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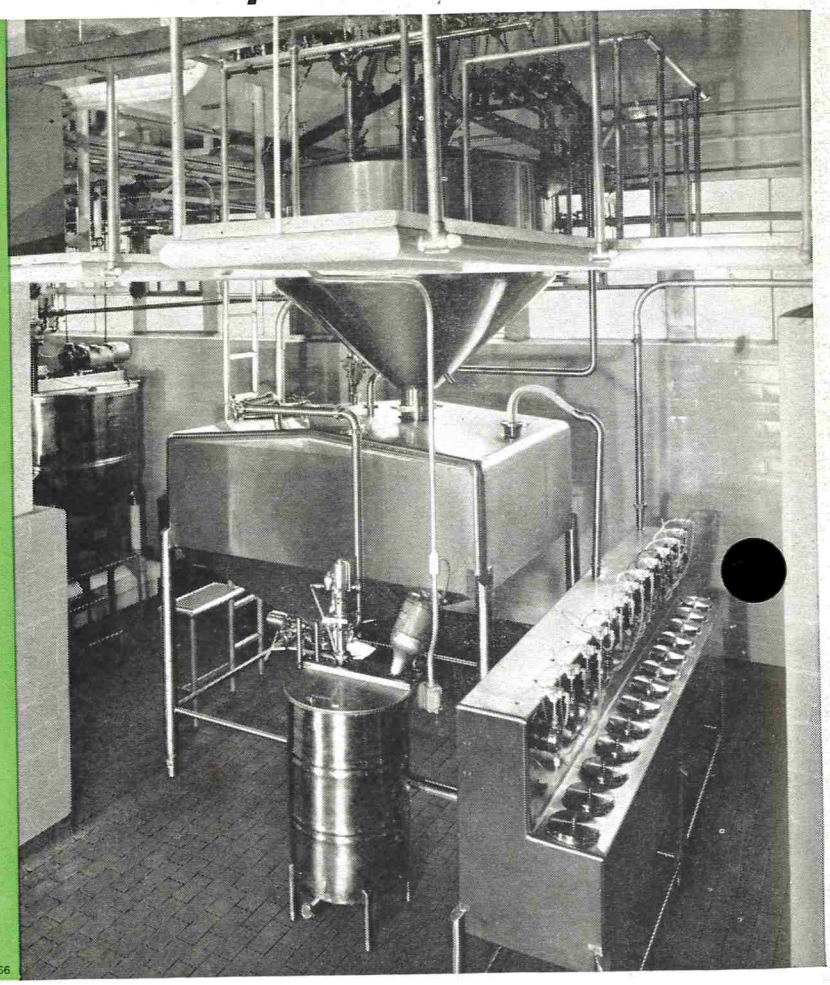

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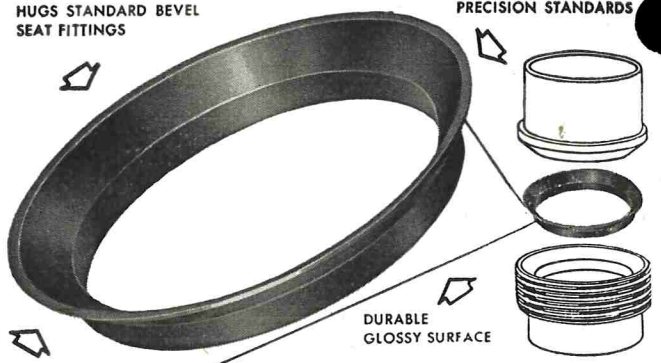

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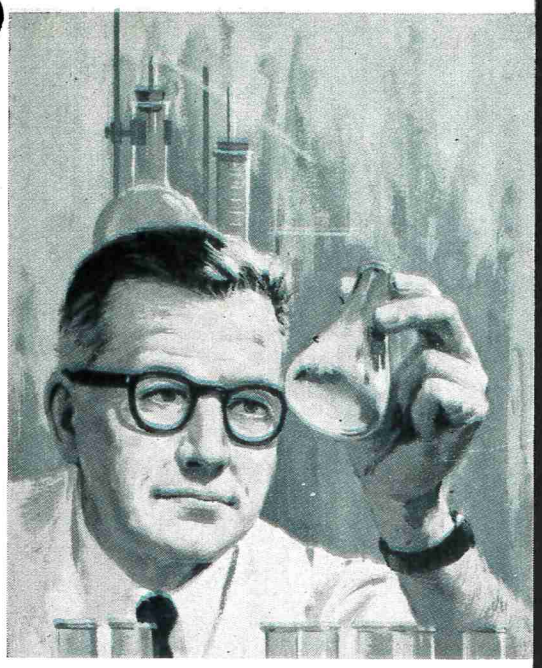

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BACTERIA AND YEAST COUNTS OF PREPACKAGED, SLICED, CURED BACON, AND SLICED, FRESH SIDE PORK[1]

WILLIAM A. MILLER[2]

Department of Bacteriology,
Kansas State University, Manhattan 66502

(Received for publication October 7, 1966)

SUMMARY

Initial counts of 161 packages (21 brands) of sliced, cured bacon (yeasts and bacteria combined) ranged from <1,000 to 30 million per cm². After 3 to 14 days at 3 to 6 C counts ranged from <1,000 to 650 million per cm². Brand F showed the highest counts, and numerous small yeast colonies were seen on the lean. Abnormal odors and sliminess were observed in some samples. Initial bacterial counts on sliced, fresh side pork (53 packages, 2 brands, 2 stores) varied from <1,000 to 25 million per cm². Species of *Pseudomonas* and *Achromobacter* dominated and counts were higher in packages from Store A, rising to 1 billion per cm² in 6 to 7 days at 6 C.

There is considerable interest at present in the microbial flora of prepackaged meats at the time of purchase, and how this relates to subsequent keeping quality in the home.

Cavett *(1)* reported that bacon with a normal salt content of 5 to 7% in the aqueous phase spoiled in about 15 days when stored at 20 C. The sour odor which had developed was probably due to combined activities of micrococci and lactic acid bacteria.

Ingram *(2)* stated that cured sliced Wiltshire bacon normally carries 100,000 to 1 million salt-tolerant bacteria per gram predominantly species of *Micrococcus* and *Lactobacillus.* When stored at 15 C for 4 days numbers rose as high as 100 million. There was a slow decline in organoleptic quality in 14 days.

Jensen *(3)* found that the flora of bacon going into cure varied from season to season and year to year, but the numbers depended on sanitary practices. In the smoking process virtually all microorganisms were destroyed.

Tonge, Baird-Parker and Cavett *(4)* studied the micro-ecology of cured, sliced, vacuum-packed bacon during storage at 20 and 30 C and found that catalase positive cocci dominated the flora the first 9 days. Streptococci and lactic acid bacteria became dominant later under low salt conditions.

EXPERIMENTAL PROCEDURE

Twenty-one brands (161 packages) of sliced, cured bacon were purchased during 20 months from 5 large volume stores. Two brands of sliced, fresh side pork were purchased from 2 large volume stores during 9 months. Within 15 minutes after purchase, the packages were placed at 3 C and initial microbial counts were made within 4 hours.

A 10-cm² portion (5 cm on each side) including approximately equal areas of lean and fat was excised and placed in 99 ml of 0.15% peptone water in a 6-oz screw-cap bottle. Plate counts, using eugonagar, were based on the numbers of microorganisms removed from 1-cm² area of meat by vigorous shaking for 5 min on a Kahn shaker, followed by appropriate dilutions in 0.15% peptone water (shaken 25 times by hand). Plates were incubated 4 days at 23 C.

RESULTS AND DISCUSSION

As shown in Table 1, initial bacterial counts on 89 packages of cured bacon comprising 14 brands (from Sept. 1964 to July 1965) ranged from <1,000 to 30 million per cm² while medians were <1,000 to 65,000. The high counts were limited to approximately 15 packages, and 7 of these yielded counts of 1 million to 30 million at purchase.

After 3 to 7 days at 3 to 6 C, samples from some of the packages yielded 100 million to 640 million microorganisms per cm². Yeasts usually dominated the flora in most samples and small colonies could be seen on the slices from some packages. Lactic acid bacteria dominated in a few packages, especially in the vacuum-packed brands. Micrococci were also found, but seldom dominated. Brand F showed the largest number of packages having high counts. Brands B, D, E, G, H, and I (42 packages) did not show a single sample above 180,000 organisms per cm². Abnormal odors and sliminess were noted in stored samples from some high count packages when yeasts were present in large numbers.

During the period from Sept. 1965 to July 1966 bacterial counts per cm² on 72 packages (17 brands) of cured bacon varied from <1,000 to 5 million at purchase time (Table 2). After 7 to 14 days at 3 to 6 C, counts per cm² ranged from <1,000 to 180 million. The higher counts were on samples from 7 brands of sliced "ends and pieces." This type of product appeared on the retail market in larger quantities when the price of bacon increased.

Because Brand F showed the highest counts during 1964-1965, additional packages were purchased and analyzed in 1965-1966. Samples from 13 packages

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TABLE 1. COMBINED YEAST AND BACTERIAL COUNTS ON SLICED, CURED BACON (SEPT. 1964-JULY 1965) SOON AFTER PURCHASE AND AFTER STORING AT 3 TO 6 C FOR 3 TO 7 DAYS

Brands of bacon	No. of pkgs.	Initial counts	Counts per cm² at time indicated[a]			
			Time and temperature of storage (portions of opened packages)			
			3 to 4 days at:		7 days at:	
			3 C	6 C	3 C	6 C
A	8	1T to 13M Md. = <1T	1T to 24M Md. = 110T	<1T to 50M Md. = 125T	<1T to 65M Md. = 190T	<1T to 46M Md. = 300T
C	8	<1T to 25M Md. = <1T	<1T to 65M Md. = <1T	<1T to 100M Md. = <1T	<1T to 70M Md. = <1T	<1T to 100M Md. = <1T
B, D, E, G, H, I	42	<1T to 21T Md. = <1T	<1T to 25T Md. = <1T	<1T to 80T Md. = <1T	<1T to 180T Md. = <1T	<1T to 100T Md. = <1T
F	10	<1T to 30M Md. = 65T	<1T to 100M Md. = 4.5M	<1T to 200M Md. = 5M	<1T to 140M Md. = 8M	<1T to 650M Md. = 10M
J	4	<1T to 1M Md. = 10T	——— ———	<1T to 5M Md. = 1M	——— ———	<1T to 17M Md. = 5M
K Vacuum packed	9	<1T to 10M Md. = 10T	<1T to 25M Md. = <1T	<1T to 75M Md. = <1T	<1T to 60M Md. = <1T	<1T to 100M Md. = <1T
L, M, N Vacuum packed	8	<1T to 25M Md. = <1T	<1T to 2M Md. = 3T	<1T to 20M Md. = 10T	<1T to 13M Md. = 20T	<1T to 25M Md. = 40T

[a]T = Thousand; M = Million; B = Billion; Md. = Median.

TABLE 2. COMBINED YEAST AND BACTERIAL COUNTS ON SLICED, CURED BACON (SEPT. 1965-JULY 1966) SOON AFTER PURCHASE AND AFTER STORING AT 3 TO 6 C FOR 7 TO 14 DAYS. BRANDS OF SLICED ENDS AND PIECES INCLUDED

Brands of bacon	No. of pkgs.	Initial counts	Counts per cm² at time indicated[a]			
			Time and temperature of storage (portions of opened packages)			
			7 days at:		14 days at:	
			3 C	6 C	3 C	6 C
F	13	<1T to 650T Md. = <1T	<1T to 1M Md. = <1T	<1T to 8M Md. = <1T	<1T to 6M Md. = 5T	<1T to 12M Md. = 30T
9 Miscellaneous brands	28	<1T to 140T Md. = <1T	<1T to 600T Md. = <1T	<1T to 3 1/2M Md. = <1T	<1T to 3M Md. = <1T	<1T to 5M Md. = <1T
7 Miscellaneous brands (ends & pieces)	31	<1T to 5M Md. = <1T	<1T to 210M Md. = 3T	<1T to 110M Md. = 30T	<1T to 160M Md. = 200T	<1T to 180M Md. = 1M

[a]T = Thousand; M = Million; B = Billion; Md. = Median.

TABLE 3. BACTERIAL COUNTS ON SLICED, FRESH SIDE PORK (OCT. 1965-JUNE 1966) SOON AFTER PURCHASE AND AFTER STORING AT 3 TO 6 C FOR 3 TO 7 DAYS

Brands of fresh side pork	No. of pkgs.	Initial counts	Counts per cm² at time indicated[a]			
			Time and temperature of storage (portions of opened packages)			
			3 to 5 days at:		6 to 7 days at:	
			3 C	6 C	3 C	6 C
Store A	27 (unless otherwise indicated)	<3T to 25M Md. = 160T	65M to 350M (5 packages only)	150M to 500M (5 packages only)	100T to 560M Md. = 100M	10M to 1B Md. = 200M
Store B	26 (unless otherwise indicated)	<1T to 13T Md. = 3T	30T to 65M Md. = 1M (14 packages)	10T to 100M Md. = 2.5M (14 packages)	250T to 75M Md. = 4M (7 packages)	1M to 150M Md. = 12M (7 packages)

[a]T = Thousand; M = Million; B = Billion; Md. = Median.

(Table 2) stored up to 14 days at 3 to 6 C showed considerably lower counts during 1965-1966. The microbial flora of the brands in Table 2 was essentially the same as those in Table 1.

Bacterial counts were made on samples from 53 packages of sliced, fresh side pork purchased from 2 stores (Table 3). Counts were much higher in packages from Store A, and there was obvious spoilage in some samples held for 3 days at 3 to 6 C. Species of *Pseudomonas* and *Achromobacter* dominated, and counts were as high as 500 million per cm² after 3 to 5 days at 6 C.

ACKNOWLEDGMENT

The author acknowledges the technical assistance of Eldon Misak, student in Veterinary Medicine, Kansas State University, Manhattan.

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LATEST DEVELOPMENTS IN AUTOMATIC DISHWASHING[1]

W. M. Podas and S. B. Crecelius

Economics Laboratory, Incorporated
St. Paul, Minnesota

Over the past twenty years automatic dishwashing has grown from a rather poorly controlled and inefficient operation into a scientifically controlled, well integrated, and highly important part of todays food service industry. This growth has been brought about by a number of factors: (1) higher standards of sanitation; (2) population growth with more people eating out; (3) rising labor costs which has forced more efficiency and automation; (4) improved and more efficient dishwashing machines; and (5) last but not least, significant improvements in automatic dishwashing detergents and detergent aids plus equipment for automatically feeding them.

How did this come about? Mainly through concentrated study of the dishwashing process itself and constantly trying to find ways of improving the process through research. We will point up the development of some of these improvements in this discussion.

Methods for Evaluating the Dishwash Process

In order to determine whether any progress is being made, there first had to be developed more scientific and reliable methods of evaluation of the dishwashing process. The following questions had to be answered: (1) How clean is clean? How can you really tell when you have the ultimate in soil removal? (2) How sanitary is the operation? How do you achieve the lowest possible bacterial count on the utensils being washed? (3) What is the appearance of the utensil being cleaned from an aesthestic standpoint? Are the glasses clean and glistening free of spots, film and streaks? Is the silverware bright and shiney? Are the plates clean and bright looking and free of marks and scratches? Are the cups free of unsightly stains? (4) And, again, important from the standpoint of the food operator, what type chemical formula will give you all these desired end results at the lowest possible cost and how do you control the use of these chemicals?

