Biochemical oxidation of dairy wastes. V. A. review. Sewage and Ind. Wastes, **25**: 201. 1953.
3. Hoover, S. R., Jasewicz, L. and Porges, N. Biochemical oxidation of dairy wastes. VI. Relationship between the rate of purification and rate of oxidation and graphical estimation of first order velocity constants. Proc. 9th Ind. Waste Conf., Purdue Univ., 71. 1954.
4. Hoover, S. R., Jasewicz, L., Pepinsky, J. B. and Porges, N. Assimilation of dairy wastes by activated sludge. Sewage and Ind. Wastes, **23**: 167. 1951.
5. Hoover, S. R., Pepinsky, J. B., Jasewicz, L. and Porges, N. Aeration as a partial treatment for dairy wastes. Proc. 6th Ind. Waste Conf., Purdue Univ. 313. 1951.
6. Hoover, S. R., and Porges, N. Treatment of dairy waste by aeration. II. Continuous aeration studies. Proc. 5th Ind. Waste Conf., Purdue Univ. 137. 1949.
7. Hoover, S. R. and Porges, N. Assimilation of dairy wastes by activated sludge. II. The equation of synthesis and rate of oxygen utilization. Sewage and Ind. Wastes, **24**: 306. 1952.

8. Hoover, S. R. and Porges, N. Treatment of dairy waste by aeration. U. S. Dept. of Agric. Bull. AIC-332, Mar. 1952.

9. Kountz, R. R. Big problem: Dairy wastes. Striking solution: Bio-oxidation. Food Eng. **26**: (No. 10), 89. 1954.

10. Kountz, R. R. Dairy waste treatment at the Pennsylvania State University. Conference on Agric. Processing Wastes, Nov. 1, 1954, Eastern Util. Res. Branch, Phila., Pa.

11. Kountz, R. R. Evaluating proprietary aerating devices. Proc. Conf. on Biol. Waste Treatment, Manhattan College, April, 1955.

12. Levowitz, D., Dir. New Jersey Dairy Laboratories, Personal communications.

13. Porges, N. Rapid bio-oxidation method of waste disposal. Amer. Brewer. (In press).

14. Porges, N., Jasewicz, and Hoover, S. R. A microbiological process report. Aerobic treatment of dairy wastes. Applied Microbiology, **1**: 262. 1953.

15. Porges, N., Jasewicz, L. and Hoover, S. R. Principles of biological oxidation. Proc. Conference on Biol. Waste Treatment, Manhattan College, April, 1955.

16. Porges, N., Jasewicz, L. and Hoover, S. R. Biochemical oxidation of dairy wastes. VII. Purification, oxidation, synthesis and storage. Proc. 10th Ind. Waste Conf. Purdue Univ. (In press).

17. Porges, N., Pepinsky, J. B., Hendler, N. C. and Hoover, S. R. Biochemical oxidation of dairy wastes. I. Methods of study. Sewage and Ind. Wastes, **22**: 318. 1950.

COME-UP TIME METHOD OF MILK PASTEURIZATION.

I. DESCRIPTION OF LABORATORY INSTRUMENT[1,2,3]

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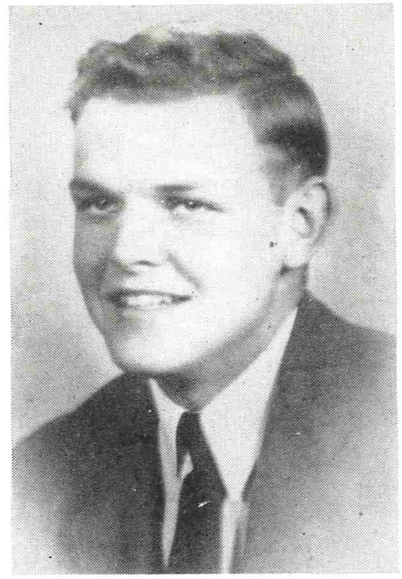
Conventional milk pasteurization treatment recognized by State and Federal statutes includes the vat method (143°F. for 30 min.) and the high-temperature, short-time method (HTST) (161°F. for 15 sec.). As the years have passed there has been a tendency to convert to the HTST method for milk pasteurization for reasons such as economy of space, heat, refrigeration and man-hours. One of the problems associated with the HTST process is the standardization of the holding period, i.e., the time required for a given particle of milk to flow through the holding tube.

Methods for the establishment of the holding time now in use are of three varieties. They are salt injection, dye injection, and electronic (heat-wave) measurement. Rates of flow with these methods have proven difficult to establish and even more difficult to maintain. The timing depends on a constant speed milk pump which because of its mechanical nature is subject to variations.

Another problem which is continually associated with milk pasteurization is the prevention of a cooked or heated flavor in milk. Current investigations on the subject of higher temperature processing suggests the possibility of improvement in flavor as well as greater bacterial destruction as a result of this treatment.

If a satisfactory higher processing temperature can be found which will permit the elimination of the holding time requirement, then the holding tube on commercial HTST pasteurizers could be eliminated so that milk could leave the heater section of the unit and go directly into the cooling section. In addition, it is felt that this reduced holding time will enable one to produce a pasteurized milk with a flavor closer to that of raw milk than is being produced with the commercial equipment now in use.

With a HTST pasteurizer modified as is suggested above, the lethality of the pasteurization process will be restricted to the lethality of the come-up and cooling times. Since the commercial HTST pasteurizers vary in capacity, or in other words, heat and cool at different rates, it is necessary to base a study on the feasibility of come-up time pasteurization on heating times which will not be exceeded with the most rapid heating and cooling commercial machines. Flow velocities may need to be established in the commercial machines which will prevent cooking on.



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The purpose of the study reported in this series of papers is to (a) design and construct an instrument capable of heating milk from room temperature to as high as 210°F. in one second or less, (b) to determine the effects of this rapid heating on milk, and (c) to determine the effects of this type of heating on pathogenic and heat resistant strains of bacteria associated with milk.

Description of Equipment

Basically, the equipment consists of a stainless steel tank and a small bore stainless steel tube heated

[1]This investigation was supported by a research grant from the National Institutes of Health of the Public Health Service.

[2]Contribution No. 1016 of the University of Massachusetts College of Agriculture Experiment Station.

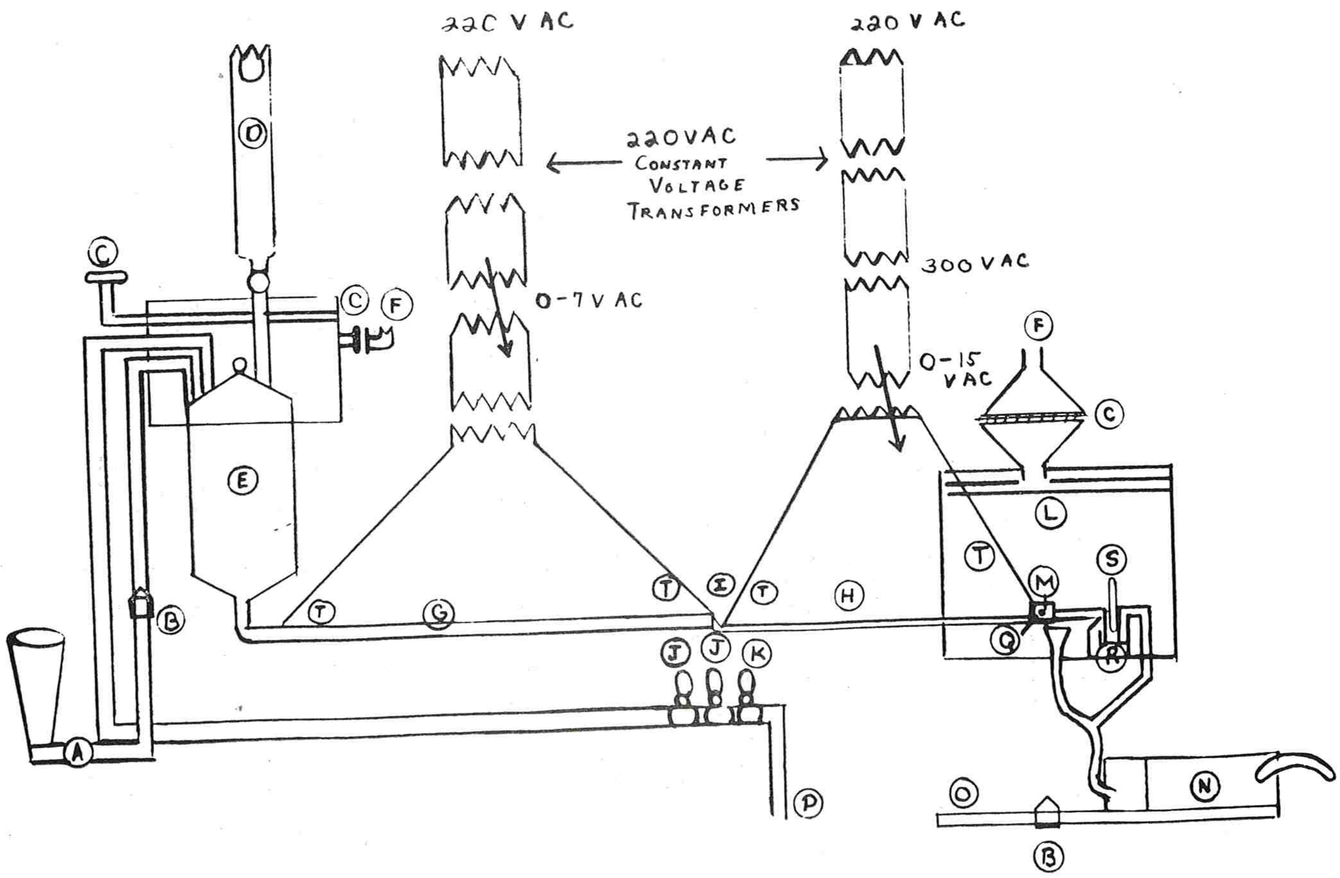
[3]Presented at the 42nd annual meeting of the *International Association of Milk and Food Sanitarians, Inc.*, at Augusta, Georgia, October 2-6, 1955.

by electrical resistance. Figure 1 shows a schematic diagram of the working parts of the instrument. Figures 2 and 3 are photographs of different views of the instrument. The tank is 10 inches in diameter and 22 inches in height. It has a capacity of 5 gallons. There are two openings on the top of the tank: one, 3 inches in diameter with a sanitary ferrule and cap for filling and cleaning the tank; the other, a 3/4 inch standard pipe thread for an air line connection. The outlet for the tank is at the bottom. It is equipped with a 1½ inch sanitary ferrule to which is attached a 1½ inch sanitary milk line elbow. At this point, the diameter of the milk line is reduced to that of a small bore stainless steel tube.