Evaluation of a detergent composition begins in the laboratory. A synthetic soil had to be found which was very difficult to remove and gave reproducible results. One standard soil is a mixture of cooked oatmeal and india ink which is sprayed on scrupulously clean plates in a uniform film. This soil is then baked on in an oven at controlled temperature until it forms a hard impervious film. It has been found through a cooperative study with the Mid-West Research Institute that this is the most difficult soil to remove of the standard soils commonly used. In addition to the standard soil on the plates, the following other soils are added to the machine in carefully measured amounts: beef stew, tomato juice, fresh whole milk and coffee. The latter soils are not difficult to remove but they do complicate the dishwashing operation through redeposition of films and their contribution to foaming and staining of surfaces.

The machine used for this evaluation is a standard commercial model dishwashing machine which is widely used in the industry. A specific number of juice glasses, glass tumblers and coffee cups are placed in the machine and the same pattern of racking is followed in each test to eliminate as many variables as possible. In addition to the above dishware, a given number of clean glass slides and plates are also racked in the machine. A carefully controlled concentration of the detergent to be tested is then added to the machine and the machine is put through a wash and rinse cycle which is carefully controlled from the standpoint of time and temperature. These steps are repeated a given number of times allowing a definite controlled amount of time for drying between each cycle.

Interpretation of Soil Removal Tests

After the controlled washing cycle is completed, the soiled plates which have been washed are then checked against a set of standard soiled plates which range from 0 (100% completely clean) to 33 (100% dirty). These standard plates vary in three unit intervals. Figure 1 shows a standard set of plates to which comparison can be made. After checking all the plates washed in the test, each plate is given a value somewhere between 0 and 33. A statistical average is then determined from the series of numbers which are obtained. This is called the cleanability number and can be used to evaluate one experimental detergent against another or a whole series of detergents against a standard detergent.

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[1]Presented at the 53rd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., at Minneapolis, Minnesota, August 15-18, 1966.

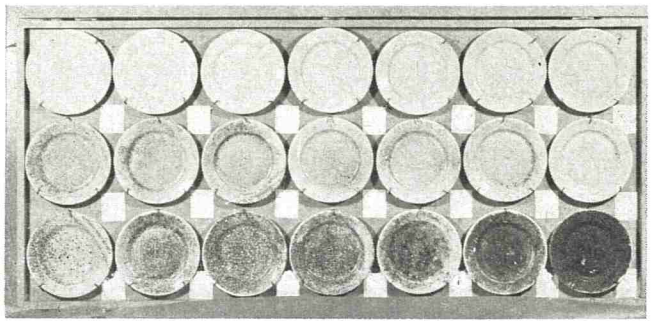

Figure 1. Standard plates used in soil removal evaluation.

The glass slides mentioned above are measured on a specially constructed photometer which has a range from 0 (completely clean) to 900 (very dirty). After a photometer reading is taken on each slide, a statistical average is then taken of these various readings. This is known as the photometer number and points up the value of the detergent in respect to soil redeposition and ease of rinsing. This photometer reading can be complicated by the character of the rinse water itself. If it is a low solids water (0 - 5 gr.), the value that you get is a true measure of redeposition which can cause spots and film. However, if it is a high solids rinse water (15 - 30 gr.), the spots or film which contribute to photometer reading may be caused by the rinse water itself. Thus the nature of the rinse water itself must be taken into consideration. Figure 2 shows a comparison of glasses rinsed in low solids and high solids water.

EVALUATION OF RINSE ADDITIVES

Another important problem is the evaluation of rinse aids. Rinse aids are formulated organic surfactants, usually nonionic in character, which when added to the rinse water in very small amounts (50 - 150 ppm) cause the rinse water to drain quickly from the dishware without forming clinging droplets. Without a rinse aid water droplets tend to cling to the utensil causing it to stay wet for a longer period of time and may make toweling necessary. Use of a rinse aid causes the rinse water to spread out in a thin film without forming droplets thus allowing the dishes to dry very quickly and makes toweling unnecessary. Rinse aids not only speed up the drying and make toweling unnecessary but they prevent large amounts of water from drying on the dishes and leaving unsightly spots from the natural solids contained in the water. The elimination of toweling eliminates one of the main causes of bacterial contamination. Figure 3 shows the comparison of two glasses with and without the use of rinse additive.

Figure 3. Comparison of two glasses with and without the use of rinse additive. On left, rinsed with 100 ppm additive to water; on rinse additive.

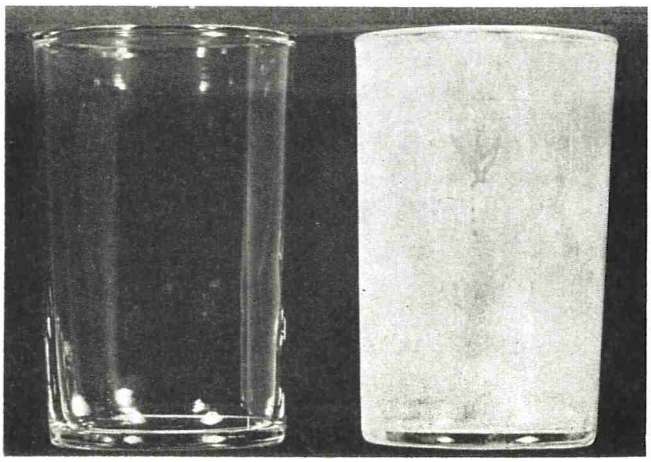

Figure 2. Comparison of glasses rinsed in low and high solids water. On left, rinsed with 850 ppm solids water; on right, rinsed with 0 ppm solids water.

Rinse additives are evaluated in the following manner. A rack of clean glasses are placed in a dishwasher containing a standard soil load and a standard detergent. The glasses are washed through a regular cycle and then rinsed for a given amount of time with a specified amount of rinse additive, added directly to the rinse water line. The rinse additive is injected directly into the rinse line by means of a proportionating pump. This cycle is repeated at least ten times allowing the glasses to dry at two minutes each cycle. The glasses are then removed from the rack and inspected in a dark room under a special lighting system. They are compared with ten standard glasses graded 0 (no spots and film) to 10 (very heavy spots and film). The glasses are given a rating as compared visually with standard glasses.

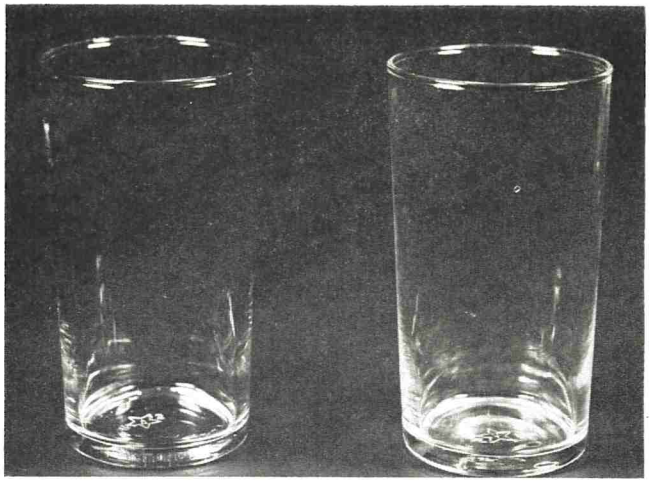

Figure 4. A comparison of two glasses showing extreme ranges in evaluation. On left, rating of 1 with free of spots and film; on right, rating of 10 with heavy spots and film.

A statistical average is then calculated from the several readings and this is assigned as the value obtained for the rinse additive at the concentration use. Usually, evaluation measurements are made at several different concentration levels for a single rinse additive. Figure 4 shows the comparison of two glasses, one with a rating of 1 (free of spots and flim) and one with the rating of 10 showing heavy spots and film.

These are the two most basic types of automatic dishwashing evaluations. Many variations of these evaluations can be made by changing a variable and holding all other factors constant. Variables might be type of water, concentration of detergent, temperature, time of wash, etc.

MEASURING CAPACITY OF DETERGENT FOR STAIN REMOVAL

Recently a more specific evaluation has been developed to measure the capacity of various types of detergents for stain removal. By using this technique, one is able to definitely determine the value of available chlorine in dishwashing formulations.

This is done by preparing stained cups with a standard concentration of stain. Tea or coffee is poured into cups and allowed to stand a given length of time. This staining procedure is repeated approximately 10 times until the stain build up reaches the right intensity. These stained cups are then run through a regular machine cycle with the detergent to be tested. These cycles are repeated until all the stain is removed. The number of cycles it takes to remove the stain is the value then assigned to the detergent. The lower the number, of course, the better the detergent. Figure 5 shows the comparison of two plastic cups, one badly stained and one free of stain.

FIELD EVALUATION OF DETERGENTS

Another method which is used to evaluate detergent is the field panel test. This goes beyond the laboratory into actual field conditions. The panel consists of accounts where prearranged permission is granted to conduct the test. There may be from ten to thirty such accounts. The first step is to go into the account and to evaluate as objectively as possible the conditions existing before the evaluation is made such as the condition of the glass (a number rating is given to a random sample of the glasses); the condition of the silverware, plates, cups, etc.; the use concentration of detergent being used and the overall cost of the operation. After all these data measurements have been made, the detergent is actually placed in the account without changing any of the operating conditions and the measurements are then made on its performance over a period of weeks and sometimes months. The data from these measurements are then compared on a statistical basis with the condition which formerly existed in the account. As large a variety of different types of accounts are covered as possible including different types of machines, water conditions, food soil conditions, etc. This panel type evaluation has proved very valuable in supplementing laboratory evaluations and gives a much broader picture of the performance of the detergent under controlled conditions.

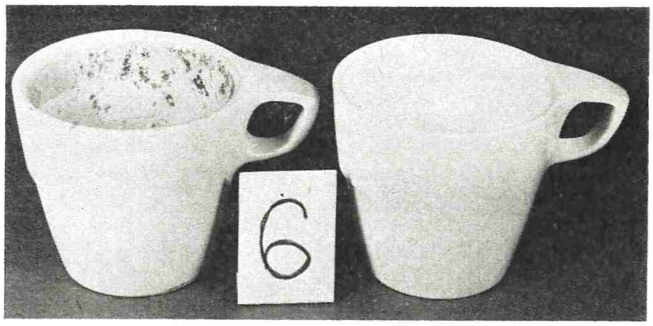

Figure 5. Comparison of two cups showing extremes of stain evaluation. On left, badly stained; on right, free of stain.

DEVELOPMENT OF DISHWASHING EQUIPMENT STANDARDS

At the same time that the detergent industry has been developing new evaluation methods and new detergent systems, the dishwashing machine manufacturers in cooperation with leading people in the

sanitation field have been working towards better and more efficient dishwashing equipment. The National Sanitation Foundation whose headquarters are at the University of Michigan, Ann Arbor, serves as a focal point for setting new standards in dishwashing equipment. The N.S.F. Standard No. 3 covers spray-type commercial dishwashing machines and has been revised and a new revision issued in 1966. The National Sanitation Foundation authorizes the use of their N.S.F. seal on dishwashing machines which meet these standards. This seal of approval is granted only after the N.S.F. has investigated the applicants method of manufacture and made an examination of the final equipment produced. The health officer will be guided by this standard in inspection of newly installed equipment.

The standard covers the following points: (1) the use of materials in manufacture of equipment in relation to corrosion, wear, ease of cleanability, etc.; (2) method of physical soil removal; and (3) methods of proper final sanitation. Any piece of equipment which deviates from the standard must prove to the N.S.F. that they produce results which equal the standard before they will gain the approval of N.S.F.

The mechanics have been set up for complete review of the standard each three years in order to make changes or deletions which will bring it up to date. This will include:

In Section 2. All terms defined in relation to the dishwashing operation and equipment used therein.

In Section 3. The type of materials defined which are acceptable in the fabrication of dishwashing equipment.

In Section 4. Methods of construction and design which meet minimum standards.

In Section 5. Methods and materials and design defined that will meet minimum requirements for the handling of dishware prior to washing.

In Section 6. Acceptable conditions of operation defined in terms such as temperatures, pressure, volumes, and spray patterns of wash and rinsewater.

In the final section of this standard, general instructions are recommended for the installation and operation of the dishwashing equipment and any auxillary equipment needed to carry out a complete dishwashing operation. In this section they specify that the use of detergent and rinse aid shall be in a manner specified by the manufacturer to obtain the best possible cleaning and sanitizing conditions.

What does this mean to the dishwashing operation as a whole? We believe that though it may not solve all the problems of dishwashing since one of the factors in such an operation is the human element, it at least sets a track to run on and serves as a guide to the equipment manufacturer, the operator, the heath official and the detergent supplier to meet on a common ground.

Recent Advances in Detergent Formulation

Dishwashing detergents have undergone a number of advances over the years. One of the greatest advances was the use of polyphosphates in detergent formulation to control water hardness. Unfortunately, the use of polyphosphate did not completely solve the problem of hard to remove soils.

It was later found that the addition of caustic (NaOH) to detergent formulation increased the efficiency of this soil removal greatly. However, with the use of caustic or strongly alkaline detergents another problem developed which caused serious drawbacks. The strong alkaline detergents hydrolyzed the protein soil and caused foam to develop in the dishwasher. This foam clogged the pump and wash arm of the machine resulting in inadequate wash pressure and spray pattern. Efforts to solve this problem mechanically did not prove satisfactory. After an intensive research program a high molecular weight, specially constructed, nonionic type surfactant was discovered which when added in relatively small amounts would serve to defoam this protein foam and restore the proper wash pressure to the washing operation. This made it possible to combine highly alkaline detergents with defoaming properties and was an important step forward in dishwashing detergent efficiency.

Concurrently, it was well known that available chlorine added to a dishwashing detergent would increase the efficiency of stain removal and removal of very thin soil films on utensils. The most familiar commercially available chemical used to introduce chlorine to detergents, however, was chlorinated trisodium phosphate. This reagent would work quite well in a mildly alkaline detergent but when formulated into a strong alkaline detergent, it would decompose forming a mushy wet compound with loss of the chlorine. After further research, a method was found to add gaseous chlorine to a highly alkaline blend of inorganic materials which gave a high concentration of solid hypochlorite. This material could be formulated into an automatic dishwashing compound giving a finished product containing both caustic and chlorine. This product gave a vast improvement in automatic dishwashing results, both from the standpoint of removing heavy soil and in bleaching and removing thin tenacious films and stains.

Thus the blending of caustic and chlorine had been achieved and likewise the blending of caustic and defoamer. The blending of all three of these factors

into one product, however, remained yet to be accomplished. The former product would clean heavy soils and remove stain but still gave some problems with foaming. The latter product would remove heavy soils and control foam but still would not give the stain removal desired. Original attempts to blend these three ingredients together (caustic, chlorine and defoamer) were unsuccessful because chlorine would attack the defoamer and after a short storage time, one would end up with a deterioration of both effects. After continued research, a method was finally found whereby these three components could be blended together to give a stable product. This method involved encapsulation of the defoamer in a separate step to protect it from the chlorine. This special intermediate could then be blended with caustic and chlorine to give a final product which gave defoaming stain removal and heavy cleaning properties. This again was a definite advance in automatic dishwashing efficiency.

EFFECT OF WATER CONDITION ON THE DISHWASHING PROCESS

One of the biggest factors in automatic dishwashing is the water itself. The nature of water varies tremendously throughout the continental U. S. For example, along the eastern seaboard the water in most cases is naturally soft (1 - 5 grain) and medium or light duty detergents will suffice in most cases. In certain areas around Chicago, Indiana, Pittsburgh and certain other areas in the midwest, the water is very hard requiring special heavy duty detergents to acquire results. In areas of the southwest such as Phoenix, Arizona, and on the west coast in Los Angeles, the water contains a very high content of neutral solids which poses another problem particularly in rinsing. Hard water which has been softened will still contain a high amount of dissolved solids.