A centrifugal pump is used to fill the tank with the fluid under investigation. This pump is connected to the tank by stainless steel pipe instrumented with suitable valves. The tank is inoculated with the organism under test from a burette located at the top of the tank. The organism is burtted into the tank and then the tank is filled with the carrying fluid. This procedure insures homogeneous dispersion of the test organism.

A series of six spark plugs have been installed along the sides of the tank at different levels. These are connected to a series of lights which in turn indicate the amount of fluid in the tank at any given time.

Air pressure is used to force the fluid through the small bore stainless steel tube. The air pressures range from 50 to 200 psi according to the velocity



A- Milk Pump
B- Valve
C- Bacteriological filter
D- Burette
E- Tank
F- Tovacum blower
G- Preheater tube
H- Heating section
I- Thermocouple
J- Pressure regulators gauges
K- Air pressure gauge
L- Hood and ultraviolet lights
M- Three way valve
N- Steam Injector
O- Steam line
P- Air line
Q- Sample collection point
R- Thermos bottle
S- Thermometer
T- Adjustable connectors

Figure 1. Schematic diagram of high temperature heater.

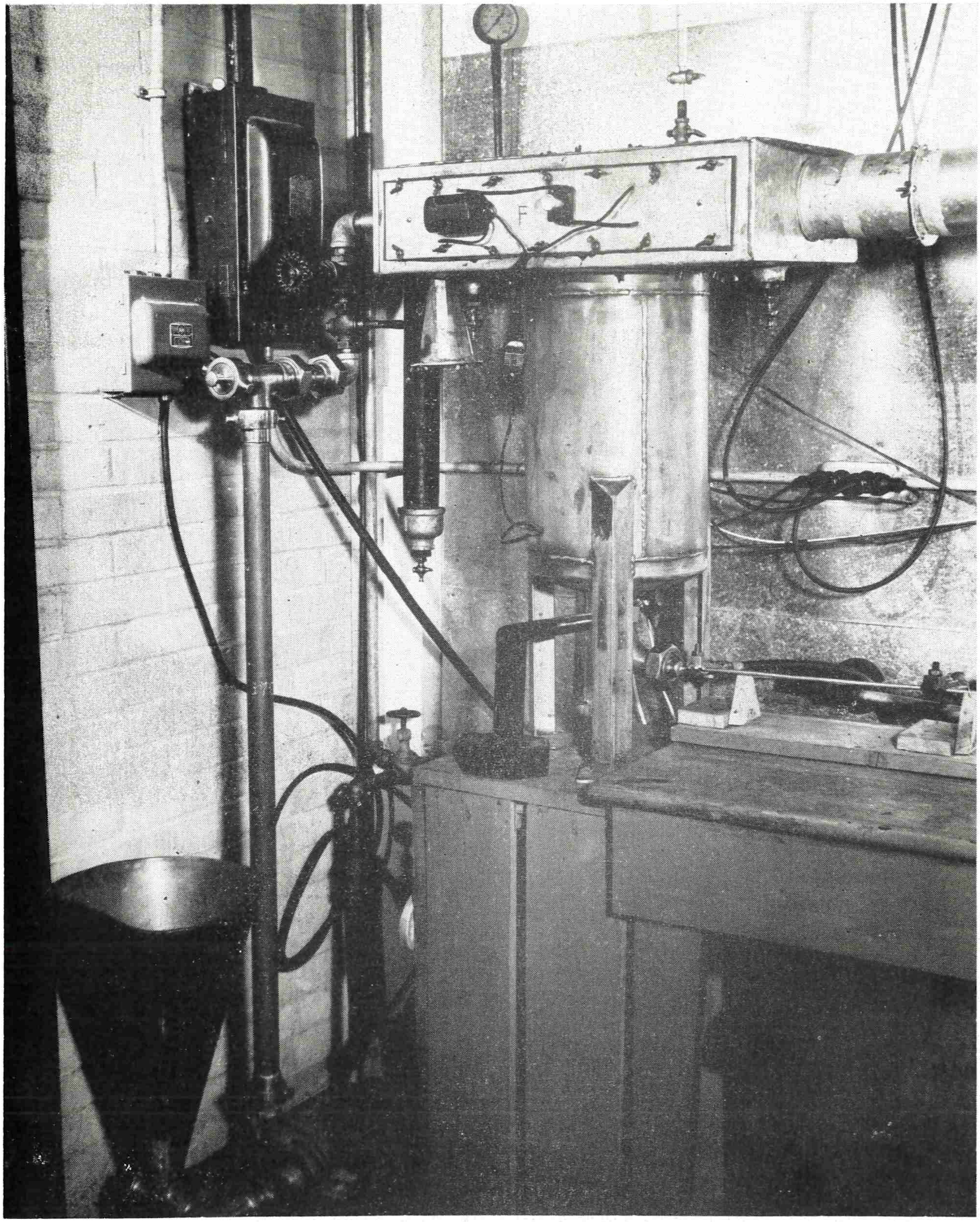


Figure 2. Filling connections, supply tank, discharge connections and hood for high temperature heater.

desired, the length of tube being used, and the diameter of the heating tube. The air pressure is regulated by two pressure regulators mounted in series. The air line from the pressure regulators is connected to the 3/4 inch inlet at the top of the tank.

Several different lengths and sizes of heating tubes have been used in this study. At the beginning, a 10 foot, 1/16 inch inside diameter stainless steel tube

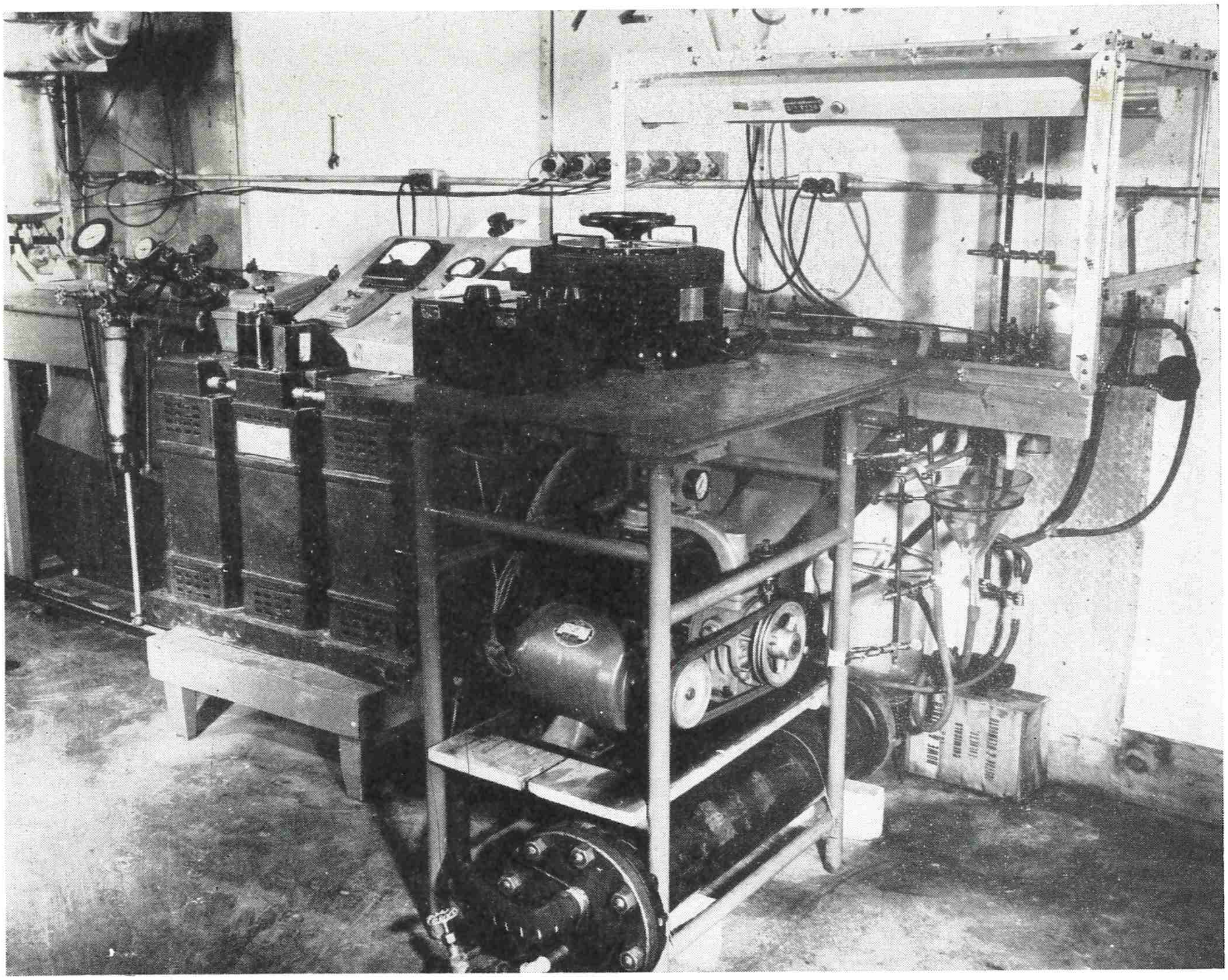


Figure 3. Air supply, transformers, steam injector and hood over discharge valve for high temperature heater.

was used. Then the tube was shortened to 5, 4, 3, and finally 2 feet to obtain a higher velocity of flow. However, it was found that in spite of increased flow velocities, the lumen of the tube was partially obstructed after a short running time. This caused the flow rate to decrease with a resulting change in velocity and hence in heating time. In order to eliminate this undesirable result, a tube of larger diameter was used. This tube is divided into two sections—one for a preheater, the other section for a heater. The tube for the preheater is 5 feet long with an inside diameter of 3/16 inch and is made from stainless steel. A tube 5 feet long with an internal diameter of 7/64 inch is connected to the preheater tube. It has been the practice with this tube to preheat the fluid in the preheating section to 135°F. Then the fluid enters the heater and is then heated to any desired temperature within the limits of the instrument. Velocities in this study have ranged from 10 to 20 feet per second. All velocities used are well within the range of turbulent flow as calculated by the Reynold's number.

The outlet end of the heating tube is equipped with a specially constructed small bore three-way stainless steel valve so made that the fluid under test can be directed in either of two ways. This valve is of a non-closing type so that at no time will flow be retarded or stopped when the valve is being turned from one position to the other. This feature is essential in that any retardation or stoppage of flow would cause uncontrolled overheating or the "burning on" of some fluids to the walls of the heating tube.

The three-way valve is necessary so that a given temperature can be established with the valve positioned in diverted flow. When the desired temperature is established, a sample can be taken by turning the valve. The heated fluid is directed into a sampling bottle or tube.

The fluid flowing through the tube is heated by heat transfer from the stainless steel tube which in turn is heated by electrical resistance. Two separate independent electrical systems are used to heat the tube. One has been designated as a preheater, the other as a final heater.

The preheater consists of a 10 K. V. A. step down transformer operating on the primary side from 0 to 270 volts A. C. The primary voltage for this transformer is regulated by a 200-220 V.A.C. variac with a capacity of 31 amperes. The secondary side of the transformer operates in the range of 0 to 5 volts. Six leads are connected from this transformer to the stainless steel pipe in which the fluid is heated. The preheater is used to raise the fluid from refrigeration temperature to any temperature up to 140°F. With the velocities used, the time of fluid exposure to the preheating temperature is less than one minute. Amperages on the secondary side of the transformer, used for preheating the fluid, range from 0 to 600 amperes.

The heater consists of three transformers. A 220 V-A.C. source is used which is connected to a 5 K.V.A. constant voltage transformer. The regulated voltage is next raised to 300 V-A.C. and then is wired to a variable transformer with a range of 0 to 15 V-A.C. on the secondary side. The secondary side of the latter transformer is connected to the heating tube by multiple connections which can be arranged to provide variation in the length of tube to be heated, and therefore in the heating time.

The preheater and the heater are used when a 10-foot tube consisting of 2 five-foot lengths of different sizes of stainless steel tube is employed to heat the fluid. The preheater is not used when a shorter length of tubing is in use. The various combinations of length and size of tubing provide a wide variation in velocities and therefore a variation in heating time.

The type of thermocouple used to measure fluid temperatures inside the stainless steel tube consists of a 30 gauge copper constantan thermocouple imbedded in bakelite. Around the bakelite there is a 1 inch length of stainless steel tubing 1/8 inch OD, 1/16 inch ID. This is threaded directly into the wall of the tube at the point where one wishes to measure temperature. This type of thermocouple is used to determine preheat temperatures as well as the heating curve of the various sizes of tubes used in this study. This thermocouple is shown in Figure 4.

A mercury in glass thermometer is used to measure final heating temperatures. As the milk leaves the heating tube it is directed into a thermos bottle. Temperatures are read and emergent stem corrections made.

The rate of heating can be varied either by pressure variation or by length of the tube heated. Investigations show that fluid may be heated from 40°F. to boiling in as little as 0.1 second. This minimum time was established for milk because shorter heating times required faster transfer rates, which resulted in coating of milk to the heating tube. When water or buffer is used, heating rates have been attained which raise the liquid from refrigeration to boiling temperature in times of less than 0.05 second.

SAFETY DEVICES

Numerous safety devices have been incorporated in the building of this machine so that bacterial aerosols which could result from bacterial suspensions under pressure will be controlled as much as possible.

The tank which is used as a reservoir for the bacterial suspension has been equipped with a hood at the top to trap any aerosol which might escape from the sanitary fitting cap at the top of the tank. This hood is totally enclosed and is equipped with two 18 inch ultraviolet lights. In addition to this, this hood is equipped with a negative pressure exhaust containing bacteriological filters at the inlet and outlet of the hood.

On the terminal end of the stainless steel tube a glass hood was constructed and was equipped with a negative pressure exhaust. This hood was also fitted with a bacteriological filter at the exhaust pipe. Two

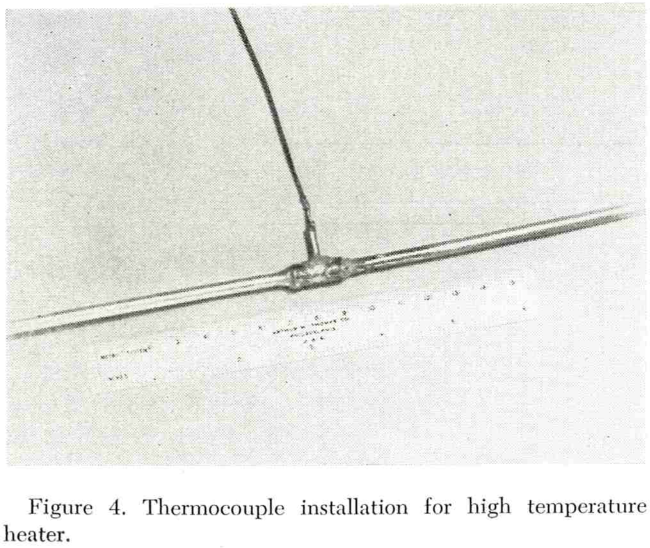


Figure 4. Thermocouple installation for high temperature heater.

30-watt ultraviolet lamps were installed in this hood for further reduction of viable aerosols.

The exhaust line from the tank is piped so that all compressed air being exhausted from the tank must pass through another bacteriological filter. Between the outlet of the tank and this filter there are two traps which effectively prevent any fluid reaching the bacteriological filter in the exhaust line.

The fluid which has been heated and is not used for sampling purposes is passed directly into a steam injector where it is heated to 212°F., held for approximately 10 seconds, and passed directly into the sewer. The steam injector consists of three feet of six inch steam pipe fitted with a cap on one end and a flange and a blank on the other. The cap has been tapped and fitted with a 1/4 inch pipe which is used as an inlet. The blank on the flange was tapped one inch from the bottom and equipped with a three foot section of 3/8 inch pipe which had been drilled with 1/8 inch holes every four inches. This section of 3/8 inch pipe extends from the flange or outlet and back to within three inches of the cap or inlet end. This pipe is connected directly to a steam line with a gauge pressure of 40 psi. Above this steam line the blank on the flange was tapped for a 1 1/4 inch hole which is used as an outlet. Thus the steam injector must be almost full before any fluid can escape, thereby insuring exposure of all bacteria introduced into this steam injector of at least 10 seconds at 212°F. Trials with this injector have shown that this type of heating has sufficient lethality to kill all vegetative cells which have been investigated.

The room in which this machine is located is equipped with four 36 inch 30 watt ultraviolet lamps. These lamps are run continually when the room is not in use. Since vacuum blowers are run at all times, a continuous circulation of air in the room is assured.

The instrument as now designed appears to be well adapted to milk heating studies because of the ease of adjustment of the heating rates, flow velocities, and final temperatures used. The instrument as constructed should not be limited to studies on milk alone, but should prove useful in the investigations of heat treatment of numerous fluids such as beer, fruit juices, bacterins, vaccines and other biologicals.

Subsequent papers will report the results on the effect of this heat treatment using this instrument on milk properties and bacterial destruction in milk and other fluids.

COME-UP TIME METHOD OF MILK PASTEURIZATION.

II. INVESTIGATION OF MILK PROPERTIES AND SOME PRELIMINARY BACTERIOLOGICAL STUDIES[1, 2, 3]

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In recent years, there has been increased interest in higher temperatures for processing milk with a corresponding reduction in heating time. Simplicity of operation, improved flavor and keeping quality have been objectives in the utilization of these higher temperatures. With the use of higher temperatures it appears practical to depend entirely on the lethality of the come-up and cooling portions of the cycle to achieve adequate pasteurization. This would enable one to completely eliminate the holding time requirement normally contained in the definition of high-temperature short-time (HTST) pasteurization. Since the amount of lethality from the cooling portion is relatively minor in this study, the investigation has been confined to the effect of the come-up portion of the heating cycle, thus the term "come-up time pasteurization" is used to describe this process in which there is no intended holding time.

The object of this study is to evaluate the effect of rapid heat treatment on the phosphatase enzyme, creaming, curd formation, bacterial destruction and flavor using the instrument described in a previous paper (1).

Review of the Literature

In recent years new terms have been introduced which have replaced the term "Flash pasteurization" for the designation of any process involving pasteurization wherein the fluid is heated at rapid rates. Newer terms to designate this rapid heating to higher temperatures are "quick-time", "no hold", "no intended hold", and "come-up time" pasteurization.

"Quick-time" pasteurization was a term introduced by Dahlberg, Holland, and Miner (2) in 1941 in which pasteurization of milk was carried out from 169° to 177.5°F. with the time interval above 140°F., varying from 5 to 24 seconds. It was found that a slightly better milk was produced by "quick-time" pasteurization than by vat pasteurization. No data were secured using pathogenic bacteria.

Tobias, Herreid and Ordal (3) heated milk in the Mallory small-tube heat exchanger and found that a temperature of 168.34°F. with a holding time of 2.36 seconds was found to give destruction of *M. freudenreichii* (MS66) equivalent to laboratory pasteurization at 143°F. for 30 minutes.

Barber (4) used the term "no hold" pasteurization in discussing various problems connected with the pasteurization of dairy products in short time periods.

Ball (5) emphasized the lethality contained within the come-up time portion of the heating curve. For this reason, the designation of "come-up time" pasteurization was used in a previous paper (6) which described a type of pasteurization wherein virtually all the lethality from the heating cycle was derived from the heating portion of the cycle.

Specific types of equipment have been developed to accomplish rapid heating such as the Vacreator, Mallorizer, and the Roswell heater. Roberts, Blanton, and Warren (7), using the Vacreator, reported that phosphatase was destroyed at 185°F. and temperatures of 195° and 200°F. produced a milk comparable in keeping quality to vat pasteurized milk.