To complicate this picture still further, areas such as Pittsburgh are subject to constantly changing water conditions which vary with the season. In the winter and spring the water in the Pittsburgh area is fairly normal containing only about 100 ppm of dissolved solids. In the summer and fall the water changes and can go up to as high as 600 to 700 ppm solids. Hence a detergent and rinse additive system which might work very well in Pittsburgh in the winter and spring might give mediocre results in the summer or fall unless adjustments are made.

THE VALUE OF RINSE ADDITIVES

As mentioned before, rinse additives are chemical formulae which are injected directly into the final rinse line to aid in quick run-off of water droplets, fast drying and elimination of spots, streaks and film. The spots and film after they have dried can result from two sources, poor detergency before rinsing or deposit from the rinse water itself. As mentioned above, we believe with advances made in detergency formulation we are getting excellent detergency in most cases but the effects of the rinse water itself are much harder to control.

There are different types of rinse agents for use in various types of water. A light duty rinse additive may give good results in soft water where there is no problem with solids. Another product might be referred to as a regular rinse additive which is higher in surface activity and is meant for the average water conditions where there may be some hardness and solids but not excessive. Also a heavy duty product is available which is designed specifically for use in high hardness and alkalinity. This product contains a chelating agent in the acid form which keeps the hardness and alkalinity solubulized so that it can run off without percipitating of the final rinse utensil. We also have an acid type rinse additive designed especially for areas with high calcium hardness which can clog up the rinse jets and foul up the rinsing apparatus generally.

Recently we have been faced with another rinsing problem which may necessitate the development of another rinse additive. On the West Coast in the Los Angeles area we are confronted with a problem where rinse waters may contain as high as 800 ppm solids. In most cases the water is softened but the solids are still there in the form of neutral salts. Present rinse additives give good sheeting and thin films but even so, with these high solids, unsightly filming is left on the glasses and silverware. This requires even a different kind of rinse additive that will work well with high solids. This only goes to show how carefully each of these rinse additives has to be formulated to get the special effect required for the particular water condition.

DETERGENT BIODEGRADABILITY IMPROVEMENTS

During the past three years the detergent industry as a whole has voluntarily undergone a program to change their product to be based on surfactants which are biodegradable. This change, however, has mainly affected products which were based on ABS. (alkyl benzene sulfonate). The products concerned here are mainly laundry detergents and hand dishwashing detergents. The shift has been to LAS (linear or straight chained alkyl benzene sulfonate). This LAS can be degraded by microorganisms in a short period of time. Specifications have been set up by the Soap and Detergent Association definitely stating the degradation requirements which must be

met. Practically all the industry has met these requirements.

Automatic dishwashing detergents, however, are not affected by this program since they are not based on anionic alkyl benzene sulfonate type raw materials. The reason for this is that ABS type surfactants are high foamers and for this reason are not adaptable for use in automatic machines. The bulk of the raw materials used in automatic dishwashing are various inorganic salts such as tripoly phosphate, trisodium phosphate, sodium metasilicate, sodium hydroxide and others. These products are not concerned in the biodegradability problem. Certain special nonionic surfactants are used in small amounts (as mentioned above in discussion of defoamers); the use of these range from about 1 - 5% based on the total formula. The chemical industry as yet has not determined a good way to measure the biodegradability of nonionic detergents. They are presently working on this and several different methods are under study. As soon as an acceptable method is found to definitely determine the extent of biodegradability of nonionic type surfactants, the entire industry will probably conform to these standards.

POWDER VERSUS LIQUID DETERGENT SYSTEMS

Up to the present time powder systems have been predominantly used in mechanical dishwashing. In recent years, however, there has to be some experimentation with liquid systems and there probably will be an expansion of this in the future. Liquid systems do have the advantage of being easier to dispense and more adaptable to bulk handling than powders. Up until now they seem to have the disadvantage of being more expensive and with less latitude in formulation. If these disadvantages can be overcome, liquids will undoubtedly have a place in the future.

LONG RANGE RESEARCH STUDIES

Although great improvements have been made in automatic dishwashing over the last several years, we do not feel that we have reached the ultimate by any means. Some examples of long range research studies in this industry are as follows:

1. *Replacement for the Polyphosphates*—To date the various polyphosphates have been the most economical and versatile water conditioning agents available. There is some indications, however, that polyphosphates contribute to excessive algae growth in fresh water supplies. It may be that some day in the future, we may be called upon to replace polyphosphates with some other inoccuous water conditioner. As yet none are available which will do all the things polyphosphates will do. Research in the synthesis of replacements for polyphosphates is active.

2. *Conditioning of Rinse Water*—Water supplies in general are deteriorating and the mineral content rising, all of which contributes to dishwashing problems. Research is being carried out on new water softening and water demineralizing systems for dishwashing machines.

3. *More Controlled Chlorine Release*—We know that available chlorine is of benefit in dishwashing detergents. The effectiveness of the level of chlorine can be measured quite accurately. One problem is that once the chlorine doner is present in solution, it begins to lose its chlorine quite fast due to reaction with organic material and it is difficult to keep the proper level in the wash tank at all times. Research is being carried out on new available chlorine materials.

4. *New Surfactants*—As mentioned before, the problem of biodegradability may be extended in the future to nonionics. Research projects are active to find nonionic surfactants which will give the same properties of defoaming and surface activity and still be diodegradable as those presently used and this has to be supplemented with biodegradable studies on each surfactant as it is synthesized.

Another goal which has not been achieved is the development of anionic surfactants which can be dispersed in a liquid formulae along with inorganic builders and remain stable.

All of these are problems which are challenging. As we solve them, undoubtedly more will arise in their wake but this is the nature of the research business.

ABNORMAL MILK CONTROL AND THE SANITARIAN

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The Grade "A" Pasteurized Milk Ordinance—1965 Recommendations of the United States Public Health Service contains 21 separate items or sanitation requirements for Grade "A" raw milk for pasteurization. These are known as the "r" Items of Section VII and refer to raw milk as opposed to the "p" Items of Section VII which refer to pasteurized milk.

Questioning of sanitarians in several areas of the United States would seem to indicate that more than 95% of the sanitary inspections of producer dairies are made at other than milking time. Exceptions are found in those areas with extremely large dairy herds which milk up to 20 hours per day. In these areas, the majority of the sanitary inspections are made at milking time.

There are four of the "r" Items which can be observed only at a milking time inspection. These are Item 13r, Utensils and Equipment - Handling; Item 14r Milking - Flanks, Udders, and Teats; Item 16r Milking - Transfer and Protection of Milk; and Item 18r, Personnel Cleanliness. In addition to these four items, there are two other items which are more practical to observe during milking time inspections. Compliance with Item 11r, Utensils and Equipment, is difficult to determine unless the sanitarian is there to observe and judge the application of the sanitizing procedure. Swab tests of the utensils can be run by the laboratory to determine the effectiveness of the sanitizing procedure. But how often is this done?

A similar condition exists relative to Item lr, Abnormal Milk. Laboratory tests are necessary to determine compliance with portions of this item relating to adulteration with antibiotics, pesticides, or radionuclides. During a milking time inspection the sanitarian can make an immediate check for abnormal milk due to mastitis. Approximately 25% of the mastitis cases result in milk which is grossly abnormal. Any evidence of flakes, clots, blood, or other abnormal secretion on the strainer pad is indicative of non-compliance with Item lr. To detect the other 75% of the mastitis cases, laboratory or special test equipment is required. In addition, Item lr requires that "equipment, utensils, and containers used for the handling of abnormal milk" shall not be "used for the handling of milk offered for sale, unless they are first cleaned and effectively sanitized."

SANITARIAN'S ROLE IN ELIMINATING ABNORMAL MILK

The marking of an inspection form and posting of it in the milk house does not complete the work of a conscientious sanitarian. Whenever possible, he should explain any demerits or checks to the dairyman. He should also be able to advise the dairyman on how to correct his deficiencies.

The problem of bovine mastitis is the major disease entity faced by most dairymen today. Mastitis is costly from an economic standpoint to the producer, the inflammatory by-products of mastitis are aesthetically undesirable, and many of the causative agents of infectious mastitis are inimical to the health of the consuming public. Many dairymen are seeking a way out of the dilemma of bovine mastitis. The observant sanitarian, with a little bit of extra time, often sees errors in milking practices or can spot signs of malfunctioning milking equipment.

Some of the things that a sanitarian can observe during milking time inspections are listed below. These are not violations *per se* of the Grade "A" Pasteurized Milk Ordinance—1965 Recommendations of the United States Pubic Health Service, but their occurrence often contributes to the increasing incidence of mastitis. Very often malfunctioning equipment or poor milking practices have an insidious onset and the dairyman is unaware of their presence. He may well appreciate an alert sanitarian informing him of these trouble spots.

MILKING PRACTICES

Factors of importance which should be observed and checked during the milking procedure are:

Use of strip cup or strip plate—This seems elementary but many dairymen omit this practice in an effort to shorten the milking time. If the dairyman is going to withhold all abnormal milk from the milk supply, he must examine the milk from each quarter prior to milking.

Time interval between udder massage and application of the milker—Milk let-down occurs approximately 30-60 seconds following udder massage. Failure to take advantage of milk let-down could lead to incomplete removal of milk from the udder and to increased milking time.

Teat cup crawl—This may be caused by the use of wide-bore inflations on young cows but the more probable causes of teat cup crawl are excessive vacuum or leaving the milking machine on after the udder is empty. The latter practice tends to cause the sides of the teat cistern to rub together resulting in injury to the teat lining. Injured tissue is, of course, much more susceptible to infection than healthy tissue.

Prolonged machine stripping—The average cow should machine strip in 15-20 seconds. A few so-called "hard milkers" are exceptions to this rule. As with teat cup crawl, excessive machine stripping may irritate the lining of the teat and predispose that quarter to infectious mastitis.

Method of removal of the teat cups—Merely pulling off the inflation at the completion of the milking act puts undue stress on the teat resulting in irritation. The vacuum should be broken prior to removal of the teat cup. This is accomplished by use of a shut-off valve or by depressing the lip of the inflation with the finger to permit the entry of air.

Disinfection of teat ends following milking—The drop of milk on the teat end following milking is an ideal media for bacterial growth. Most dairy specialists recommend that the teat end be dipped in a solution of chlorine, iodine, or quaternary ammonium compounds following milking to reduce the potential for bacterial growth.

Rinsing and sanitizing of teat cups between cows—It appears redundant to say that teat cups should be sanitized between cows to reduce the spread of infectious organisms. Yet this step is omitted by many dairymen. The inflations should first be rinsed in a bucket of clear water and then dipped in a sanitizing solution. As with all sanitizing operations, its effectiveness is increased with longer exposure to the sanitizing agent.

Number of milking units per milker—Generally speaking, the average milker can properly handle no more than two bucket type units in a stanchion barn or three pipeline milking units. When more than the recommended number of milkers are being used, you will generally find that one or more other items are also being violated.

MILKING EQUIPMENT—INSTALLATION

Proper milking cannot be accomplished without good equipment properly designed and installed. The following items are important:

Check the size of the vacuum line—Under sized vacuum lines result in insufficient vacuum level at the milker. This, in turn, prolongs the milking act and predisposes the udder to mastitis. The Milking Machine Manufacturers Council recommends the following minimum sizes of vacuum lines:

a. 1″ lines—up to 3 milking units.
b. 1¼″ lines—up to 6 milking units.
c. 1½″ lines—up to 10 milking units.

Check vacuum line installation—Dairy engineers recommend that the vacuum line be a continuous loop in double row stanchion barns rather than having two dead ends. Should dirt or milk cause a partial plug in a line with a dead end, all vacuum outlets between the plug and the dead end would have insufficient vacuum. The continuous loop would by-pass one partial plug in the line.

Check the location of the vacuum controller—The vacuum controller should be located between the first stall cock and the vacuum pump in bucket type installations. In pipeline installations, the controller is usually located very close to the milk receiver. Some installations use more than one vacuum controller and the additional controllers or regulators may be located at other points in the vacuum line.

Problems related to equipment should be referred to a well qualified milking machine representative or extension dairy engineer for correction. Unless the sanitarian has had special training in milking machine installation, he should only advise the dairyman that a problem exists and he should seek qualified help.

MILKING EQUIPMENT—OPERATION

Some adverse conditions due to faulty operations of the equipment may affect the milking. Points to be carefully observed are:

Check the milking time per cow—With few exceptions, the average cow should be milked out in 2½-4 minutes. Longer milking times may indicate low vacuum, too many milking units per man, or over-milking.

Do the teat cups fall off frequently during milking?—If they do, the vacuum level is probably inadequate. Another possibility is inadequate vacuum reserve. The sharp reduction in vacuum when air is admitted into the line permits the teat cups to fall off.

Are the cows uneasy while being milked?—Do they appear to tread or dance as though they are nervous or uncomfortable? Do they kick at the milking unit? An occasional heifer may exhibit these actions because she is untrained or an occasional cow may have acute mastitis resulting in a painful milking procedure. If several of the cows exhibit this type of

action, the vacuum level is probably too high and the milking procedure is painful.

Observe the vacuum gauge—Wide variations in the vacuum level or a slow return to the proper vacuum following the entrance of air into the line are probably due to an inadequate vacuum reserve or an inadequately sized vacuum pump.

Check the vacuum regulator—These are sometimes called relief valves or vacuum controllers. They are designed to permit atmospheric air to enter the vacuum system at a preselected level of vacuum. You should hear the hiss of atmospheric air entering the system except during peak demand times. The absence of sound of air entering the system through the vacuum controller or regulator is probably due to a sticking regulator or an inadequately sized vacuum pump.

ENVIRONMENT

Other factors which may have a bearing on good dairy farm operation are:

Contruction defects—High door sills have a bad reputation for causing udder injury and subsequent mastitis. Wherever found, the dairyman should be encouraged to correct them. Steep ramps leading to some milking parlors are also responsible for many udder injuries. The ability of the cattle to obtain traction on ramps can best be judged when the ramp is wet.

Stanchion size—Inadequately sized stalls in stanchion barns are responsible for many self-inflicted udder injuries, especially to the teats. This defect is common on dairy farms which have changed over from one of the smaller breeds of dairy cattle to one of the larger sized breeds without remodeling the barn interior. Often too, we will see an increase in size of progeny within a breed as a result of improved breeding and feeding programs. The county agricultural agent should have literature from the State Agricultural Extension Service on the proper sizing of stalls.

SUMMARY

Several of the "r" items of Section VII of the Grade "A" Pasteurized Milk Ordinance—1965 Recommendations of the United States Public Health Service are peculiar to milking time inspections. Milking time is the ideal time to determine the dairyman's compliance with regard to Section 7, Item lr, Abnormal Milk. In addition to the regular inspection, the sanitarian can make several observations of the milking operation and equipment at this time which will aid the dairyman in his fight to control abnormal milk.

When apparent defects are noted in the operation or installation of milking equipment, the sanitarian should recommend that a qualified milking machine serviceman be engaged to check the system and correct any deficiencies. In some areas, the State Agricultural Extension Service has the equipment to analyze the milking system and they will work closely with any dairyman who requests their aid.

The conscientious sanitarian does not need a lot of expensive equipment to help the dairyman overcome the abnormal milk problem. He can help the dairyman considerably by using his powers of observation during a milking time inspection.

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THE EFFECT OF FREEZE-DEHYDRATION ON THE SURVIVAL OF CERTAIN PSYCHROTROPHIC BACTERIA IN SKIMMILK, ICE CREAM MIX SUBSTITUTE AND COTTAGE CHEESE[1]

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SUMMARY

Studies on the effect of freeze-dehydration on the survival of psychrotrophic bacteria in milk and ice cream mix substitute showed that a species of *Achromobacter* was relatively resistant as compared to five cultures of *Pseudomonas*. The effect of freezing on the viable population varied greatly not only between cultures but also within cultures from one sampling period to another. In some instances increases in viable count were observed after freezing. The effect of freeze-dehydration on the cultures in ice cream mix substitute was in many aspects similar to that observed in skimmilk. Increases in viable count took place when freeze-dehydrated milk cultures of F11 and 54 were rehydrated and stored at 5.5 C. However, a further reduction in viable count took place in samples stored in the dehydrated form. Freeze-dehydration of milk cultures with different concentrations of bacteria did not show a definite pattern in change of viable population with cell concentration.

Freeze-dehydration of cottage cheese contaminated with cultures F11 and 54 caused an extensive reduction of the number of viable bacteria. When dehydrated samples were rehydrated and stored at 5.5 C no extensive changes in viable count occurred. In samples stored dry, however, there were further reductions in viable count. The effect of freeze-dehydration on culture 54 in cottage cheese was different from that observed in milk or ice cream mix substitute. Preliminary experiments suggest that the method used to enumerate this organism may be responsible for this phenomenon.

It is known that many species of the natural microbial flora of various foods can survive commercial freeze-dehydration *(13, 16)*. An examination of eight commercial freeze-dehydrated foods *(13)* showed that the survivors were representative of the natural flora of each product and of the contaminants introduced during handling and processing. Few studies, however, have examined the fate of microbial population in a freeze-dehydrated food during storage and the type and extent of microbial growth following rehydration and subsequent storage. May and Kelly *(8)* determined the survivors of the natural flora of chicken meat after freeze-dehydration and rehydration at room temperature for 30 minutes and at 50, 85, and 100 C for 10 minutes. Approximately 32% of the bacteria in the meat survived during dehydration and rehydration at room temperature. *Staphylococcus aureus* survived dehydration and rehydration at 60 C. Pablo et al. *(11, 12)* showed that the growth pattern of rehydrated freeze-dehydrated chicken and shrimp was greatly influenced by the level of initial population and the temperature and time of subsequent storage. After freeze-dehydration the microbial flora was essentially mesophilic. Upon storage at 4 C, there was a shift from a mesophilic to a psychrotrophic flora. *S. aureus* and fecal enterococci grew in competition with the natural flora at 20 C or above, while no increase occurred at 4 C. Lauro et al. *(7)* contaminated sterilized peas on the surface with *Serratia marcescens, Bacillus subtilis, Bacillus stearothermophilus, Saccharomyces cerevisiae* and *Lactobacillus fermenti.* The only significant change in viability due to freeze-dehydration was 1 to 2 log reductions in count with *S. cerevisiae* and *L. fermenti.* All freeze-dehydrated products showed decreases in viable population during storage at room temperature.

This study was initiated to determine the effect of freeze-dehydration and subsequent storage conditions on the survival of certain psychrotrophic bacteria in milk and certain milk products.

EXPERIMENTAL METHODS

Preparation of skimmilk, ice cream mix substitute and cottage cheese.

Skimmilk was prepared by recombination (9%) of low-heat nonfat dry milk solids with distilled water. The skimmilk was heated for 15 minutes at 121 C and 15 lb steam pressure. A sterile ice cream mix substitute containing 10% fat, 11% milk solids-not-fat, and 15% sucrose was made by mixing appropriate amounts of evaporated milk, sterile cream (30% fat), sucrose and sterile distilled water. Prior to mixing with the other ingredients, the sucrose was sterilized by flooding with diethyl ether. The ether was removed by evaporation after 24 hours. The preparation of the mix was carried out under aseptic conditions. Before use, the mix was examined for sterility by the agar plate method.

Small curd cottage cheese was manufactured from fresh skimmilk by a short-set method. High quality milk from the University dairy was separated in a sterile laboratory separator. The milk was pasteurized at 63.3 C for 30 minutes.

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The setting temperature was 32.2 C. The cheese was made in a sterile 2-gallon plastic container under aseptic conditions. The equipment which came in contact with the milk or curd was sterilized by heat. A commercial lactic culture was used. The rennet was filter-sterilized. The curd was cooked for one hour during which time the temperature was raised gradually from 32.2 to 48.9 C. Sterile distilled water (3 washes) was used as wash water. The curd was stored overnight at 5.5 C in sterile cheese cloth within a sterile glass cylinder.

Preparation of samples for freeze-dehydration.

The inoculated samples (2 ml) of skimmilk and ice cream mix substitute were placed into preweighed sterile cups made from heavy duty aluminum foil. The cups were 20 mm in height and 15 mm in diameter. The weight of the sample was determined by weighing the cup and contents. The cups then were placed at −20 C for 2 hours. While in the cold room, just prior to placing in the freeze-dryer, the aluminum was removed under aseptic conditions. The sample then was placed on a piece of sterile aluminum window screen in a weighed sterile aluminum moisture dish (height 15 mm, diameter 60 mm). This dish was placed in a sterile petri dish which had a paper clip attached to the rim of the bottom to permit the escape of vapor. The entire ensemble then was placed in the freeze-dryer. The preparation of the cottage cheese samples was essentially the same as that for skimmilk except that a larger sample (20 g) was weighed into a sterile aluminum moisture dish.

Freeze-dehydration was performed in an Industrial Dynamics pilot plant Model CPF-20 freeze-dryer. The two programs used in this study were *(a)* a platen temperature of 40 C throughout the drying cycle, and *(b)* an initial platen temperature of 30 C with a progressive increase in temperature up to about 105 C which was then successively lowered to 40 C, to prevent the product surface temperature from rising about 40 C. For this purpose thermocouples were inserted into the surface of the product and attached to the temperature controller of the dryer. The chamber pressure was 0.1 mm Hg. Dehydration rates were established by weighing the samples at various intervals during the dehydration cycle. The cycle was ended when the residual percent of initial moisture was below 3. The dehydration time for skimmilk and cottage cheese was 8 hours, for ice cream mix substitute 4 hours. Preliminary studies showed that under these conditions of freeze-dehydration, the dehydrated products retained their rigidity, rehydrated easily and did not show off-flavors when examined organoleptically. The results of this phase of the study will be reported elsewhere. The total solids content of the samples was determined according to *Standard Methods (1).*

Cultures and inoculation of samples.

Cultures F11, FLE, FE, F01, P10 and 54 were from the stock culture collection of the Department of Animal Science. They were isolated from milk and milk products and were maintained on slants of Standard Methods agar *(1).* All cultures were examined for various cultural, morphological and physiological characteristics as outlined in the *Manual of Microbiological Methods (17).* The cultures were gram-negative rods, and were polarly flagellated, except for culture 54 which had peritrichous flagella. All cultures utilized carbohydrates oxidatively *(6).* Except for culture 54, all test cultures *(a)* grew on Olson's medium *(10), (b)* were oxidase positive *(18), (c)* produced NH_3 from arginine under anaerobic conditions *(19), (d)* were resistant to 2.5 I.U. of penicillin, and *(e)* did not grow on Staphylococcus medium 110. All test cultures were sensitive to streptomycin, oxytetracycline and chloramphenicol. With respect to growth temperature, all cultures grew at 5 C. Cultures F11 and FLE produced fluorescin. On the basis of identification schemes for gram-negative organisms *(4, 5, 14, 15, 18, 19, 20)* cultures F11 and FLE were tentatively identified as *Pseudomonas* type I, cultures F01, FE and P10 as *Pseudomonas* type II, and culture 54 as an *Achromobacter* species.

For the individual experiments, the cultures were grown for 18 to 20 hours at 25 C either in sterile skimmilk or ice cream mix substitute. A 1% inoculum was used for all test samples. Immediately following inoculation, samples (2 ml) were prepared for freeze-dehydration. The inoculated test samples then were incubated for 10 days at 5.5 C. The sampling, freezing, freeze-dehydration and plating procedures described for 0-day were repeated after 3, 5, and 10 days of incubation.

Determination of the viable count.

In milk and ice cream mix substitute the number of viable bacteria before freezing, after freezing and after freeze-dehydration with or without subsequent holding in the dried or rehydrated state was determined by the agar plate method according to *Standard Methods (1).* The plates were incubated for 48 hours at 32 C. In cottage cheese the viable count of culture F11 was determined by surface plating of 0.1 ml aliquots of appropriate dilutions of the cheese on Olson's medium. The initial dilution was prepared by mixing 11 g of cottage cheese or rehydrated product with 99 g of sterile distilled water in a sterile blender. The same procedure was used for culture 54, except that Staphylococcus medium 110 was used as the plating medium *(5, 21).* The plates with Olson's medium were incubated at 32 C for two days, those with Staphylococcus medium 110 for 5 days. Duplicate plates were used in all experiments.

RESULTS AND DISCUSSION

Table 1 shows the effect of freezing and freeze-dehydration (platen temperature from 30 to 104.4 C) on the viable population of the six test cultures. In another series of experiments a constant platen temperature of 40 C was employed. Except for culture 54, freeze-dehydration at both platen temperature programs reduced the viable population of the cultures over 95 percent. There was little difference in the effect of the two programs on the percent reduction in viable population. Culture 54 was more resistant to freeze-dehydration at both platen temperature programs. The reduction in viable population by freezing varied greatly not only between cultures but also for the same culture from one sampling period to the other. In some cases (7 out of 24), particularly with culture P10, increases in viable count were observed after freezing. In others, for example culture FE (3-10 days) freezing had little effect on the viable count.

In a similar series of experiments, samples of ice cream mix substitute were inoculated with the test cultures and incubated for 10 days at 5.5 C. In one trial a platen temperature of 40 C was used, in the

TABLE 1. THE EFFECT OF FREEZING AND FREEZE-DEHYDRATION[a] ON THE VIABLE POPULATION OF MILK CULTURES OF F11, FO1, FLE, FE, P10, AND 54

Cultures	Plated[b]	Age of culture: 0d	% kill	3d	% kill	5d	% kill	10d	% kill
	BF	$58x10^4$		$65x10^5$		$52x10^6$		$140x10^5$	
F11	AF	$130x10^3$	78	$140x10^4$	78	$230x10^5$	56	$190x10^6$	+36[c]
	AFD	$48x10^2$	>99	$<30x10^2$	>99	$83x10^2$	>99	$97x10^4$	>99
	BF	$290x10^3$		$50x10^5$		$140x10^5$		$59x10^6$	
FO1	AF	$200x10^3$	31	$90x10^5$	+80	$98x10^5$	30	$38x10^6$	36
	AFD	$30x10^2$	99	$<30x10^2$	>99	$150x10^2$	>99	$96x10^5$	>99
	BF	$36x10^5$		$63x10^4$		$51x10^5$		$40x10^6$	
FLE	AF	$100x10^3$	97	$180x10^5$	71	$54x10^4$	89	$32x10^6$	20
	AFD	$<30x10^2$	>99	$<30x10^2$	>99	$<30x10^2$	>99	$110x10^2$	>99
	BF	$90x10^4$		$71x10^5$		$91x10^5$		$170x10^6$	
FE	AF	$49x10^4$	46	$70x10^5$	1	$91x10^5$	0	$170x10^6$	0
	AFD	$160x10^2$	98	$<30x10^2$	>99	$140x10^2$	>99	$78x10^4$	>99
	BF	$34x10^4$		$30x10^5$		$210x10^5$		$170x10^6$	
P10	AF	$45x10^4$	+32	$66x10^5$	+120	$38x10^6$	+81	$210x10^6$	+24
	AFD	$77x10^2$	98	$31x10^2$	>99	$140x10^2$	>99	$72x10^4$	>99
	BF	$160x10^3$		$100x10^4$		$210x10^4$		$210x10^5$	
54	AF	$120x10^3$	25	$83x10^4$	17	$33x10^5$	+57	$170x10^5$	19
	AFD	$69x10^3$	57	$270x10^3$	73	$67x10^4$	68	$67x10^5$	68

[a]The platen temperature ranged from 30 to 104.4 C.

[b]The samples were plated before freezing (BF), after freezing (AF) and after freeze-dehydration (AFD).

[c]Increase in viable population.

other the platen temperature ranged from 30 to 101.7 C. The effect of freezing and freeze-dehydration on the cultures in ice cream mix substitute was in many aspects similar to that observed in skimmilk. Culture 54 was more resistant to freeze-dehydration than the other test cultures. The reduction in viable count of culture 54 in ice cream mix substitute was in most instances somewhat less than in milk. In ice cream mix substitute the viable count increased after freezing in 13 out of 24 cases, in milk in only 7 out of 24 cases. Except for culture 54, freeze-dehydration of the cultures in ice cream mix substitute usually caused large reductions (over 90 percent) in viable count. Exceptions were *(a)* 10-day old cultures of FE and F11 and *(b)* a 5-day old culture of FO1.

Numerous studies have shown that different microbial species or different strains of the same species can vary greatly in their sensitivity to freezing. In the present study too, the sensitivity of freezing of cultures of *Pseudomonas* differed greatly in many cases. The same was true for cultures of the same species but of different ages. Differences in the phase of growth and cell concentration may be responsible in part for this observation. Increases in viable count after freezing may be caused by a disruption of clusters which would increase the viable count by the plating technique. With respect to the observed reductions in viable count (percent kill), it should be pointed out that it is not certain that either freezing or freeze-dehydration has destroyed the multiplication mechanisms of the cell. It is possible that, under a different set of conditions with respect to nutrients, temperature and time of incubation, an increased number of survivors could have been observed *(2, 3)*.

Table 2 shows the effect on the viable population of storing freeze-dehydrated milk cultures F11 and 54 in the dry and rehydrated state. Cultures F11 and 54 were selected to represent two types of cultures namely sensitive and relatively resistant to freeze-dehydration. Following inoculation, the skimmilks were stored at 5.5 C for 5 and 10 days. In this manner, studies could be made on cultures at two age levels. Immediately after freeze-dehydration, some of the samples were rehydrated by adding sterile distilled water. The amount added was the same as that removed during freeze-dehydration. The rehydrated samples were stored in separate sterile containers at 5.5 C. The viable count was determined after 1, 3, 5, and 7 days of storage. The remainder of the freeze-dehydrated samples were stored at 25.5 C in separate sterile containers for up to 4 weeks. The viable count of these samples was determined after 3, 7, 14, 21, and 28 days. Just before plating, the

TABLE 2. THE EFFECT OF HOLDING ON THE VIABLE POPULATION OF FREEZE-DEHYDRATED[a] MILK CULTURES OF F11 AND 54 WHEN STORED IN REHYDRATED AND DRIED FORMS

Culture and age	Plated[b]		Rehydrated and stored (5.5 C)				Stored dry at 25.5 C and then rehydrated				
	BF	AFD	1d	3d	5d	7d	3d	7d	2wk	3wk	4wk
F11	110×10^7	160×10^5	180×10^5	79×10^7	38×10^8	140×10^8	220×10^2	140×10^2	$<30\times10^2$	$<30\times10^2$	
5d	% kill	99					>99	>99	>99	>99	
F11	300×10^7	82×10^6	68×10^6	46×10^7	170×10^8	39×10^8	c				
10d	% kill	97									
54	45×10^6	150×10^5	210×10^5	55×10^6	56×10^7	43×10^7	86×10^4	33×10^2	$<30\times10^2$		
5d	% kill	67					98	>99	>99		
54	66×10^6	290×10^5	47×10^6	42×10^7	89×10^7	32×10^7	240×10^4	120×10^3	65×10^4	270×10^4	260×10^3
10d	% kill	56					96	>99	>99	96	>99

[a]The platen temperature ranged from 30 to 104.4 C.

[b]The samples were plated before freezing (BF) and after freeze-dehydration (AFD).

[c]Sample was completely proteolyzed.