Experimental

Methods used for evaluation of rapid heat treatment of milk

Raw milk was obtained from the university herd, pumped into the holding tank of the instrument and forced through the small bore stainless steel tubing by air pressure. As the fluid passed through the tube, it was heated to the desired temperature by electrical resistance. Samples were cooled by collection of this fluid in bottles containing glass marbles which were refrigerated prior to their use. In all cases, the final temperature of the fluid was below 135°F. after collection in bottles. The bottles were immediately placed in ice water and refrigerated until used in the various tests.

Milk properties studied after heating were: (a) phosphatase, (b) pH, (c) creaming, (d) curd

[1]This investigation was supported by a research grant from the National Institutes of Health of the Public Health Service.

[2]Contribution No. 1017 of the University of Massachusetts College of Agriculture Experiment Station.

[3]Presented at the 42nd Annual Meeting of the *International Association of Milk and Food Sanitarians, Inc.*, at Augusta, Georgia, October 2-4, 1955.

formation, and (e) flavor.

The phosphatase test was performed immediately after heating. A second test was performed after 24 hours to determine possible enzyme reactivation. The phosphatase determinations were made using the modified Scharer Laboratory method (8). Phenol standards were prepared according to the procedure outlined. A standard curve was prepared using a Cenco photometer with a red filter for measuring light transmission through the colored samples. A boiled milk control was used to adjust the light transmittancy to 100 percent.

The pH of the milk was determined immediately before and after heating. The pH determinations were made using a Beckman Model H pH meter.

After heat treatment, the samples under test were placed in 100 ml. graduates and refrigerated for 24 hours. At this time, the cream line readings were taken and recorded as per cent decrease in cream line as compared to the unheated control.

A sample of rennin obtained from Chr. Hansen Laboratories, Milwaukee, Wisconsin, was diluted 1:25. One cc. of this dilution was added to each 6″ x 3/4″ test tube in a series and 5 ml. of heat treated milk were added. Incubation was carried out at 86°F. At intervals of 1 min., a tube was inverted and checked for clotting. The curd formation end point was taken as that time when the clot would not slip down the barrel of the inverted tube. Controls were run at 143°F. for 30 minutes and 160°F. for 30 minutes. The experimentally heated samples were compared with the controls.

The samples were examined organoleptically at room temperature for evidence of heated flavor. Flavor was evaluated as follows: no heated flavor; slight heated flavor; definite heated flavor; pronounced heated flavor.

Methods used to evaluate destruction of vegetative cells of bacteria

The organism MS 102 is an unidentified micrococcus which has been used in several heat resistance studies. This organism was grown on N-Z Case medium of the following composition:

Yeast extract	1.0 gram
N-Z Case (Sheffield)	.5 gram
Glucose	.5 gram
K_2HPO_4	.4 gram
KH_2PO_4	.1 gram
Agar	1.5 gram
Distilled water	100.0 gram

pH 7.0, sterilization at 15 lbs. for 20 minutes.

The transfer schedule for this organism was as follows. Daily transfers of the culture were prepared and incubated at 37°C. for 24 hours; the slants were then stored in the refrigerator for 48 hours. A transfer was made from the refrigerated slant, and incubated at 37°C. for 24 hours and then used as the test culture. After growth, the organisms were washed from the medium with approximately 10 ml. of sterile distilled water. The culture suspension was then aseptically filtered through Reeve Angel Filter paper No. 235, to remove large clumps of bacteria. The suspension was then checked for optical density and a suitable aliquot used to inoculate the suspending fluid.

MS 102 was found too heat resistant to accomplish 100 percent kill below 100°C. at 0.25 sec. heating time. With the instrument set to heat to 97°C. in 0.25 second, it was found that 19 percent of the samples taken demonstrated growth of MS 102. Accordingly, the 99.9 percent destruction level was investigated. This was done by inoculating 10 ml. of fluid as it left the instrument into 90 ml. of sterile water. Dilutions of 1:10, 1:100, and 1:1000 were prepared. All samples were taken in triplicate. The recovery medium was the N-Z Case medium. Counts were done after 48 hours of incubation at 37°C. The 99.9 percent destruction point was computed from the initial count.

Determination of heating curve

Multiple thermocouples were installed along the heating tube so that the thermocouple was exposed directly to the fluid in the tube. The heating curve of the tube was determined by taking temperatures of the fluid at intervals of one foot while the tube was under actual operating conditions. Heating curves were determined for intervals of 10°F. from temperatures of 150 to 200°F. using 0.25 and 0.50 sec. come-up time. All determinations were made using milk as the fluid heated.

RESULTS

Phosphatase

Phosphatase studies were performed on samples immediately after heat treatment and were repeated after 24 hours at 46.4°F. to check for reactivation. (9, 10, 11) Using 2.3 micrograms of phenol as a standard, it was found that with a preheat temperature of 135°F. and a heating time of 0.25 sec., phosphatase was inactivated at a mean temperature of 182.4°F. Results are shown in Table 1.

Samples which showed 2.3 micrograms of phenol immediately after heating were re-examined after 24 hrs. at 46.4°F. It was found that reactivation did occur in these samples. However, results were rather erratic and are shown in Table 1.

A similar study was conducted using a heating time of 0.5 seconds. The mean temperature of phos-

TABLE 1 — PHOSPHATASE DESTRUCTION AND REACTIVATION WITH 0.25 SEC. HEATING TIME

Trial	Temperature yielding 2.3 mu gm phenol per ml immediately after heating	24 hour reading mu gm phenol per ml
	(°F.)	
1	182.5	10.0
2	181.8	2.2
3	182.7	7.3
4	180.1	7.2
5	184.1	3.5
6	181.8	6.0
7	184.1	3.1
8	181.8	3.5
Range	180.1 to 184.1	3.1 to 10
Mean	182.4	5.35

TABLE 2 — PHOSPHATASE DESTRUCTION AND REACTIVATION WITH 0.5 SEC. HEATING TIME

Trial	Temperature yielding 2.3 mu gm phenol per ml immediately after heating	24 hour reading mu gm phenol per ml
	(°F.)	
1	179.8	0.5
2	179.1	2.3
3	178.5	2.2
4	179.8	2.3
5	177.1	4.5
6	176.9	5.5
7	178.2	2.3
Range	176.9 to 179.8	0.5 to 5.5
Mean	178.5	2.7

phatase inactivation at this time was 178.5°F. Reactivation either did not occur, or occurred at an extremely low rate with a heating time of 0.5 seconds. The mean of 9 determinations was 2.7 mu: μ gms phenol after storage at 46.4°F. Results are shown in Table 2.

pH

Heating times of 0.25 and 0.5 seconds and temperatures as high as 203.0°F. did not change the pH of the milk appreciably. In fact, heating times as long as 0.9 sec. to temperatures as high as 200°F. gave no demonstrable change in pH values from the raw control. Longer heating times were attempted since it was felt that they would represent extreme conditions. No significant variation in pH could be demonstrated for any time-temperature range listed. Results of a typical series are shown in Table 3.

Cream Line

Creaming studies show that there was a severe reduction in cream line at temperatures of 185.0°F. Results of a typical study are shown in Table 4.

Curd Formation

Curd formation data follow very closely the work of Mattick and Hallet (12) who found that a moderate amount of heating (up to 141°F. for 30 min.) reduced the coagulation time when compared to raw milk. On the other hand, in their studies, heat treatment of 145 to 151°F. for 30 minutes yielded coagulation times about the same as for raw milk. Furthermore, heat treatments above 155°F. for 30 min. gave coagulation times which increased progressively with higher temperatures when compared with raw controls. In this study, with a heating time of 0.5 sec., it was found that in no case did the coagulation time exceed that of raw milk. Results of a typical series are summarized in Table 5.

TABLE 3 — THE EFFECT OF RAPID HEATING ON THE pH OF MILK WITH 0.9 SEC. HEATING TIME

Sample	Final temperature	pH Initial	pH 24 hrs.
1	174.6	6.6	6.7
2	175.6	6.65	6.75
3	179.2	6.65	6.7
4	181.4	6.6	6.7
5	184.5	6.6	6.7
6	187.3	6.6	6.7
7	190.0	6.6	6.7
8	192.4	6.7	6.7
9	195.3	6.6	6.75
10	197.2	6.6	6.75
11	199.0	6.65	6.75
12	Raw control	6.65	6.75

Flavor

With heating times varying from extremes of 0.14 to 0.9 sec., it was found that no heated flavor was detected in milk heated to as high as 211.8°F., provided that the milk was cooled rapidly. Results of many tests have indicated that milk processed in this manner is comparable or better than vat pasteurized milk from a flavor standpoint.

TABLE 4 — REDUCTION OF CREAM LINE BY RAPID HEATING WITH 0.5 SEC. HEATING TIME

Final temperature (°F.)	Reduction of cream line (percent)
205.5	79
197.2	71
186.6	28
181.2	21
175.6	14
167.0	7
160.0	0
155.3	0
150.6	0

Bacteriological studies using MS 102

The temperature necessary for 99.9 percent destruc-

TABLE 5 — RENNIN COAGULATION RATE WITH 0.5 SEC. HEATING TIME

Temperature (°F.)	Clotting time (min.)	Temperature (°F.)	Clotting time (min.)
202.6	20	159.8	17
195.8	20	156.2	15
187.0	19	152.1	14
181.2	18	Raw	23
175.2	18	Raw—passed through machine	21
168.4	17	Lab. pasteurized 143°F. for 30 min.	14

TABLE 6 — TEMPERATURES REQUIRED FOR 99.9% DESTRUCTION OF MS102 WITH 0.25 SEC. HEATING TIME

Trial	°F.
1	192.0
2	191.3
3	191.8
4	192.0
5	191.3
6	192.9
7	192.2
Mean	191.9
Range	191.3 - 192.9

TABLE 7 — TEMPERATURES REQUIRED FOR THE 99.9% DESTRUCTION MS102 WITH 0.5 SEC. HEATING TIME

Trial	°F.
1	189.5
2	190.8
3	189.9
4	190.9
5	190.4
6	190.4
7	191.1
8	189.9
9	190.6
10	191.1
11	191.8
12	191.1
Mean	190.6
Range	189.5 - 191.8

tion of an unidentified micrococcus[4] was determined for heating times of 0.25 and 0.5 sec. using milk as the vehicle. The mean temperature for a series of seven trials with 0.25 sec. heating time was 191.9°F. whereas a series of twelve trials using a 0.5 sec. heating time yielded a mean temperature of 190.6°F. for the 99.9 percent destruction level. Results are shown in Tables 6 and 7.

Heating curve determination

Many trials were made to determine the nature of the heating curve in the stainless steel heating tube. Averages of these trials were determined and the results for heating times of 0.25 and 0.5 sec. are shown in Figures 1 and 2.

The heating curves are essentially linear for the 0.25 and 0.5 sec. heating times.

DISCUSSION

Results of this study indicate that laboratory pasteurization of milk can be accomplished using heating rates as short as 0.25 sec. heating time with no intended holding period. Calculations of the holding time in this study involve a consideration of the time required for the milk to pass through the stainless steel valve at the terminal end of the holding tube. This time is approximately 0.05 sec., and is therefore part of the total heat applied and is in addition to

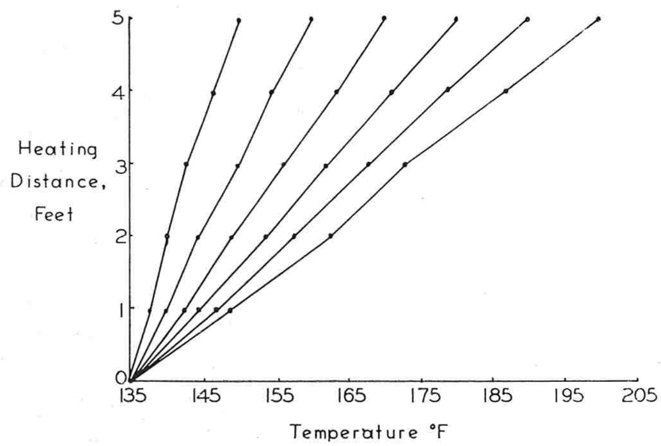

Figure 1. Heating curve for various final temperatures; initial temperature 135°F, heating time 0.25 sec.

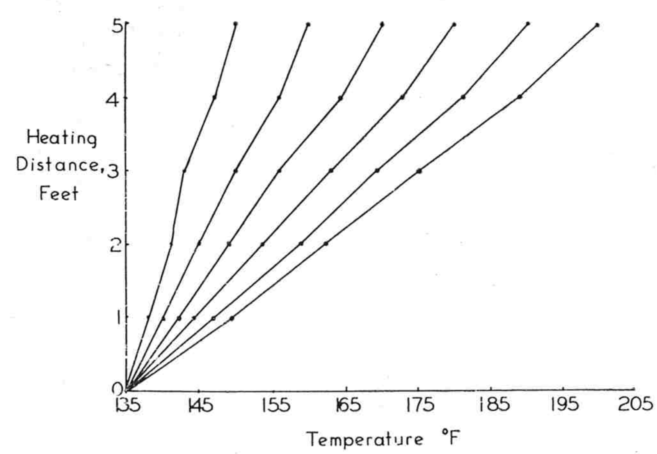

Figure 2. Heating curve for various final temperatures; initial temperature 135°F, heating time 0.5 sec.

[4]Obtained from Dr. Franklin Barber of the National Dairy Products Research Laboratories, Oakdale, L. I.

the reported 0.25 or 0.5 sec. come-up time. Following heating, the fluid is collected and cooled either by passing over pre-cooled glass marbles or by inoculation into a pre-cooled fluid. Since thermocouple studies have shown that the temperature of the fluid as measured in the collecting flask has never been above 135°F., the lethal effect of the cooling portion of the cycle was considered to be much less than the heating time and therefore was not evaluated separately. However, any lethality in the cooling cycle is in addition to the reported 0.25 or 0.5 sec. come-up time.

Phosphatase inactivation was found to occur at a point below the 99.9 percent destruction level of MS102. Studies on bacteria other than MS102 completed in this laboratory suggest, however, that the 99.9 percent destruction level of MS102 requires a temperature considerably higher than most other organisms commonly associated with milk. These studies on other bacteria will be published in a subsequent paper. Accordingly, if the phosphatase test is used as an indicator of adequate pasteurization, the observed reactivation of the phosphatase enzyme must be taken into consideration, using this type of heating.

Creaming studies indicate a severe loss in cream line especially with higher temperatures. The heating tube used is of small bore and the fluid velocity is such that highly turbulent flow is produced as calculated by Reynold's Number. The turbulence probably producers a homogenizing effect on the milk. Perhaps creaming would not be reduced so dramatically in a standard HTST machine modified for a come-up time process, since the milk would not be subjected to the same forces between the conventional plates of the HTST unit as in the small bore tube.

Curd formation, flavor, and pH determinations indicate that this rapid heating process can produce a milk either as good or perhaps slightly better than the standard vat process.

The instrument used in this study is intended only for laboratory investigation of the effects of rapid heat on milk properties and the thermal resistance of bacteria. It is felt that data obtained from this machine may be applied to the commercial HTST unit which is modified by the elimination of the holding tube. Actual studies on the commercial HTST pasteurizer will be necessary to show the feasibility of more rapid heating and the extent of modification necessary.

Conclusions

1. Phosphatase is inactivated at temperatures of 182.3°F. and 178.5°F. for heating times of 0.25 and 0.5 sec. respectively.
2. No significant changes in pH were produced by this process.
3. Creaming was markedly impaired by this process at temperatures over 185°F.
4. Curd formation tests demonstrated no marked protein denaturation from this heating.
5. Flavor tests demonstrated a heated flavor either comparable to or less than vat pasteurized milk.
6. The organism MS102 was 99.9 percent destroyed at temperatures of 191.9°F. and 190.6°F. for heating times of 0.25 and 0.5 sec., respectively, using milk as the vehicle.
7. The heating curve for the instrument used is essentially linear.

References

1. Read, R. B., Jr., Boyd, T. C., Litsky, W. and Hankinson, D. J. Come-up-time pasteurization. I. Description of Laboratory Instrument. J. Milk & Food Technol. **19**: 2, 39, 1956.
2. Dahlberg, A. C., Holland, R. F. and Miner, R. K. "Quick-time" pasteurization of milk. N. Y. Agr. Exp. Sta. Bull. 261, 1941.
3. Tobias, J., Herreid, E. O. and Ordal, Z. I. A study of milk pasteurization at high temperatures. J. Dairy Sci., **36**: 356, 1953.
4. Barber, F. W. No-hold pasteurization makes progress. Food Eng. **25**: 11, 62. 1953.
5. Ball, C. O. Short-time pasteurization of milk. Indust. and Eng. Chem. **35**: 71. 1943.
6. Hankinson, D. J., Read, R. B., Litsky, W. and Brown, R. R. Come-up time method of milk pasteurization. Pub. Health Rep., **68**: 769. 1953.
7. Roberts, W. M., Blanton, L. F. and Warren F. G. Vacreation of fluid milk. Southern Dairy Prod. J. **56**: (No. 5), 36. 1954.
8. Scharer, H. Scharer modified phosphatase method. J. Milk and Food Technol., **16**: 86. 1953.
9. Wright, R. C., and Tramer, J. I. Reactivation of milk phosphatase following heat treatment. J. Dairy Res. **20**: 177. 1953.
10. Wright, R. C., and Tramer, J. II. Reactivation of milk phosphatase following heat treatment. J. Dairy Res. **20**: 258. 1953.
11. Wright, R. C. and Tramer, J. III. Reactivation of milk phosphatase following heat treatment. J. Dairy Res. **21**: 37. 1953.

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NEWS AND EVENTS

RESTAURANT INSPECTION PROGRAM IN MEMPHIS AND SHELBY COUNTY PRESENTED BY ARTHUR M. TEEFER TENNESSEE PUBLIC HEALTH ASSOCIATION ANNUAL MEETING - DECEMBER 1, 1955, NASHVILLE TENN.

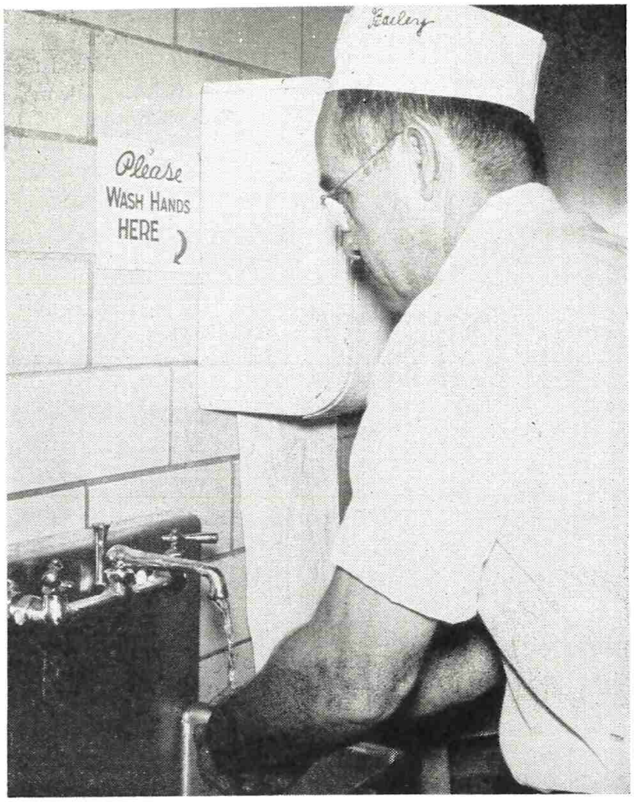
In Memphis and Shelby County we have about 3,600 food establishments, broken down as follows: (This does not include the Dairy Program)

Restaurants	1,293
Grocery Stores	1,194
Drug Stores (with ftns)	158
Package Goods Places	590
Fish Markets	24
Others	340

You can readily see and appreciate the responsibility the Memphis and Shelby County Health Department has toward the public in supervising these establishments for the best in food sanitation.

The food division of our Health Department is one of eight sections in the Bureau of Sanitary Engineering. The responsibility of the inspection service is under the direct supervision of Mr. E. C. Handorf,

Engineer Director, Bureau of Sanitary Engineering. The inspection personnel for the Food Division includes 12 sanitarians and 1 field Supervisor. The City of Memphis is divided into 10 territories, with a sanitarian in complete charge of each territory. In Shelby County there are 2 sanitarians on the food



program. Each inspector covers his territory once a month, with special follow-ups if necessary.