TABLE 3. THE EFFECT OF CELL CONCENTRATION ON THE SURVIVAL OF CULTURES F11 AND 54 AFTER FREEZE-DEHYDRATION[a]

Culture	Plated[b]	Concentration of cells				
		A	B	C	D	E
	BF	51×10^7	52×10^6	43×10^5	46×10^4	37×10^3
F11	AFD	170×10^5	170×10^4	36×10^3	260×10^2	34×10^2
	% kill	97	97	>99	94	91
	BF	81×10^6	110×10^5	100×10^4	140×10^3	110×10^2
54	AFD	37×10^6	40×10^5	45×10^4	37×10^3	35×10^2
	% kill	54	64	55	74	68

[a]The platen temperature ranged from 30 to 104.4 C.

[b]The samples were plated before freezing (BF) and after freeze-dehydration (AFD).

samples were rehydrated as described before. As observed previously, culture 54 was more resistant to freeze-dehydration than culture F11. An increase in viable count was observed during storage of the rehydrated samples. A further reduction in viable count took place in the samples stored in the dehydrated form. A similar observation was made by Lauro et al. *(7)* with various microbial species on peas and by Baird-Parker and Davenport *(3)* with S. *aureus* in freeze-dehydrated milk. Extensive proteolysis took place in culture F11 after incubation for 10 days at 5.5 C. There was little material left after freeze-dehydration which made recovery of these samples for experiments on the effect of storage in the dehydrated form impractical.

Table 3 shows the effect of freeze-dehydration on the viable count of cultures F11 and 54 at different levels of cell concentration. A 20-hour milk culture of each was employed. Five 10-fold dilutions (A-E) were prepared with sterile skimmilk. No definite pattern could be detected in the reduction of the viable count with respect to cell concentration.

A study was made of the effect of freeze-dehydration on psychrotrophic bacteria in cottage cheese. For this purpose, cottage cheese was prepared under aseptic conditions as described in the experimental methods section. Cultures F11 and 54 were grown on slants of plate count agar at 5.5 C for 7 days. The growth was removed from the slants with cold sterile distilled water. Contamination of the curd was achieved either by *(a)* inoculation of the milk immediately after addition of the starter and rennet, or *(b)* by adding the bacteria to the sterile wash water. Contamination with the wash water was carried out at a high (Experiment 1) and a low level (Experiment 2).

In each series of experiments a control batch of cottage cheese was prepared from the same milk but

TABLE 4. THE EFFECT OF REHYDRATION AND STORAGE ON THE VIABLE COUNT[a] OF COTTAGE CHEESE CONTAMINATED WITH CULTURE F11

Exp.	BF	AFD[b]	Rehydrated and stored (5.5 C) for 1d	3d	5d	7d	Stored dry (25.5 C) and rehydrated after 3d	7d	2wk	3wk	4wk
					F11 in washing water						
1	60×10^4	30×10^2	230×10^2	160×10^2	190×10^2	180×10^2	14×10^2	18×10^2	<10	–	–
	% kill	>99							>99		
2	130×10^2	3×10^2	2×10^2	22×10^2	29×10^2	17×10^2	19×10^2	38×10^2	<10	–	–
	% kill	98							>99		
					F11 in the milk						
1	70×10^3	59×10^2	33×10^2	18×10^2	22×10^2	35×10^2	49×10^2	26×10^2	14×10^2	<10	<10
	% kill	92								>99	>99

[a]The count per g of cottage cheese was determined before freezing (BF) and after freeze-dehydration (AFD).
[b]The platen temperature ranged from 30 to 104.4 C.

TABLE 5. THE EFFECT OF REHYDRATION AND STORAGE ON THE VIABLE COUNT[a] OF COTTAGE CHEESE CONTAMINATED WITH CULTURE 54

BF	AFD[b]	Rehydrated and stored (5.5 C) for 1d	3d	5d	7d	Stored dry (25.5 C) and rehydrated after 3d	7d
			Culture 54 in washing water				
150×10^4	12×10^2	14×10^2	23×10^2	25×10^2	<10	2×10^2	<10
% kill	>99					>99	>99
			Culture 54 in the milk				
110×10^2	2×10^2	1×10^2	5×10^2	<10	<10	1×10^2	<10
% kill	98					>99	>99

[a]The count per g of cottage cheese was determined before freezing (BF) and after freeze-dehydration (AFD).
[b]The platen temperature ranged from 30 to 104.4 C.

without addition of a test culture. Samples of the control cheese were plated in the same manner as the contaminated cheese. Few if any gram-negative bacteria were detected. In addition, the characteristics of colonies on the plates containing contaminated cheese were checked and compared with those of the contaminant, either culture F11 or 54. Immediately after freeze-dehydration, some of the samples were rehydrated with sterile distilled water and stored at 5.5. C in separate sterile dishes for 1, 3, 5, and 7 days. The remaining dehydrated samples were stored at 25.5 C for 3, 7, 14, 21, and 28 days. The viable count was determined after each storage interval. Freeze-dehydration caused an extensive reduction in the viable count of F11 (Table 4). In some cases increases in viable count occurred during holding of the rehydrated samples. In milk, however, the increases in count during storage of the rehydrated samples were more extensive. It is possible that the conditions in rehydrated cottage cheese, for example pH, did not support growth of bacteria "damaged" during freezing and dehydration. No viable bacteria could be detected after 2 to 3 weeks in the dehydrated samples stored in the dry form.

Table 5 shows the effect of freeze-dehydration on culture 54 in cottage cheese. In this case, freeze-dehydration caused an extensive reduction in the viable count of culture 54. Rehydration and storage of the dehydrated samples at 5.5 C for 1 to 3 days did not change the viable count extensively. No viable *Achromobacter* could be detected in the dehydrated samples stored for 7 days at 25.5 C. The effect of freeze-dehydration on culture 54 in cottage cheese was different from that in milk or ice cream mix substitute. The effect of freeze-dehydration on culture 54 seemed much more extensive in cottage

cheese than in milk or ice cream mix substitute. Preliminary experiments suggest that the method used to enumerate may be responsible for this phenomenon. In order to enumerate *Achromobacter* (culture 54) in cottage cheese, Staphylococcus medium 110 was employed. This medium although excellent for the recovery of non-treated *Achromobacter* species may be somewhat deficient or inhibitory to treated (heat, cold, dehydration) organisms. This seems to be indicated by the fact that the colonies of *Achromobacter* on Staphylococcus medium 110 from freeze-dehydrated samples were smaller than those which did not receive freeze-dehydration treatments. In a study on the isolation of *S. aureus* on various recovery media, Baird-Parker and Davenport *(3)* reported that surface plating on laboratory media did not support the growth of all viable cells after freeze-dehydration. Recovery in these media could be improved by adding blood or catalase as well as pyruvate. Nelson *(9)* showed that 5% NaCl in Plate Count Agar had no effect upon counts of unheated enterococci, but this NaCl concentration reduced markedly the apparent survival of sublethally heated organisms. It is possible that similar factors are responsible for the poor recovery of *Achromobacter* from freeze-dehydrated foods on Staphylococcus medium 110. In view of these results, further studies on the conditions required for the recovery of microorganisms from freeze-dehydrated foods seem highly desirable.

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THE LOW TEMPERATURE MICROFLORA OF YOUNG CHEDDAR CHEESE[1]

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Summary

A plating procedure simulating conditions in ripening Cheddar cheese was used to isolate microorganisms in young cheese that grow at ordinary ripening temperatures. Forty-one commercial cheese samples, most 7 days old, were obtained from ten Iowa manufacturing plants. Samples were plated in special Trypticase-soy agar, covered with 50 ml of 1.5% (w/v) agar, and incubated at 7.2 C for 3 months. Following incubation, 967 microorganisms were isolated, purified, and characterized. Numbers and percentages of microorganisms were: 475 enterococci, 49.5%; 148 micrococci, 15%; 126 lactic streptococci, 13%, 108 miscellaneous gram-positive rods, 11%; 48 associate bacteria (resembling species of *Leuconostoc*), 5%; 33 miscellaneous gram-negative rods, 3.5%; 24 lactobacilli, 2.5%; and 5 other miscellaneous microorganisms, 0.5%.

Forty-five commercial lactic starter cultures were examined by the same plating procedure. Duplicate plates of each culture were incubated at 7.2 and 21 C. Although agar plate counts were slightly higher at 21 C, they were within the same range, at both incubation temperatures, for most samples. No enterococci were recovered from commercial lactic starter cultures.

The bacteriology and chemistry of Cheddar cheese ripening have been studied extensively. Most bacteriological investigations have dealt with attempts to isolate and identify microorganisms of importance in flavor production and body breakdown.

One of the earliest reports of the bacterial flora of cheese was made by Russell *(21)*, who stated that the bacterial content of cheese differed markedly from that of milk. Harding and Prucha *(10)* studied the microflora of normal cheeses representing first-class factories. More than 300 cultures were isolated from agar plates, 167 of which were studied extensively and divided into 33 different groups. Hastings, Evans, and Hart *(12, 13)* found only two groups of bacteria constantly present in large numbers in Cheddar cheese, while Evans, Hastings, and Hart *(6)*, from a study of 21 raw-milk cheeses, reported that all microorganisms constantly found in cheese were included in four groups.

Hucker's results *(14)* indicated that better grades of Cheddar cheese contained a microflora distinctly different from the microflora of poorer grades. Tittsler et al. *(25)* confirmed the correlation between bacterial flora and cheese quality reported by Sherwood *(24)* that cheese manufactured from poor and very poor milk, either raw or pasteurized, contained many more bacterial types than did cheese manufactured from fair and good milk.

Feagan and Dawson *(7)*, Irvine and Beach *(15)*, and Kelly *(16)* have reported the results of their investigations of the microflora of young Cheddar cheese. However, a search of the literature has failed to reveal reports of any previous attempts to study the Cheddar cheese microflora that grow at low temperatures.

This study was undertaken to determine the low-temperature microflora in young Cheddar cheese. Because Cheddar cheese ordinarily is cured at low temperatures, this approach is commercially important.

Experimental

Collection, handling, and treatment of samples.

Forty-one commercial Cheddar cheese samples from ten Iowa cheese manufacturing plants were obtained for study. All samples were collected and handled according to procedures described in *Standard Methods for the Examination of Dairy Products (3).*

Bacteriological examination of samples.

Samples were plated immediately upon arrival at the laboratory. The procedure given in *Standard Methods for the Examination of Dairy Products (3)* for the yeast and mold count of cheese, other than Cottage, was used to prepare samples for plating, except that emulsification was obtained by high-speed agitation in a Waring Blendor (Waring Product Corporation, New York, N. Y.) for 2 min. Plates were prepared in duplicate and poured with 15 ml of special Trypticase-soy agar composed of:

	% (w/v)
Trypticase, BBL	1.5
Phytone, BBL	0.5
NaCl	0.4
$Na_3C_6H_5O_7 \cdot 2H_2O$	0.1
L-cystine	0.02
Dextrose	0.5
Bacto-agar, Difco	1.5

The medium was adjusted to pH 6.7 before autoclaving at 121 C for 20 min. After solidification, 50 ml of 1.5% (w/v) agar were added to each petri dish. Following solidification

[1]Journal Paper No. J-4919 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa; Project No. 1188.

of the cover-layer, plates were sealed tightly with 1¾-inch-wide rubber bands and incubated at 7.2 C for 3 months. All cheese samples were between 4 and 8 days old when plated.

Isolation and purification of microorganisms.

An attempt was made to pick 30 colonies from one agar plate of each cheese sample. All colonies present were picked when plates contained between 20 and 40 colonies. Colonies were picked from duplicate plates when fewer than 20 colonies appeared in a plate. If plates contained more than 40 colonies, the colonies were picked according to the random sampling method suggested by Harrison *(11)* until at least 30 isolates were obtained to represent each cheese sample.

To facilitate picking, the thick, two-layer agar plaque was inverted with the aid of a sterile spatula into the petri dish cover. The appearance of each colony was recorded before it was picked for inoculation into sterile litmus milk. The litmus milk used in this study was prepared from fresh skimmilk and was autoclaved at 121 C for 12 min.

Litmus milk cultures were incubated at 21 C until a reaction was observed. They were streaked for purification on special Trypticase-soy agar plates. Plates were incubated at 21 C until colonies formed. A single, characteristic colony from each plate was picked into litmus milk, grown at 21 C, and examined for Gram stain reaction and morphological characteristics of the microorganism. The litmus milk culture then was frozen. If more than one type of colony was observed on the purification agar plates, a colony representing each type was picked.

Any isolates not producing visible changes in litmus milk after 5 days were streaked and treated as stated previously.

Characterization and identification of isolates.

Frozen cultures were thawed rapidly in a 40 C water bath and immediately inoculated into tubes of litmus milk for incubation at 21 C. As soon as a litmus milk reaction was observed (usually 24 hr), a drop of the fresh transfer was inoculated into special Trypticase-soy broth. This broth was incubated at 21 C until abundant growth was observed. The broth composition was the same as that for special Trypticase-soy agar, except that Bacto-agar was not added.

The following characteristics were determined for each culture by using the special Trypticase-soy broth for subculturing; Gram stain for verification of purity, catalase reaction, litmus milk reaction at 21, 32, and 37 C, methyl red and Voges-Proskauer reactions, ability to grow in 4.0 and 6.5% NaCl, gelatin liquefaction, and carbohydrate fermentation. Determination of the fermentative pattern was accomplished by using eight compounds: arabinose, dextrose, glycerin, lactose, maltose, mannitol, sucrose, and xylose. In addition, all catalase-negative cocci were examined for ammonia production from arginine, reduction of 0.1 and 0.3% methylene blue milk, initiation of growth at pH 9.2 and 9.6, and growth in litmus milk at 45 C. Isolates growing at 45 C were streaked on bovine blood agar to determine hemolytic reactions. Those not growing at 45 C were tested for growth in litmus milk at 40 C. All catalase-positive microorganisms were tested for nitrate reduction; all gram-negative rods were tested for the formation of indole from tryptophan. Lipolytic and proteolytic actions were determined for all catalase-positive isolates by streaking the cultures on Nile blue sulfate agar *(17)* and Standard methods agar plus 10% (v/v) added sterile skimmilk *(3)*, respectively. Except when stated otherwise, characterization of isolates was accomplished at 21 C. All media were stored under refrigeration but were removed and properly tempered before inoculation and subsequent incubation.

Plating lactic starter cultures.

To ascertain that the plating procedure used to isolate microorganisms from the young cheese samples did not inhibit lactic starter cultures, 45 commercial starter cultures, obtained from four different sources, were plated in quadruplicate *(3)*. Duplicate plates of each starter culture were incubated at 7.2 C for 3 months and 21 C for 10 days to obtain a comparison between the counts at each incubation temperature. Following the 3-month incubation period, colonies were counted, and 379 were picked into litmus milk. After one transfer in litmus milk at 21 C, transfers were made into litmus milk, previously tempered to 45 C, for incubation at that temperature to insure that the lactic starter cultures were not a source of enterococci.

RESULTS AND DISCUSSION

Bacteriological examination of samples.

Bacterial counts of the cheese samples ranged from 45 x 10^4/g to 100 x 10^6/g (Table 1). Cheeses made from pasteurized milk tended to have slightly lower counts than those made from heat-treated milk. These results are in accord with the findings of Franklin and Sharpe *(8, 9)* as well as most other workers. Even considering the heat treatment given the milk, no large differences in counts were observed between cheeses manufactured at different plants.

Characterization and identification of microorganisms isolated from cheese.

Microorganisms isolated from Cheddar cheese were classified into eight groups based upon morphological and biochemical characteristics. The data presented in Table 2 summarize the types and incidence of microorganisms isolated from the cheese samples studied.

Enterococci constituted the entire population recovered from seven samples and more than 70% of the population in ten others. Enterococci were present in all but four samples, occurring more frequently and in much larger numbers than any other group. Fifty-six per cent of the enterococci belonged in the *Streptococcus durans* group, 32% were identified as *S. faecalis*, 9% as *S. faecalis* var. *liquefaciens*, and 3% as *S. faecalis* var. *zymogenes*. Several workers *(8, 9, 22, 25)* have reported the frequent occurrence of enterococci in young cheese. Others *(5, 7)* have isolated and characterized microorganisms only as lactic acid bacteria. Enterococci could have constituted a high percentage of this group of bacteria. In addition, early workers *(6, 10, 21)* reported the occurrence of lactic acid bacteria without clearly specifying what was included in this group. To these investigators, enterococci, as we know them, were not defined and, therefore, could not be reported separately.

TABLE 1. AGAR PLATE COUNTS OF CHEESE SAMPLES

Manufacturing plant	Sample number	Heat treatment of milk	Age of cheese	Agar plate count/g[a]
			(Days)	*(X 10^5)*
A	1	162 F; 20 sec	7	6
	2			10
	3			10
B	4	162 F; 15 sec	7	10
C	5	160 F; (Pasteurized)	5	7.2
	6			4.5
	7			9.7
D	8	152-156 F; 15 sec	8	25
	9		7	31
	10			21
	11			16
	12			32
	13			11
E	14	150-162 F; 15 sec	8	54
	15		7	760
	16			1000
F	17	155 F; 15 sec	7	55
	18		6	55
	19			490
G	20	151 F; 15 sec	7	50
	21			130
	22			34
	23			11
	24			53
	25			21
H	26	149-152 F; 17 sec	5	250
	27			69
	28		4	150
I	29	147 F; 20 sec	7	110
	30			110
	31			85
	32			160
	33			47
	34			100
	35			100
J	36	147-148 F; 16 sec	7	40
	37			35
	38			34
	39			38
	40			63
	41			85

[a]Plate count in special Trypticase-soy agar with cover layer after incubation at 7.2 C for 3 months.

Micrococci, the second most frequent group of microorganisms recovered, constituted 15% of the isolates and were found in 24 of the cheese samples. They contributed 72% of the total flora in two samples and composed about 50% of the microbial population in seven others. Alford and Frazier *(1)* reported that micrococci constituted 78% of the microbial flora, other than lactic acid bacteria, in cheeses (ripened at 5 to 7 C) that they studied. Other workers *(5, 7)* also have reported finding large numbers of micrococci in some cheese samples.

Lactic group streptococci were recovered from only 14 of the 41 samples. In five, the lactic streptococci contributed 50% or more of the flora. It was difficult to classify these isolates to typical *S. lactis* and *S. cremoris* species. Therefore, these microorganisms were reported only as members of the lactic group. The common occurrence of variants of *S. lactis* and *S. cremoris* strains has been reported frequently *(4, 20, 23, 26)*. Allen and Knowles *(2)* reported that some atypical microorganisms isolated from cheese possibly were derived from more typical strains of lactic acid streptococci that had become modified during cheese ripening. Nichols and Hoyle *(19)* reported difficulty in the classification of "wild" lactic strains and grouped these strains as intermediates between *S. lactis* and *S. cremoris*.

Miscellaneous gram-positive rods were recovered from 18 cheeses. Except in two samples, in which they constituted 46 and 50% of the flora, these microorganisms occurred in small numbers, contributing one-third or less of the microbial population in all samples.

Associate bacteria (resembling species of *Leuconostoc*), miscellaneous gram-negative rods, lactobacilli, and other miscellaneous microorganisms, contributing the remaining 11.5% of the microflora, were found infrequently and in low numbers when re-

TABLE 2. GROUPS AND FREQUENCY OF OCCURRENCE OF MICROORGANISMS ISOLATED FROM YOUNG CHEDDAR CHEESE

Microorganisms isolated	Incidence[a]	Range in % of sample flora[b]	% of total isolates
1. Enterococci	37/41	3-100	49.5
2. Micrococci	24/41	3- 72	15
3. Lactic streptococci	14/41	3- 88	13
4. Miscellaneous gram-positive rods	18/41	3- 50	11
5. Associate bacteria[c]	7/41	3- 69	5
6. Miscellaneous gram-negative rods	14/41	3- 35	3.5
7. Lactobacilli	8/41	3- 74	2.5
8. Other miscellaneous microorganisms	4/41	3- 11	0.5

[a]Number of samples recovered from total number of samples studied.

[b]Percentages based upon those samples where recovery was made.

[c]Organisms resembling *Leuconostoc* species.

covered. Of the five isolates categorized as other miscellaneous microorganisms, three closely resembled the *Arthrobacter*, one was a yeast, and one was a mold.

Gas-forming microorganisms, determined by detection of gas in Durham tubes placed in the carbohydrate media, were recovered from only seven samples. Of the 50 isolates that did produce gas, 39 produced only trace amounts. Half of the gas-forming microorganisms isolated were obtained from a single sample, comprising 50% of the sample flora. However, gas formation was not observed in the cheese sample.

Of the 265 isolates tested for proteolysis and lipolysis, 77% were proteolytic, while less than 1% were lipolytic. Because degradation of protein has been firmly established as one of the major changes occurring in ripening cheese, the isolation of proteolytic microorganisms is not unusual. Proteolytic microorganisms capable of growth at temperatures common to those used for ripening cheese may play a role in protein breakdown. The proteolytic action of streptococcal and lactobacillus isolates was not determined. However, these microorganisms also are known to influence protein degradation in ripening Cheddar cheese. The significance of lipolytic microorganisms in Cheddar cheese is unknown because the role of fat hydrolysis during ripening has not been fully explained.

Only microorganisms present in large numbers during the early ripening period of the cheese were studied in this investigation. No attempt was made to determine if numbers of microorganisms recovered were increasing, decreasing, or remaining stationary. Specific delineation of the role of these microorganisms in cheese ripening would depend upon their ability to survive, at least in moderate numbers, for a time to leave sufficient quantities of metabolic products to affect later changes. Also, additional information regarding the biochemical reactions of these microorganisms would be necessary for establishing their role in the ripening process. Before either of these areas could be studied, it was necessary to find what microorganisms usually are present in young Cheddar cheese under selected conditions — the purpose of the present investigation.

Commercial lactic starter cultures.

Although the counts obtained by incubating commercial lactic starter cultures at 7.2 and 21 C average higher, arithmetically, at 21 C than at 7.2 C, statistical analysis showed that this difference was not significant. Thus, the plating procedure used in this study was not unduly inhibitory to lactic starter microorganisms. However, microorganisms have optimum growth temperatures, and a temperature of 21 C is more favorable for the growth of lactic streptococci than is 7.2 C. Therefore, even the prolonged, 3-month incubation period may not have permitted maximum growth of the lactic streptococci.

None of the 379 isolates representing the 45 commercial lactic starter cultures grew in litmus milk incubated at 45 C. Failure to recover enterococci from any of the commercial lactic starter cultures studied indicates that starter cultures commonly used for the manufacture of Cheddar cheese are not a source of enterococci in cheese. Kosikowsky and Dahlberg *(18)* and Nichols and Hoyle *(19)* also reported that no enterococci could be isolated from the commercial starter cultures they examined.

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NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS

Plans for the 1967 meeting of the National Conference on Interstate Milk Shipments to be held at the Deauville Hotel, Miami Beach, April 2-6, have about reached completion. Don Race, Chairman of the Program Committee, promised to have the programs in the mail by the end of February.

HOTEL RESERVATIONS

About February 1, the management of the Deauville Hotel will mail a hotel reservation card to each person who registered at the 1965 Conference in Louisville.

The management of the Deauville Hotel is offering special convention rates of $6, $7, $8 and $9 per person double occupancy, or $10 single occupancy on the European Plan. Those who wish the Modified American Plan (breakfast and dinner nightly) will be offered a special rate of $4 per person per day extra.

Any persons who wish to arrive up to 3 days in advance, or remain 3 days after the official convention has adjourned, will still enjoy the same convention rates if rooms are available. Room reservations, to be assured of confirmation at the special rate, must be made at least 4 weeks in advance of the convention dates.

RECEPTION

The management of the Deauville Hotel will provide a complimentary hour-long reception on Tuesday evening, April 4, during which time hot and cold hors d'oeuvres and liquid refreshments will be served.

LADIES ACTIVITIES

The Deauville Hotel will sponsor several activities of particular interest to the ladies, such as bingo games, quiz games and scenic tours as well as fashion shows and dance instructions. If a sufficient number of ladies attend the meeting, the hotel chef will put on a demonstration on the preparation of hors d'oeuvres and fancy food items. Miss Alyce Conti, hotel hostess, will assist the ladies by answering questions concerning shopping, various hotel facilities, etc. It would be appreciated if all men who intend to bring their wives and/or families to the convention would notify the Secretary-Treasurer at least two weeks in advance of the meeting so that suitable arrangement can be made for a coffee-get-together on Monday afternoon, April 3.

TENTATIVE PROGRAM

Sunday, April 2

2-5 P.M.	Registration
2-5 P.M.	Committee meetings—Committee chairmen wishing to hold meetings on Sunday afternoon or Monday morning must contact the Secretary-Treasurer not later than March 15.

Monday, April 3

8 A.M.-5 P.M.	Registration
9 A.M.	Executive Board Meeting
9 A.M.-Noon	Committee meetings
1:30 P.M.	General Session—Governor Kirk is expected to give the welcoming address. Orlo Osten of Minnesota will speak on "Rules of the Road." Dr. K. G. Weckel will review the activities and accomplishments of the National Conference from the time of its inception in 1950 through the 1965 meeting.

Tuesday, April 4

9 A.M.-Noon	Registration
9 A.M.-Noon	Continuation of general session
1:30-5 P.M.	Task Force meetings

Wednesday, April 5

9 A.M.-Noon	Task Force meetings
Afternoon	No meetings—Time available to enjoy the many scenic beauties of Miami Beach and southern Florida.

Thursday, April 6

8:30 A.M.-Noon	General Session
1:30 P.M.	Executive Board Meeting

MORE ABSTRACTS OF PUBLICATIONS RECOMMENDED BY DAIRY FARM METHODS SUBCOMMITTEE

Additional brochures, pamphlets and bulletins on subjects of interest to dairy fieldmen and sanitarians have been selected for abstracting. Some 200 publications are being reviewed by the Subcommittee on Education, an active component of the IAMFES Committee on Dairy Farm Methods, and these publications are recommended for use as educational material in quality control programs.

The material being reviewed has been obtained from various university and state extension services, departments of health and of agriculture, equipment manufacturers and others. In the following abstracts the source of the material is indicated as well as the year of publication, when available.

SAFE SEWAGE DISPOSAL

In a Portland Cement Association publication entitled "Concrete Structures for Farm Water Supply and Sewage Disposal" is an article describing a typical farm or suburban sewage disposal system consisting of a house drain, house sewer, a septic tank, an outlet sewer, a distribution box and a disposal field. According to the article this system has been designed in accordance with recommendations in the U.S.P.H.S. publication, *Individual Sewage Disposal Systems*, Reprint No. 2461 from the Public Health reports.

Beginning with the cast iron house drain and the house sewer of cast iron or mortared sewer tile the article gives recommendations for slope of the drains and other installation factors. Operation of the septic tank is described briefly and specifications are given for tank capacities related to the number of bedrooms and the maximum number of persons served. Basic factors regarding construction of the tank, whether pre-cast or cast-in-place concrete, are outlined. Steps for building forms for pre-cast tanks are given.

The essential purposes of the disposal field are emphasized and the design and construction is covered in some detail. A table gives recommended width and depth of trenches and the lineal feet of trench required per bedroom. The entire article is well illustrated with cross-section sketches, tables and other details.

It is the opinion of the Subcommittee that this is still one of the best articles available for septic tank and disposal field construction. 1954.

MASTITIS—PREVENTION AND CONTROL

This 16-page circular No. 647 issued by the Extension Service, University of Wisconsin, describes briefly some of the aspects of mastitis and reasons for control. Good herd management practices are outlined and instructions are given for proper milking procedures. Care of equipment and the necessity for maintaining good milking machine operation is underscored. Some brief comments are given about herd replacements and the treatment of infected cows. Liberal use is made of illustrations in this brief and concise discussion of the importance of mastitis control in milk production. This is one of the more recently issued bulletins on the subject. 1966.

THE MODIFIED WHITESIDE TEST. RECOMMENDED PROCEDURES FOR BULK OR BLENDED MILK DELIVERIES

A reprint from *The Cornell Veterinarian*, Vol. LIII, No. 1, January, 1963, discusses the modified Whiteside test and the equipment and procedures for making the test. The possibilities for variable results are indicated and reasons are given for the variations. An explanation for the cause of positive reactions and the grading of reactions complete the publication which is in the form of a six-page brochure.

IODOPHORS. I. EFFECT ON FLAVOR OF MILK AND OTHER OBSERVATIONS

Originally published in the *Journal of Dairy Science*, August, 1963, Vol. XLVI, No. 8, this is also in the form of a brochure of eleven pages. The effects of five commercial iodophors on the flavor of milk and related factors were studied and it was found that two to five ppm of the iodophors imparted a chemical iodine-like flavor to skim milk. This off-flavor could also be induced by contaminating milk with iodophor-soaked milking machine inflations and by transmitting sublimed iodine deposit on bottle closures to milk. Corrosion of stainless steel was common to all five iodophors tested. The pH of the solutions varied with the hardness of water of dilution. Results of the tests in the form of tables and illustrations are given and the results are interpreted in some detail.

UNIVERSITY OF MINNESOTA "FACT SHEETS"

These are a series of two-page bulletins in a form suitable for mailing pieces to producers and were released in early 1963. The first Fact Sheet reviewed is entitled "Proper Milking Practices" and is designed to emphasize the "prime importance of a good job of milking." There is a brief, semi-technical description of the milk secretion process within the udder and the reasons for washing and massaging the udder and other preliminary milking steps are given. This Fact Sheet tells how these steps can be used to induce fast milking. Further suggestions are given regarding the order of milking certain animals, value of careful checking of milking times and certain milking practices and customs which will avoid udder troubles. "A good job of milking results in a reduction of milking time, as well as a reduction in the incidence of udder troubles."

The second Fact Sheet entitled "Hydrolytic Rancidity—Cause and Control" reviews the reasons for rancidity and off-flavor development. Using semi-technical terms, hydrolytic rancidity is defined and the action of lipase is explained. There are short paragraphs on factors related to the production of milk susceptable to off-flavors, influence of pasteurization on lipase, characteristics of the rancidity reaction and methods of measuring rancidity. Control measures to be employed on the farm and at the plant are stated briefly.

Copies of these Fact Sheets are available at 136 Dairy Industry Building, University of Minnesota, St. Paul 1.

YOU CAN CONTROL MASTITIS

Circular 129 of the University of Vermont Extension Service was prepared by an extension dairyman with the idea of providing for the milk producer in brief and easily read form certain facts which are considered responsible for development of mastitis. The eleven page pamphlet lists recommendations for proper milking, including before-milking procedures and the correct operation of milking machines. There is a milking machine check sheet listing in brief form the probable causes of mastitis development and suggesting immediate remedies. Recommendations are made for cow comfort and the value of using a milking check sheet for timing the milking of individual cows is demonstrated.

PLANNING AND BUILDING FARM INSTALLATIONS FOR PRODUCTION OF GRADE A MILK

The North Dakota State University Extension Service has released this 18 page special circular compiled by a joint committee of representatives of health services and state departments interested in good milk production. Contruction details for a stanchion barn are given with illustrations and specifications as to area, lighting and ventilation, and floor, wall and ceiling construction and finish and other details. For the loose housing system there are recommendations for the loafing or bedded area, holding area, milking parlor or milking area, cow yard and feeding area and appropriate facilities to be provided for each. Construction features for each area are described in detail.