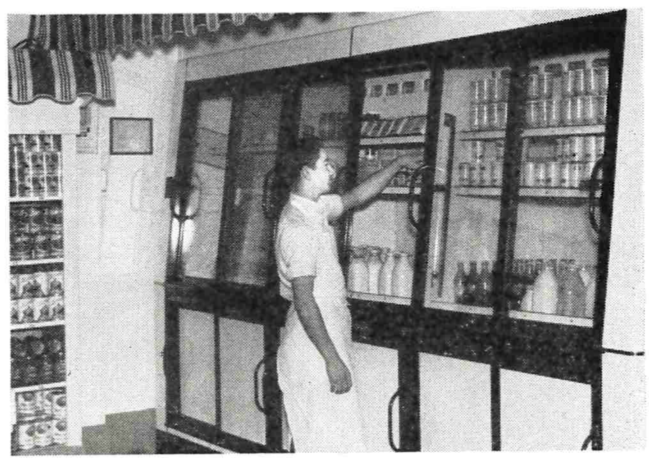
Many fine programs have been inaugurated at various times to help train, educate and also bring about better food sanitation for the food operator, manager, and food handling personnel. We feel that when these people better understand and fully realize their responsibility to the public, through an educational program, a better job will be accomplished. In any program seeking to educate food service waiters, the management must first be convinced of the importance and worthwhileness of such education. Management, too, must be prepared to provide whatever means and materials are necessary to assure that the principles be observed.

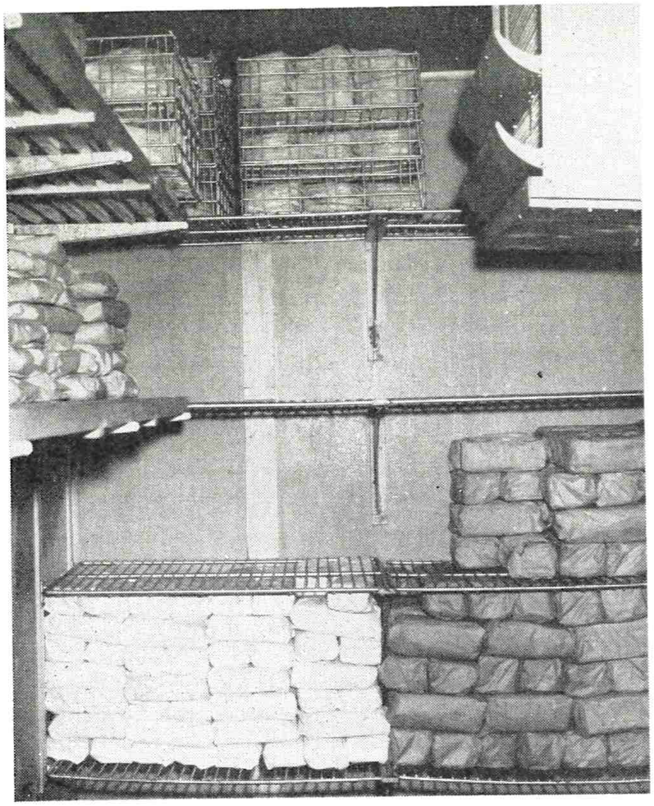
In June 1953, an Educational Program was started known as "The Educational Program At The Place of Inspection". In the beginning one large section of the downtown area of Memphis was selected to try out this program for the restaurants. Because some 70,000 people eat out in the Memphis downtown area daily, it was felt this section was the place to start the plan. In less than a year this program became so successful and popular in this trial area, with owners, management, and personnel, that it was decided to extend this educational program throughout the entire City. This is now being done and here is how the program works....

Each sanitarian conducts these educational talks in his own assigned territory. He will usually hold a meeting of all personnel on duty after making his regular inspection, or he will return later after arranging a definite time with the manager. (Places employing 10 personnel or more are selected for these talks). Usually the talks are limited to 20 minutes with about 10 minutes for questions. Management of some establishments offer prizes for employees answering the most questions correctly. There are several reasons why this program has proven so successful.

1. Because all food establishments have their own problems which others are not concerned about. At a meeting held at place of inspection these faults can be pointed out, even to the employee's responsibility.

2. In Memphis we have never found it entirely successful to arrange a foodhandling personnel meeting at any one Central location because the managers of most establishments will say they cannot spare the personnel. Personnel will have one excuse after the other for not going. Also attendance at these meetings held at a central location, after the first or second meeting, will fall off to almost no attendance. Our "Educational Program Held At The Place Of Inspection" with personnel and management is very pleasant, friendly and informal. For these reasons, among others, the meetings are looked forward to with a great deal of interest. Many items are discussed, such as restaurants, the following: Cleaning of floors, walls, storage of cleaning equipment, kitchen equipment, proper washing and sterilization of eating utensils in a three compartment sink. And also by mechanical dishwashers, refrigeration, preparing food in a safe, sanitary manner, personal hygiene, handwashing, toilet habits, and dressing rooms. Important points are also discussed concerning grocery store sanitation, fish markets, etc. In these educational talks a very elaborate set of pictures are used, they are used by the sanitarians for these talks. These





pictures show very clearly the right and wrong method of doing things. Diagrams are also used. Literature and posters from the National Sanitation Foundation are used during these lectures because they serve a very definite purpose, besides adding color and interest to the group present. The attendance at these meetings were in number from 10 to 100 personnel. The larger restaurants, cafeterias, and hotels will easily have from 30 to 75 present. We, in Memphis, through our Health Department, feel sure this is by far the most practical way and a more pleasant way of conducting a Sanitation Educational Program for food handling personnel. It pleases management and personnel. This same program is conducted in our bakeries, food manufacturing plants, City and Country Schools.

Prior to the inauguration of this program an extensive one week course was given to all food inspectors by personnel from the Atlanta Office of the U. S. Public Health Service. This program consisted of lectures, technical and educational methods. This course gave background and necessary information for the program.

Bacteriological swabs of eating utensils are being taken constantly by a sanitarian assigned to this important phase of sanitation. After checked by the Lab, results are entered in a ledger for further reference. All establishments with high counts are notified by the Division of Food Sanitation. The inspector of the particular area is also notified of the high bacteria counts and he immediately will investigate the cause. An annual record is kept of these bacteriological swabs for several reasons. One is to checkback with the previous year on any progress made. We feel because of this reference system, and having a sanitarian on this important assignment, our high bacteria counts have been lowered to a minimum. Plans for restaurants are presented to the Food Division for review and approval prior to construction. On transfer of ownership the license application must be approved by the Food Division before a new permit is issued. This approval is co-ordinated with the Planning Commission, and the Plumbing Inspector.

UNIVERSITY OF MARYLAND HOLDS ELEVENTH ANNUAL DAIRY TECHNOLOGY CONFERENCE

Approximately 200 members of the dairy industry attended the Eleventh Annual Dairy Technology Conference held at the University of Maryland on November 15 and 16, 1955. The first day's session was started by the showing of the film, "It's Up To You". This film emphasized the need of establishing a good human relations program and how such a program will aid in properly preparing employees for their job.

Mr. Arnold Salinger of the Maryland State Health Department presented facts and figures regarding the "Public Health Aspects of Bulk Milk Dispensing". Mr. Salinger showed that under controlled conditions, the bulk dispensers were satisfactory.

Donald J. Seely, Dairy Department, University of Maryland, outlined the procedures used in cleaning, sanitizing and preparing the cans used in the bulk milk dispensers. The cans are rinsed, scrubbed on a mechanical can brush and then after rinsing, the cans and lids are sterilized in 200 P.P.M. chlorine solution and inverted on a can rack.

In continuing the theme Bulk Handling of Milk, Norman H. Traylor, Dairy Department, University of Maryland discussed the research which has been carried on in the department and the problems encountered in such a study. Some of these problems are source of milk, cleaning and sanitizing cans and lids, repairs on processing room during the processing hours and storage of the processed product.

Mr. J. Ridgely Parks, Embassy Dairy, Washington, D. C. concluded the Bulk Milk Dispensing section of the Bulk Handling of Milk panel by discussing, "Bulk Milk Dispensing In The Market Milk Industry". Mr. Parks brought out the information that savings in time, labor and material is realized when such a method of milk distribution is used.

"Bacteriological and Fat Test Sampling from Farm Milk Tanks" was the topic discussed by Mr. P. E. LeFevre of Chestnut Farms Dairy and Mr. Chester F. Bletch of the Maryland and Virginia Milk Producers, Inc. These two panelists very capably discussed the problems encountered in taking samples for bacteria and fat test and how these problems have been solved.

Mr. R. E. Stout of Maryland Cooperative Milk Producers, Inc. discussed the various means by which sediment tests could be obtained from milk in the farm milk tank. The most practical method for taking a sediment test of value is to use a tester with a reduced aperture giving a reduced area on the pad used for grading.

Dr. J. F. Mattick, Dairy Department, University of Maryland reviewed the studies which have been carried out concerning the keeping quality of milk held in the farm milk tank. Results of this study indicated that it is possible to maintain milk of high quality by holding for as long a period as seven to nine days, at a temperature of 38° Fahrenheit.

The 3A Standards for farm milk tanks were discussed by C. A. Abele of The Diversey Corporation. In his discussion, Mr. Abele discussed the changes which have been made in these standards and emphasized the need of better agreement between the requirements of individual states to enable the manufacturer to produce a farm milk tank which will be acceptable in all states.

Mr. B. E. Horrall, Quality Control Manager, Kraft Foods Company, presented the address, "Controlling Uniform Quality of Dairy Products" at the Annual Dinner of the Maryland Association of Sanitarians. He stated that the only way to insure consumer satisfaction is to maintain control over the quality of the dairy products from cow to consumer.

The session on the final day was started by the presentation of the film, "Corrosion In Action". This film graphically demonstrated how corrosion acts to cause an annual loss of more than six billion dollars and how this damage can be avoided or controlled by various means.

"Dairy Industry Trends" was the topic presented by Mr. O. M. Reed of National Creameries Association and the American Butter Institute. He stated that revolutionary economic developments will confront dairy farmers during the next five to ten years with the economic pressure putting a steadily increasing squeeze on small dairy farmers and small dairy plants. The biggest job of the dairy industry is to increase per capita consumption of dairy products and increase efficiency in production and processing methods.