Milk room design for both stanchion and loose housing installations is rather completely described and construction details are provided for floors, interior walls and ceilings, insulation, ventilation, heating, lighting and the provision for cleaning facilities. Typical floor designs are included which show proper locations of equipment.

The brochure concludes with a discussion of the necessity for adequate water supplies and waste disposal. A cross section of a suggested design for a sewage disposal system for milk house and milking room is given.

This summary of farm building construction requirements and suggestions is prepared as a guide to insure that new construction or reconstruction will comply with Grade A requirements of the USPHS Ordinance and Code. 1962.

CLEANING AND SANITIZING DAIRY EQUIPMENT

Originally presented at the 23rd Klenzade Educational Seminar, Chicago, Ill., March, 1962, this six page brochure is available as a reprint of an article in the *Journal of Dairy Science*, November, 1963, Vol. XLVI, No. 11. It is a rather technical treatise on the evolution of cleaning and sanitizing processes for dairy and food equipment and it discusses the general principles of cleaning and sanitizing. The care of stainless steel, desirable in all chemical applications, is emphasized. The composition of soil and principles of soil removal are discussed, the functions of commonly used detergents and sanitizers are reviewed and the advantages of circulation cleaning applications are pointed out. Principles of CIP cleaning clarifiers, separators, pasteurizers and other specific equipment are discussed in some detail.

ASSOCIATION AFFAIRS

PAPERS PRESENTED AT AFFILIATE ASSOCIATION MEETINGS

Editorial Note: The following is a listing of subjects presented at recent meetings of Affiliate Associations. Copies of papers presented may be available through the Secretary of the respective Affiliate Association.

FLORIDA ASSOCIATION OF MILK & FOOD SANITARIANS

Annual Meeting
Gainesville, Florida
November 8-10, 1966

(*Secretary*, Howard B. Young, Agricultural Experiment Station, University of Florida, Gainesville. 32601)

The Role of the Milk and Food Industries of Florida During Disasters—*C. J. Walker*

Frozen Dessert Laws and Problems and Effects of Recent Rapid Growth in Florida—*J. P. Dodd*

State Laboratory Certification Program—*Hugh Butner*

Bacterial Flora of Pasteurized Dairy Products—*K. L. Smith*

Phosphatase Test Including Admixed Milk, Reactivated Phosphatase and Bacterial Phosphatase—*Mildred Appleby*

Bacterial Quality of Salads—*A. W. Morrison*

Advances and Future of Food Dispensing and Vending Machines—*George H. Duckett*

Bacterial Counts in Bulk Tank Milk—*A. R. Brazis*

Cleaning and Sanitizing Food Handling Equipment—*Tom Pappas*

Quality Control and Preventative Sanitation As Related to a Food Chain—*L. Z. Szabo*

Public Relations Viewpoints of Regulatory Officials and Dairy Industry Personnel—*Bill Tennent and Dick Jolley*

VIRGINIA ASSOCIATION OF SANITARIANS

21st Annual Conference
Old Point Comfort, Virginia
November 9-10, 1966

(*Secretary*, William H. Gill, 6702 Van Buren Ave., Richmond, Va. 23226)

The Milk Story in Virginia as Viewed by the State Milk Commission—*R. L. Gordon, III*

A Training Program for Managers and Food Handlers—*E. E. Francis*

Role of VPI and the Virginia Sanitarians—*James R. Nichols*

Water Pollution and Its Relationship to the Future Development of Virginia—*A. H. Paessler*

Evaluation of the Score Sheet of the 1965 Pasteurized Milk Ordinance and Code—*Robert Stevens*

The Relationship of Farmers Cooperatives to the Economic Development in Virginia—*Garland Benton*

Control of Food Adulterants—*G. W. Sooy*

Report of the 53rd Annual Meeting of IAMFES—*H. L. Thomasson*

CONNECTICUT ASSOCIATION OF DAIRY AND FOOD SANITARIANS

41st Annual Meeting
Cheshire, Connecticut
January 11, 1967

(*Secretary*, Richard M. Parry, Dept. of Agriculture and Natural Resources, State Office Bldg., Hartford, Conn.)

Single Service Containers—*Richard Moats*

Report of a Study on Temperatures of Pasteurized Milk—*Arnold Smith*

Evaluation of Methods in making Leucocyte Counts in Milk—*William Ullman*

Meat Inspection in General and Additives—*Charles Gilvarg*

Aerosol, A New Development in Food and Drug Packaging—*Peter Clapp*

Salmonellosis - and its Relation to Food—*Monte Frazier*

Air Pollution in Connecticut—*L. J. Proulx*

REPORT OF THE EXECUTIVE SECRETARY JULY 1, 1965 TO JUNE 30, 1966

The following report of H. L. Thomasson, Executive Secretary, was submitted to the IAMFES at its annual business meeting on August 17, 1966, at Minneapolis, Minnesota.

Through participation of the officers and Executive Board with me, we were able to attend approximately 23 affiliate meetings this fiscal year. One of the main topics was the question of a dues raise. It is gratifying to be able to report that in many instances there was a unanimous vote by the affiliate members approving the increase and so far as I know there was general acceptance of the need by the affiliates.

In addition to the affiliate meetings I attended our 1966 program committee meeting in Minneapolis, National Mastitis Council Meeting and APHA meeting in Chicago, National Conference on Interstate Milk Shipments in Louisville, 3-A Sanitary Standards meeting in Oklahoma City and met with Florida Local Arrangements Committee on 1967 meeting in Miami Beach.

I am happy to report that I have had many compliments from members concerning improvement in the Journal in the area of general material. I believe real progress has been made in eliminating criticism of the Journal in this respect. At the same time the technical material has been maintained. We have been able to broaden our association affairs coverage and have utilized all available space for useful information in all phases of sanitation. Our circulation is up, averaging approximately 5200 copies per month during the past six months. About 1100 are classed as subscriptions (about 600 of these are foreign), 100 exchange and advertising copies, 3300 affiliate and 700 direct members.

Our financial situation is still good even though we have a deficit as anticipated in our budget for this year. In my talks to the membership and to the Executive Board, I have recommended that the membership face up to the problem of providing a retirement program for the future Executive Secretary as I felt it would be impossible to replace me without such a plan. I have been pleasantly surprised by the

general reaction which is that this should be done, not only for the future secretary but for me also, and many seemed more in favor of increasing dues for this purpose than for any other reason.

Over 30,000 copies of the first addition of the "Procedure for the Investigation of Foodborne Disease Outbreaks" have been sold. The 1966 Revised Edition is now available and over 1500 copies have been sold since published 30 days ago. Progress has been made in preparation of a Sanitarians Handbook and I am hopeful that this can be published this year. I participated with NAS and the Public Health Service in naming a committee to work with APHA in revising the sanitarians registration examination questions to make them much more suitable for use by state sanitarian registration boards.

Development of a Sanitarians Career brochure and greater effort to attract young people to the field of sanitation are among the greatest needs at present. Also education of the public as to what a sanitarian is and what he does should be given much more organized effort on the part of our association. I recommend that each and every member dedicate themselves and IAMFES to this task for the next several years. We have a nucleus for such a program in the C. B. Shogren Memorial Fund and C. B. devoted a great amount of time and effort to education of this kind in the field of sanitation.

I am proud and happy for the privilege of serving you another year.

H. L. Thomasson,
Executive Secretary

NEWS AND EVENTS

APHA COMMITTEE REPORT ON EDUCATION AND TRAINING FOR SANITARIANS

The Committee on Education and Training, Engineering and Sanitation Section, American Public Health Association, has released its report entitled "Basic Educational and Training Prerequisites For Sanitarians—The Current Situation and Background." The report follows:

The two most critical personnel problems facing sanitarians today are: (1) the development of an accurate and generally accepted description of this category, and (2) the delineation and acceptance of the academic preparation required to qualify for the profession. Today there is not general acceptance in either of these basic requirements for a professional category.

Historically, in health departments in this country, the name "Sanitarian" was commonly a job title, not a professional designation, and was conferred upon anyone who held the job. This lead to the promulgation and use of widely divergent standards for this category in states and municipalities. As new environmental health programs are added, and older programs are retained, the need for increasing numbers of personnel, without concomitant budget increases, has contributed to a current downward trend for sanitarian personnel requirements in some jurisdictions.

For the last several years, sanitarians and other concerned groups have evolved a plethora of plans and procedures in efforts to establish the identity, standardization, and professional status of the sanitarian. It is evident that there is still much confusion in the minds of public health administrators, other public health professionals, and the public, regarding the position and role of the sanitarian.

All the foregoing has clouded the professional status of sanitarians however well academically prepared and effectively experienced. In addtion, it logically follows that difficulty is experienced in the recruitment of topflight people into what would appear to them to be a rather nebulous profession.

PRESENTLY EVOLVING POSITIVE DEVELOPMENTS

The members of this committee are well aware that during the last twenty years the problems of the identification, preparation, and utilization of sanitarians have been recognized and studied, and that frequently cogent solutions have been proposed. Most of the members of the committee have served on these study groups, have contributed materially to the many excellent group reports, and have published a large number of constructive individual statements.

To the present, implementation of even those proposals which have gained much acceptance, and for which the need is widely recognized, has been unfortunately largely lacking. All the reasons for this are not apparent but may relate to the level of influence of the study groups in the public health power structure, inadequate representation in the planning by employers and other interested parties, inadequate followup to press for action, timing with regard to the state of development of the category in the overall public health structure, and divergent interests within the sanitarian group itself.

It must be emphasized, however, that a great deal of good has come from the studies and conferences. The group reports and individual papers have clearly identified the sanitarian personnel problems. A description of the sanitarian has been prepared and published in the U. S. Department of Labor's Dictionary of Occupational Titles which can serve for the present as an acceptable compromise. The subject matter for a curriculum for the undergraduate preparation of the sanitarian has been specified in detail. It should be noted here that several colleges and universities are now offering well attended degree courses in environmental health and that others are planning to offer this specialization. A model registration act has been completed and implemented in some areas. The American Intersociety Academy for Certification of Sanitarians has been brought into being. Some progress has been made in reducing the fragmentation within the discipline. There has become a clearly recognized need for the development of a non-professional category in environmental health designated by a title such as "Sanitarian Technician" and positive steps have already been taken to identify this category by education, training, and duties. Of major importance is the rapidly growing acceptance of the idea that an academically recognized, identifiable undergraduate preparation for the sanitarian is a sine qua non of professional recognition, and that this requires definitive action without delay.

Approaches to Attainable Goals

The committee agrees that there is now adequate information and identifiable procedures to permit the solution of the sanitarian's most pressing personnel needs. With the assistance and support of the Section, the Sanitarians Joint Council, the American Intersociety Academy for Certification of Sanitarians, the sanitarians professional societies, organizations of public health administrators and others concerned, a generally accepted description of the sanitarian can be rapidly agreed to and publicized, the criteria for the Sanitarian Technician established and implemented, and the subject matter for undergraduate preparation for professional sanitarians agreed to and uniformly adopted under a system of accreditation. The cooperative, constructive effort of the best minds in these vitally concerned groups is required now to produce these definitive results, for no other profession can be expected to take leadership in solving the sanitarian's problems.

The committee believes that the description of the Sanitarian in the Dictionary of Occupational Titles, while it may not suit the perfectionist, (but then what does) presents quite an acceptable posture for the profession. This standard nomenclature which is obviously being used extramurally needs only statements of acceptance by the groups concerned.

To meet urgent needs in Federal environmental health programs, extensive work on the development of the Sanitarian Technician category is being proposed to the U. S. Civil Service Commission. These needs are identical to those often reported by state and local health agencies, and the present draft of the Series Definition and Qualifications Standards - Sanitarian Technician could well serve as an acceptable pattern for those agencies. The proposed standards are designed so that they will not have the effect of reducing standards for education and utilization of the professional, or squeeze the professional out of employment. This recent development, which will be implemented by the Federal government, deserves study by the groups concerned with a view toward urging early adoption of similar standards by personnel agencies to realistically meet pressing manpower requirements in environmental health.

Instituting and accrediting a recognized curriculum for the undergraduate preparation of professional sanitarians involves, of course, the concern and cooperative activity of the academic community, as well as the groups noted above. There exists the teaching precedents, the curriculum recommendations, and the accrediting possibilities which can combine to meet this almost universally understood need.

The committee believes that the Engineering and Sanitation Section and the Association through its other appropriate groups can stimulate early, positive accomplishment in these three fundamentally important areas. The spade work has been done, the information is at hand, the means exist. With goodwill, cooperation, and understanding, these problems can be solved now.

The Committee on Education and Training consist of: Richard F. Clapp, Chairman, Harold S. Adams, M. B. Crabill, B. Russell Franklin, Jack B. Hatlen, Jr., Gilbert L. Kelso, Jerrold M. Michael, Darold W. Taylor and Lee D. Stauffer (Section Council Liaison).

REGIONAL DISASTER PLANNING CONFERENCE AT LINCOLN, NEBRASKA

The Nebraska Association of Sanitarians in cooperation with the United States Public Health Service is sponsoring a Regional Disaster Planning Conference to be held in Lincoln, Nebraska, on March 15 and 16, 1967. The two day meeting has the approval of the legally adopted Nebraska Public Health Statewide Training Committee and preparations for the program are underway with the able assistance of the Public Health Service Regional Office at Kansas City, and the Nebraska State Health Department Health Mobilization Division.

The meeting is designed to instruct environmental health personnel in planning for disasters, natural or man-made, the responsibilities of the health professions in times of disaster, and how to establish a disaster organization, personnel, duties, etc. Topics and presentations are to be chosen on a carefully selected basis. The program is organized so that sanitarians will have had an opportunity to learn how to plan for disasters on an organized basis.

WESTERN FOOD UPDATE INDUSTRY SEMINAR AT SAN FRANCISCO

A food update seminar is planned for executive and technical management of western food industries at San Francisco March 5-9, 1967. The informational forum by and for the food industry is designed as a meeting ground for examining the latest national and regional thinking in the areas of food industry management, science, production and law.

Sponsored by The Food and Drug Law Institute, Inc., and directed by its president, Franklin M. Depew, the program proposes to survey "advanced practices and future promises spanning the entire range of food development, handling, manufacture, packaging, marketing and regulations." Previous Food Update seminars held in the East and Mid-West drew speakers and participants from national corporations, government, education, agriculture and science, and served as idea-trading posts for the industry at large. The western program will continue this tradition with broad-range presentations by experts and specialists on subjects of particular interest to western food management.

Attendance will be held to an intimately-sized group within which staff and students will be able to participate personally and actively. Food Update, which is a non-profit educational activity, also supports a Food Science and Food Law Scholarship project.

Information about the program, registration and fees is available from Food Update, The Food and Drug Law Institute, Inc., 205 East 42nd Street, New York, N. Y. 10017.

INTERNATIONAL SYMPOSIUM ON PROTEIN FOODS AND CONCENTRATES

An International Symposium on Protein Foods and Concentrates will be held at the Central Food Technological Research Institute, Mysore, India, from June 27 to July 4, 1967. The Symposium is sponsored by the Council of Scientific and Industrial Research, New Delhi, in co-operation with the National Institutes of Health, U.S.A., and the Association of Food Technologists, India. International agencies like FAO, WHO and UNICEF are being invited to participate in it as co-sponsors.

In the context of the wide prevalence of malnutrition in developing countries due largely to protein deficiencies in the diets of the people, the Symposium should prove a very valuable forum for exchange of information on latest trends in the science and technology of protein foods. Emphasis will be on processing, consumer acceptance and marketing of protein foods in the newly developing countries with special reference to South and Southeast Asia.

The Central Food Technological Research Institute—the venue of the Symposium—has done pioneering work over the last decade in the development of protein concentrates and isolates from vegetable raw-material. The symposium will have seven technical sessions, namely, general aspects of protein foods; economic aspects (resources); public health and clinical aspects; amino acid production and supplementation; toxicology; protein concentrates and isolates; consumer acceptability and marketing.