In his talk, "A Working Team – Processor, Fieldman and Sanitarian", Perry Ellsworth of the Milk Industry Foundation brought out the fact that the working team of processor, fieldman and sanitarian must pull together in the production, processing and safegarding of the nation's most nearly perfect food. We must be certain that the rules and regulations we follow and expect others to follow are timely and serve the purpose of putting first class milk and milk products on the dairy shelves and doorsteps of the country.

M. W. Jensen, Assistant Chief, Office of Weights and Measures, National Bureau of Standards, presented a very informative talk on "Farm Milk Tank Testing". In his talk, he emphasized the constant need not only for uniform legal requirements but also unfirm interpretations of the requirements and uniform application of cooperatively developed inspection procedures. The wider the acceptance and enforcement of proper uniform requirements, with the least practicable restriction, the greater the public benefit.

"Rancidity in Milk and Milk Products" was the topic presented by Dr. I. A. Gould, Chairman, Department of Dairy Technology, The Ohio State University. Present methods of handling milk create conditions favorable to the production of rancidity. Dr. Gould stated that the enzyme system is a complex one and its complete control is also complex and as further developments in milk handling and processing are contemplated, continued research is needed to determine how the entire lipase system will react to newer developments and what preventive measures are necessary to insure products free of lipolytic activity.

The afternoon session of November 16 was started by the showing of an outstanding traffic safety film, "The League of Frightened Men". The safety principle illustrated throughout the picture can be applied to all members of the driving public.

Mr. A. J. Claxton, President of Meadow Gold Dairies, Inc., Pittsburgh, Pennsylvania, in his talk, "You Have Got to Make Profit", outlined and discussed the basic reasons for making a profit. Mr. Claxton stated that your employees are the best supporters you have, but they do demand that you make a profit. Your producer demands that you make a profit in order that he may realize a fair return on the milk he sells you. A profit is needed in order to cater to the demands of your customer and the government demands that you make a profit to maintain the government which is a product of our own work.

In his talk, "Sanitizing Milk Tanks and Transportation Trucks", Mr. C. A. Abele, The Diversey Corporation, presented the facts that the cleaning and sanitizing of the pick-up tank truck does not differ materially from the transport tank truck. Mr. Abele further stated that the sanitation of farm milk tanks presents only the problem of instructing personnel in practices not heretofore familiar to it and being open minded concerning the adaption in milk plant operations.

Mr. B. E. Horrall, Quality Control Manager, Kraft Foods Co., Chicago, Illinois, spoke on the topic of "Plant Sanitation Practices Essential for Quality Dairy Products". The sanitation of our plants and equipment has a direct bearing on the quality of the finished product. The cleaning work must be organized in order that direct responsibility may be delegated for particular areas or pieces of equipment. The finished products will definitely benefit quality wise by the use of sanitary practices.

"Preventive Maintenance" was the topic presented by Mr. E. D. Brice and Mr. E. J. Sutter of Western Maryland Dairy, Baltimore, Md. In their talk, Mr. Brice and Mr. Sutter discussed the reasons for a preventive maintenance program and how such a system may be effected.

In a talk illustrated by the use of slides, Mr. Clyde M. North, Chief Engineer, Green Spring Dairy, Baltimore, Maryland discussed the use of "Refrigerated Route Trucks". Mr. North discussed the various types of refrigeration units which could be installed and touched on the merits of each of these. In his talk, Mr. North discussed the savings which were realized by using refrigerated route trucks. He estimated the savings on ice alone at $5.00 per ton, would pay for the complete changeover in five to six years. Other savings noted were no loss of return milk and longer life of truck bodies by their remaining much drier.

At the joint banquet meeting with the Dairy Technology Society of Maryland and the District of Columbia, scholarship awards were made to four University of Maryland Dairy Technology students. The recipients of these awards were David Kuhn, James Brice, Frederick Burrier, and Edgar Harman.

Dr. I. A. Gould, Chairman, Department of Dairy Technology, The Ohio State University, guest speaker for the occasion, spoke on "Some Challenges To Our Industry". In his talk, Dr. Gould discussed five of the many challenges which face our industry at the present time. These five were public relations, efficiency, technical know how, research and manpower. Dr. Gould emphasized the facts that only by greater teamwork, more efficient operation, use of further studies, carrying on of research and by preparing capable men to take over the key leadership roles in industry, can these challenges be met.

KLENZADE INTRODUCES NEW BULK TANK CLEANER

After more than several years of field research and development, Klenzade Products, Inc., Beloit, Wisconsin, has introduced a new specialized product, "Klenzade Bulk Tank Cleaner", for cleaning farm bulk milk tanks. Surveys have shown that ordinary detergents are inadequate to properly clean and maintain bulk tanks, and the formulation of this new product will be welcome news both to pick-up tank drivers and dairy farmers. Klenzade Bulk Tank Cleaner is a chlorinated detergent with an exceptionally rapid soil removing and cleaning action. It is especially effective for dissolving dried on milk residues because of its rapid penetrating qualities and the ability of the cleaner to hold the soil in suspension throughout the cleaning cycle. For best results, Klenzade Bulk Tank Cleaner should be used for three successive days and then alternated for one day with Klenzade Nu-Kleen, an organic acid detergent, which removes all traces of milkstone and dulling lime.

Klenzade Bulk Tank Cleaner is conveniently packed in 10 lb., 25., and 100 lb. containers and is sold through milk plants, jobbers, and dealers, coast to coast. An attractive milk house card containing a simple cleaning routine is also available free upon request. This card assures a standardized cleaning procedure and is an important step in uniformly maintaining highest sanitary standards. Milk house cards as well as illustrated folders and complete directions may be obtained from Klenzade Products, Inc., Beloit, Wisconsin.

RESOLUTION BY INSTITUTE OF AMERICAN POULTRY INDUSTRIES

A resolution favoring the careful development and adoption of state and federal mandatory inspection for wholesomeness programs for all poultry and poultry products has been adopted by members and the board of directors of the Institute of American Poultry Industries, according to an announcement made jointly by Paul G. Gray, Jr., Estherville, Iowa, chairman of the board of the Institute, and Dr. Cliff D. Carpenter, president.

The resolution, as approved by Institute members, reads: "The Institute of American Poultry Industries contiues to encourage and support one of its chief, original objectives, namely; the utilization of every sound means to give the consumer a better product and the producer a better market.

"In furtherance of this long-standing objective of the Institute, its Board of Directors and its members favor the development and adoption of sound, mandatory inspection for wholesomeness programs for all poultry and poultry products, provided such programs are paid for from federal and state funds."

The Institute is a national trade association of poultry and egg processing and marketing firms, representing 1800 member plants.

The Institute, now in its 30th year, continually has made sanitation and wholesomeness an important part of its work program. Four years ago, the Institute initiated with Public Health a study of poultry processing plant sanitation. This led to the publication in 1955 of a Uniform Poultry Ordinance by the U. S. Public Health Service to serve as a model for state and local governments in enacting their own ordinances.

Currently, on a voluntary basis, about 25% of total poultry meat is under U. S. Department of Agriculture inspection for wholesomeness.

"Other plants," said Dr. Carpenter, "are using their own inspection systems to assure wholesomeness. Further, federal and state Food and Drug Administrations and various state and local public health agencies have specific regulatory authority and power in this field, the same as they do for other food products.

"The Institute has always stood for the principle that the consumer has every right to expect her poultry to be wholesome and to be processed in a clean plant.

"Because our industry is now doing much of the work the housewife used to, we must, of course, be 'kitchen-clean'. As a matter of fact, our members pride themselves on the cleanliness of their plants. Since, however, the housewife is buying and accepting greater services from industry, it's necessary not only for poultry to be wholesome—but also for the housewife to be convinced of this fact and to have no reason to question the wholesomeness of the poultry she buys, regardless of its source. As an industry, we want to see that the housewife has whatever added assurance she needs to keep her consuming and enjoying poultry products at a maximum rate," Carpenter added.

In announcing the approval of the resolution, Chairman Gray pointed out that the Institute's officers and directors represent companies from every region of the United States, large and small firms, private industry and co-operatives. The recorded vote of these thirty-one men, he said, showed no dissenting votes.

After referral to the entire Institute membership by mail ballot the resolution was passed with less than 5% voting against it.

"About seventy per cent of the Institute's membership," said Mr. Gray, "are engaged in processing — more than half of whom operate single plants. In fact, seventeen of the Institute's officers and directors operate single plants. We believe it is fair, then, to say that the Institute represents the poultry processing industry by geographical location, size of company and plant tonnage."

It has clearly been recognized that the benefits derived from red meat inspection have been enjoyed by the public generally and that the cost of such inspection, except overtime inspection, should be paid for out of appropriated funds. Since the purposes of poultry inspection and the benefits to be derived therefrom are the same as those for red meats, the cost of such mandatory programs for poultry, when developed, should be paid for from federal and state funds, as in the case of red meat."

Mr. Gray stated that the careful development and adoption of sound, mandatory inspection programs for wholesomeness will take considerable time. "Federal and state governments will need time to train necessary inspectors—both veterinary and lay inspectors," he said. "The poultry industry has grown by leaps and bounds and the development of sound inspection programs would be a step forward in the further progress of this industry—the third largest of all agriculture.

NEW BOOKS

Official Methods of Analysis of the Association of Agricultural Chemists. Published by the Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington 4, D. C. Eighth edition, 1955. 1008 pages. Price $12.00 domestic; $12.50 foreign.

This edition of *Methods of Analysis* of the A.O.A.C. (see above) contains officially sponsored methods "up to and including those adopted at its 1954 meeting." Newly adopted changes "became effective on the thirtieth day following their publication in the *Journal* of the Association."

"Purchasers who wish to keep up to date on the methods may obtain reprints of the changes made at the annual meetings of 1955-1958, inclusive. The changes made in 1959 will be available in the Ninth Edition which, it is contemplated, will be issued in 1960." The charge for this reprint service of changes is $1.25. The *Journal of the Association of Official Agricultural Chemists* is a quarterly costing $7.50.

The following are the more important changes in this new edition:

- New chapter on spectrographic methods (emission techniques).
- Field determination of radioactive contamination in civil defense.
- Melting point method for determining the stereochemical composition of amphetamines.
- Directions for determining the optical-crystallographic properties of substances.
- New section on hormones.
- Expansion of microchemical chapter for several elemental analyses.
- Re-naming of vitamin chapter to "Nutritional Adjuncts.

The Buttermaker's Manual, by F. H. McDowall. Published by the New Zealand University Press, Bowen Street, Wellington, New Zealand. 1953. 2 volumes. 1801 pages, 242 illustrations, 200 tables, 160 pages of index, over 1400 references to the literature. $30.00 U. S. post free.

Written primarily for the practical buttermaker, especially emphasizing New Zealand and Australian practices but including frequent reference to pertinent American and European practices, the book covers the details of the science, art, sanitation, technology, laboratory control, quality, engineering, waste disposal, management, and economics of buttermaking. It is encyclopedic in scope, and yet is correlated into an integrated whole. An appendix carries many tables of practical engineering data.

Pocket Book of Chemical Technology, by V. Stannett and L. Mitlin. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. 1954. 283 pages. Price $4.75.

This convenient pocket book is unique in that it contains *both* chemical and chemical engineering data of frequent use. Its size is about 4½ by 7 inches, and only ⅝ths inch thick. Its chapter headings are:

- Mathematical data (incl. tables of trig, log, and integrals)
- Units and conversion factors
- International atomic weights
- Radioactive materials (preparation, isotopes, labelled compounds)
- Properties of organic compounds (29 pages)
- Properties of inorganic compounds (41 pages)
- Gravimetric factors
- Dissociation constants of acids and bases
- Buffer solutions
- Laboratory freezing mixtures
- Densities and specific gravities
- Fluid flow
- Heat transfer
- Distillation
- Boilers and fuels
- Materials of construction
- Alloys
- Average plastics properties
- Standard sieves
- Engineering data (standard sections; pipes and pipe threads; screw threads; flanges; drawing conventions)
- Safety provisions
- First Aid
- Common names of minerals and other substances
- Glossary
- List of selected British standards
- Index

RESEARCH GRANT GIVEN TO GRADUATE STUDENT

Carl T. Herald, graduate student at Michigan State University in the field of dairy manufacture, has been awarded the first research assistance grant of $500 by the Dairy Remembrance Fund, it has been announced by Madison H. Lewis, president of the fund.

Herald, a graduate of Penn State University, is working toward his doctorate at Michigan State where his research activities have been concentrated on protein chemistry with special emphasis on the character of the fat globule membrane proteins in milk.

The Dairy Remembrance Fund was incorporated in February, 1954 as a means of honoring men and women in the dairy and allied fields. It is supported by voluntary contributions for that purpose and is dedicated to the advancement of scholarship in the field of dairy education, the support of research and the maintenance of non-profit institutions in the fields of health, education and public welfare.

STATE COLLEGE OF WASHINGTON TO HOLD 25TH INSTITUTE OF DAIRYING

Plans are under way to make the 25th annual State College of Washington Institute of Dairying, slated for March 12-15, 1956, an outstanding educational dairy event. This is the announcement made by Dr. H. A. Bendixen who has directed these Institutes annually, except for the war years, since 1928. Guest speakers of national renown in the dairy science field will participate in the program. Among these will be Dr. D. V. Josephson, Head of the Department of Dairy Husbandry, Pennsylvania State University, Dr. H. C. Olson of the Department of Dairying of the Oklahoma A. & M. College, and Dr. R. W. Bartlett, Professor of Agricultural Economics at the University of Illinois and many others who are leaders in dairy education and industry.

Scoring contests open to the world will again be staged with entries expected from many states, Alaska, and Canada as in the past. Quality clinics and judging contests will also be part of the program with handsome prizes provided by numerous dairy equipment and supply houses being offered in all contests.

Special sessions for milk sanitarians, planned by the Washington Milk Sanitarians Association, will be held to which sanitarians, fieldmen and inspection officials from all areas are cordially invited.

Other agencies cooperating in staging the Institute are the Washington State Department of Agriculture, the Washington State Department of Health, Washington State Dairy Foundation, Washington State Dairy Council, Washington State Dairy Products Commission, the Institute Alumni Association, and the State College of Washington Student Chapter of the American Dairy Science Association.

INDEX TO ADVERTISERS

ECONOMY THROUGH QUALITY STRESSED AT OAKITE CONFERENCE

The savings effected in industrial production through the use of quality cleaning materials were stressed in the annual technical sales conference held by Oakite Products, Inc., in New York City, November 17 through 19.

Representatives from the company's New York, Canadian, Philadelphia, and New England divisions shared their experiences in serving the cleaning needs of the metal, food, petroleum, automotive, marine, textile, paper, railroad, and other industries, and reported such savings as these: $15,000 saved every three months on a pickling operation; $2825 saved on deburring; $24 saved on every tank truck washed; $18,000 saved by the application of a special rust-proofing compound. These reductions, it was pointed out, were made possible by the use of materials designed to do specific cleaning jobs, to replace outmoded methods, to have long, scientifically controlled solution life under the watchful eye of a technical service representative.

One of the features of the conference was a discussion of 18 new cleaning, sanitizing, and metal treating materials; improvements in the Oakite Crys-Coat Process of phosphating; and improved mechanized cleaning methods developed during the past two years.

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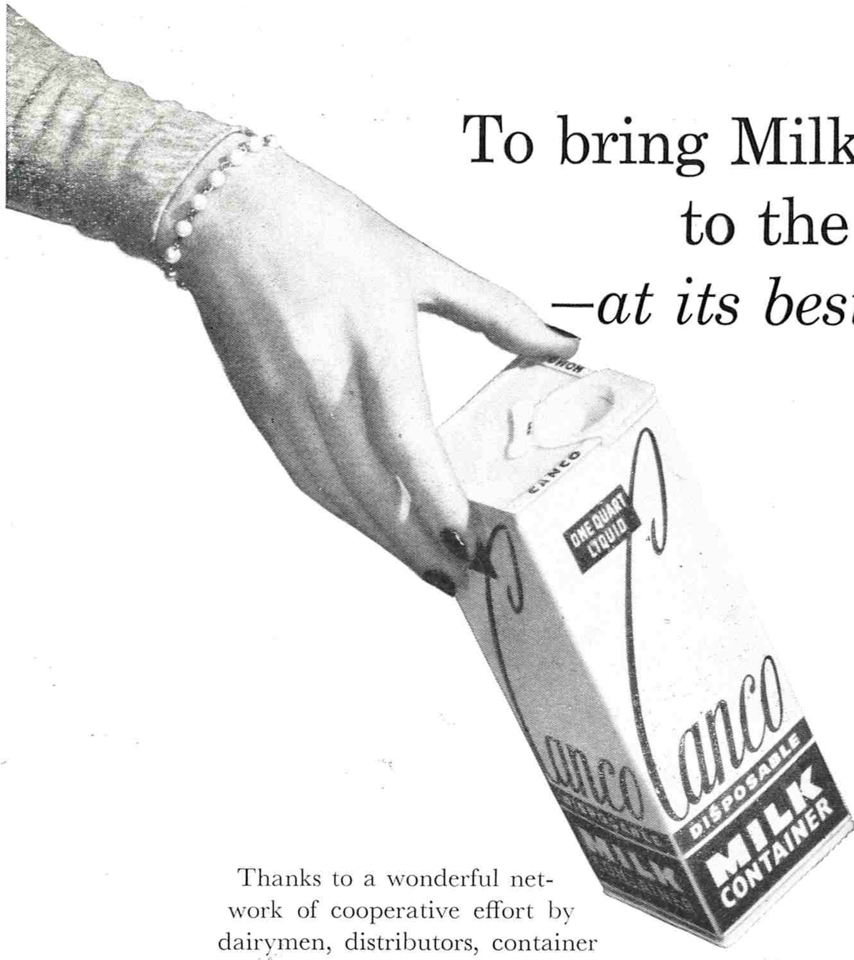

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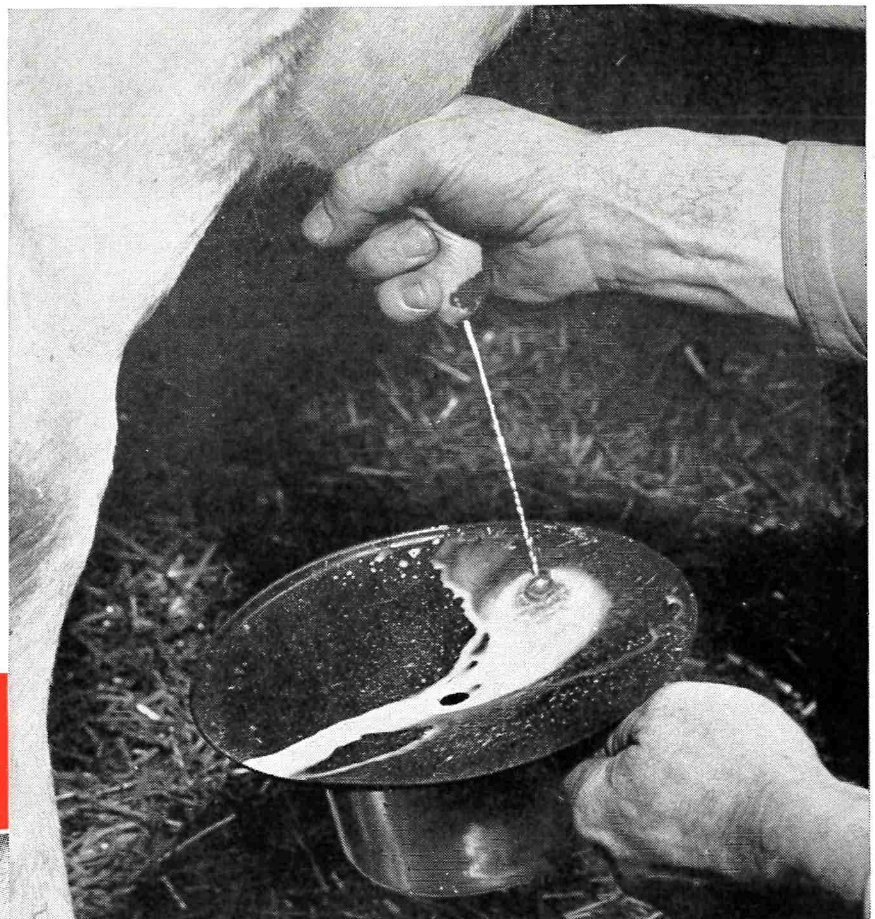

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