Invitation to participate in the symposium is extended to specialists from research organizations and industries in India and abroad specializing in science and technology of protein foods. Those interested can obtain further information by writing to Dr. B. L. Amla or Dr. T. N. R. Rao, Secretaries, International Protein Symposium, Central Food Technological Research Institute, Mysore-2, India.

NEW SOLID WASTES LABORATORY FOR FIELD RESEARCH

The Public Health Service has completed arrangements for construction of the first field laboratory for general research on solid waste pollution abatement.

The laboratory will be established under a five-year land-use permit recently executed by representatives of the Public Health Service and the University of Cincinnati, Cincinnati, Ohio. The facility will be designed for research on methods for improving the management of municipal, industrial, and agricultural solid wastes under conditions reflecting common U. S. disposal practices.

The Solid Wastes Field Laboratory will be built on a 15-acre tract in a residential-commercial area off Center Hill Road in the northwestern part of Cincinnati. The tract is owned by the University. Construction of the facility will start during the first quarter of 1967.

Work in the laboratory will be aimed at developing scientific information on methods of eliminating health hazards associated with unsanitary solid waste collection, storage, and disposal. The laboratory will maintain standards of sanitation and safety higher than those found in average community refuse disposal operations.

Establishment of the laboratory is in keeping with the University's long-range plans for creating a research park on a 50-acre tract donated for this purpose by the Procter and Gamble Company.

The land-use agreement will permit the Public Health Service to construct buildings, roads, and fencing and to conduct research on the control of air pollution from solid waste incineration; the deterioration of refuse in the environment; the design and operation of sanitary landfills; the control of ground and surface water pollution by solid wastes; and other problems related to the protection of human health and the environment from solid waste contamination. Faculty and students from the University of Cincinnati will be encouraged to observe and participate in field laboratory projects.

Activities of the laboratory will become part of a national Public Health Service program for solid waste pollution abatement authorized by Congress in the Solid Waste Disposal Act. In addition to research, the program is supporting projects to demonstrate new and improved solid waste technology; aiding in the training of engineering and other solid waste personnel; assisting in Statewide solid waste surveys and program planning; and providing technical assistance to enable local, State, and private agencies to take advantage of the best available methods of healthful solid waste management.

DFISA ANNOUNCES NEW FOOD INDUSTRY AWARD

Establishment of a new honor award for the food industry has been announced by the Dairy and Food Industries Supply Association.

The "DFISA Food Industry Award," recently authorized by the Association's Board of Directors, will be a biennial presentation "for outstanding achievement in food industrial science, technology and/or economic practice beneficial to the consuming public." It was recommended by the DFISA Awards Committee.

The Award is open to industry associations, corporations, companies or individuals and will be presented as part of the Food Forum, a DFISA-sponsored siminar held concurrently with the Dairy and Food Industrial Exposition. Criteria for selection of recipient are to be established and reexamined periodically by a special committee of food industry authorities, chosen by DFISA from the academic-business community, and including corporate representatives from major companies or associations in the food processing field.

"We believe there is a place for still a new recognition program serving interests and objectives not necessarily covered by the worthy awards of existing industry and professional programs," explained DFISA Executive Vice President Joseph S. Cunningham. "And our Board has recognized the opportunity for this Association to sponsor such a continuing philanthropy."

Cunningham emphasized that this new Award "deals with the food industry in its broadest sense" and is therefore completely distinct and apart from DFISA's present Contest and Fellowship program. The latter program provides awards and scholarships to dairy manufacturing students who participate in the annual Collegiate Students' International Contest in Judging Dairy Products.

Present plans call for inauguration of this major Award at the 1968 Food Forum. The recipient will be asked to present an address which will be published in the Forum proceedings. Such details as specific amount of the Award (now awaiting approval of the Association's Board of Directors at its March 1967 meeting), selection of candidates and machinery for implementing the Award will be released from DFISA offices as they become definite.

VIRGINIA DAIRY TECH GROUPS SAMPLE BUTTERMILK

The Eastern and Western Sections of the Virginia Dairy Technology Society at a recent meeting at Newport News and Roanoke reviewed the production and quality of Virginia buttermilk. Thirty samples collected from retail outlets were evaluated for flavor.

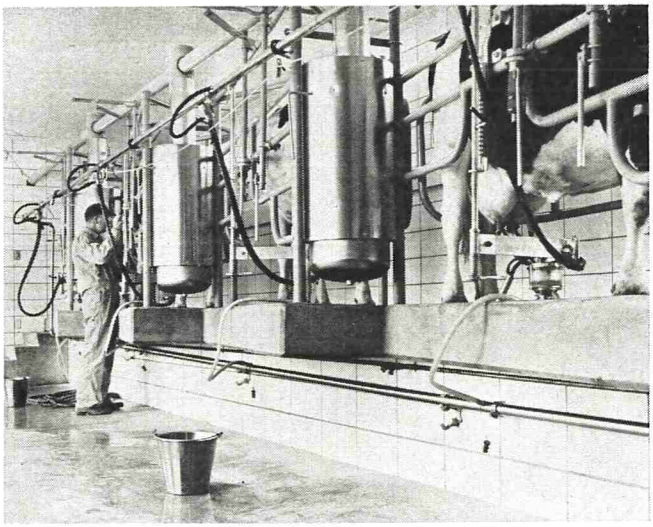
Samples were scored by the V.P.I. Dairy Staff and Society members under the direction of Professor Guy J. Nageotte, Dairy Products Specialist of the Virginia Cooperative Extension Service, V.P.I., Blacksburg, Virginia. A summary of the numerical flavor scores indicate the quality of buttermilk, marketed in Virginia at the time that the customer purchases it, is quite acceptable. The thirty samples had an average flavor score of 37.1, a perfect flavor score being 40.

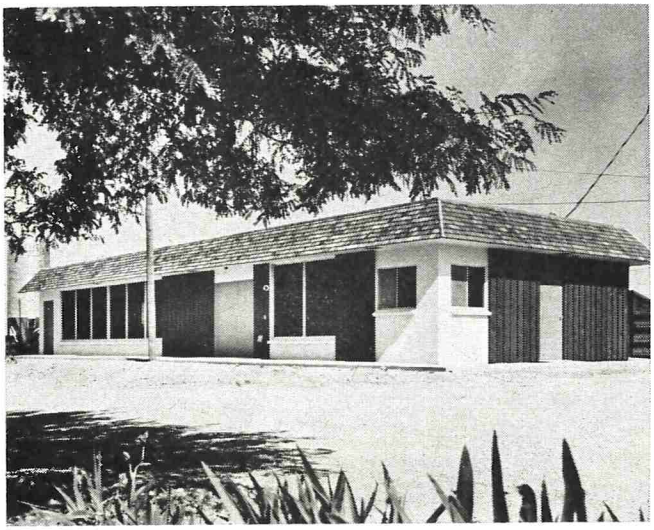
Dr. Warren K. Stone, Professor of Dairy Science at V.P.I., presented an enlightening discussion at each meeting on results of a study of buttermilk quality within Virginia, conducted during the summer of 1966. His discussion led into the factors necessary for the production and maintenance of high quality buttermilk in our modern dairy plants. Dr. Stone also discussed recent innovations in the area of cultured and acidified dairy products.

INFORMATION FROM INDUSTRY

Editorial Note: Following are items of information on products, equipment, processes and literature based on current news releases from industry. When writing for detailed information, mention the Journal.

NEW ERA IN MILKING PARLORS





Milking parlors can be beautiful as well as efficient. Proof of the pudding are the accompanying photos of the first Surge Picture Window Parlor—Series 2—to be built in the United States.

The new Series 2 parlor installed in Greeley, Colorado, contains the very latest equipment for better cow milking. It features a 2" Tonganoxie pipe line, contains four adjustable rear gate diagonal stalls, new augered feed system, an ample milk room with refrigeration and bulk rank — even an attractive office. Latest construction methods and materials were used to provide maximum function and economy.

Complete architectural, electrical, plumbing and equipment installation plans are available through Surge dealers or a set may be obtained by sending $2.50 to Babson Bros. Co., 2100 S. York Road, Oak Brook, Illinois 60523.

TWO NEW PENNSALT CLEANING COMPOUNDS

Pennsalt Chemicals Corporation of Philadelphia, Pa. is offering two new cleaning compounds for the dairy and food industry. Cleaner 81, a heavy-duty alkali for soak and moderate agitation cleaning contains a unique combination of wetting-agent systems for rapid removal of burned-on soils usually found in high heat processing equipment, including deep-fat fryers in food plants. Cleaner 81 quickly emulsifies and saponifies grease and oils and rinses free without residue.

This cleaner leaves no film or residue on metal surfaces. It can be used for soak-cleaning heat-precipitated soils from many types of equipment in milk, cheese, butter, dairy powder and ice cream plants. Food processing plant applications include cookers and kettles in canneries; smoke houses in meat processing plants; deep-fat fryers in bakeries; cookers and fryers in poultry and frozen food plants; and plate heat exchanges in bottling plants.

A new low-foaming, heavy-duty alkaline cleaner, designated Cleaner 91, is a white granular compound said to dissolve rapidly in hot or cold water, clean speedily and rinse free without any film or residue. Its low-foaming properties make it widely applicable for bottle washing, cleaning tubular and plate heaters, rendering equipment, storage tanks, CIP of product transfer lines and others.

Cleaner 91 is highly concentrated and effective in small quantities. Eleven pounds per 100 gallons of water provides a 1% caustic solution for removing heavy soils by soaking. Smaller amounts of the powerful cleaner are required when applying it by circulating or spray cleaning methods.

For additional information on the compounds write the Dairy and Food Dept., Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa. 19102.

"DO-IT-YOURSELF" TEFLON-COATED ALUMINUM FOIL

All the advantages of the well-known anti-stick properties of TEFLON are now available for any work area with Tri-Point Industries' new "do-it-yourself" TEFLON-coated aluminum foil. Produced in rolls with either self-adhering backing or plain in widths of 12", 24", 36" and 48", the new material is available in gauges of either .001 or .032 inches. Other gauges are produced to order.

Easily cut and shaped by hand to fit any area, the adhesive-backed TEFLON/foil can be applied directly; the nonadhesive type is mounted with nails, staples or tacks.

According to the manufacturer, it is ideal for such hard to clean areas as paint spraying booths, walls and table tops where food is processed as in bakeries, candy-making concerns, restaurants or in manufacturing concerns or laboratories where the product is gummy or leaves a residue that is hard to remove. Even the stickiest substances separate from a TEFLON-coated surface effortlessly with the wipe of a cloth.

Further information about the new TEFLON/foils is available from the company at 1 Teflon Way, Commack, L.I., N. Y.

NEW SPRAY-ON MASTITIS PROTECTION

A new spray protectant, sealant and healing aid has been released by Klenzade Products, Beloit, Wisconsin, under the trade name, "Udder Guard." The new product prevents bacteria from entering the teat by setting up a protective barrier, similar to the spray bandages now available for human first aid. Udder Guard also aids in the healing of cuts, bruises, burns, chapped teats and various infections. It makes the skin of the teats smooth and pliable and reduces milking machine irritations, according to the manufacture. The product is simply sprayed from its pressurized can onto each teat after each milking. Standard cow preparation procedures just prior to milking remove the chemical sealant.

CLEANING METHODS CHART FOR STAINLESS STEEL AVAILABLE

A full-page chart, "Effective Methods for Cleaning Stainless Steel," is available free of charge from the Committee of Stainless Steel Producers, American Iron and Steel Institute, 150 East 42nd Street, New York, N. Y. 10017.

This up-to-date chart tabulates effective methods for removing smears, spots, baked-on splatter, heat tint, hard water spots, grease and oil, and other deposits from stainless steel surfaces. For each type of cleaning program it lists cleaning agents commercially available, the recommended method of application and the effect of various compounds on finish.

The chart is primarily for household use but nevertheless is of interest.

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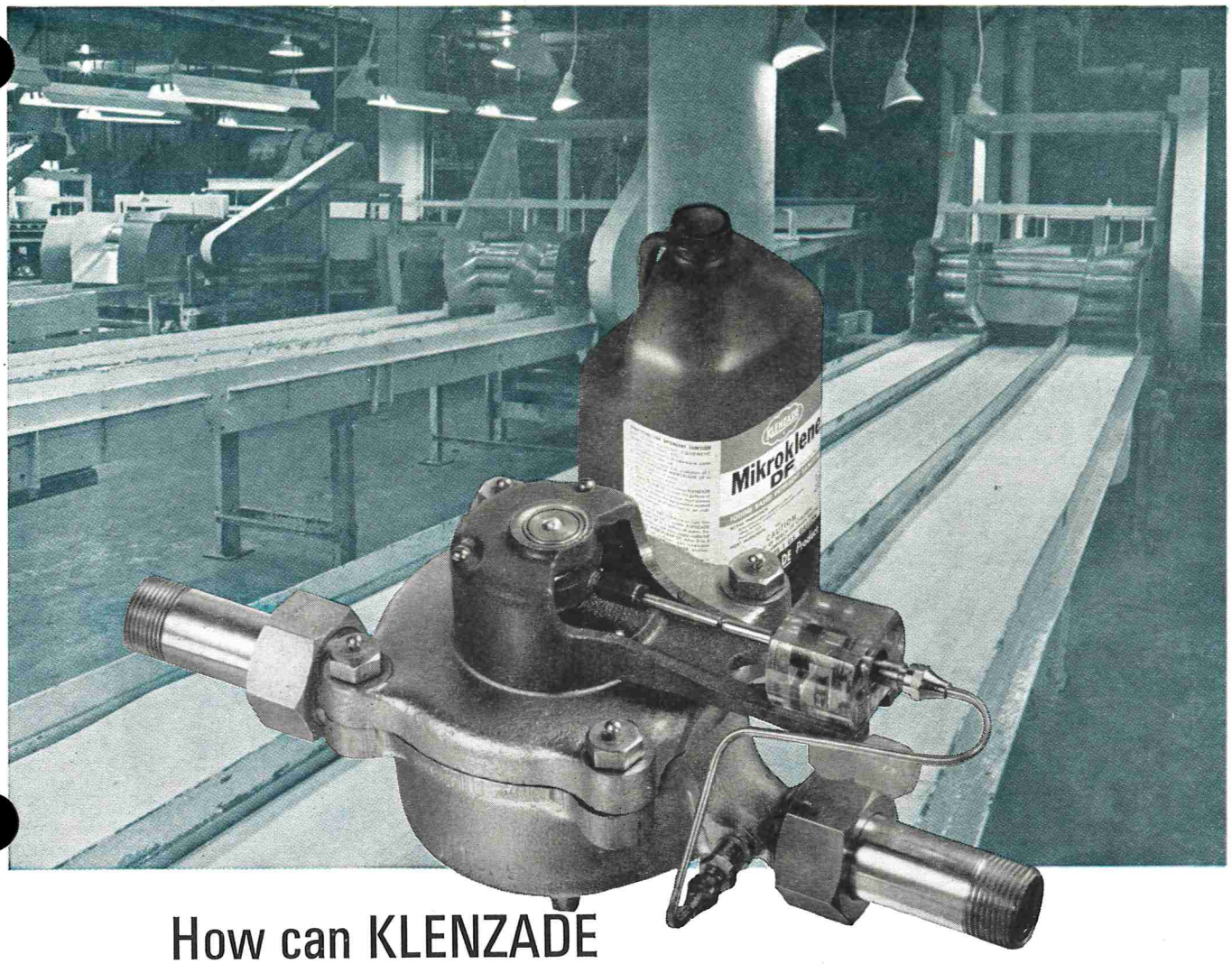

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