Chemical Sterilization of Dairy Utensils

—on the farm and in the dairy plant

By
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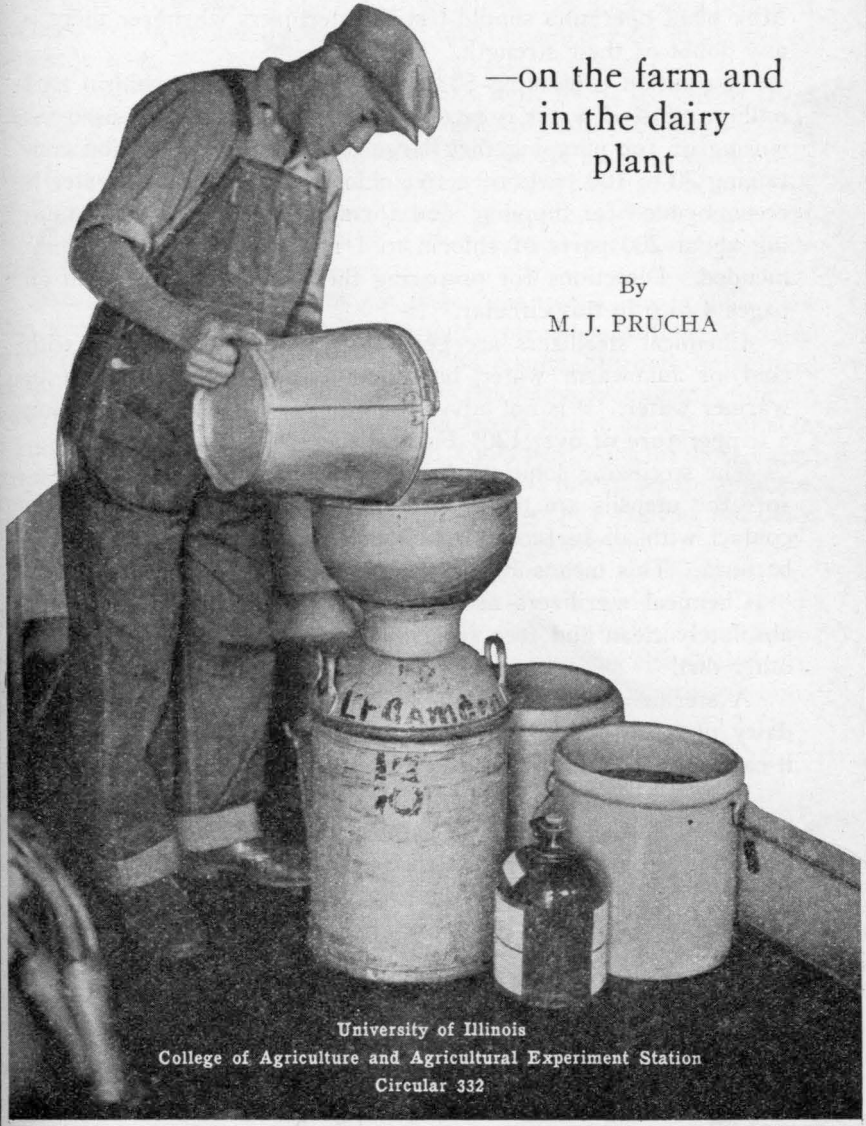

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SUMMARY

Chlorin compounds make suitable sterilizers for dairy utensils. There is advantage in selecting a compound which has in it a guaranteed amount of chlorin and which will hold its strength. Milk plant operators should test the sterilizers whenever there is any doubt of their strength.

A solution containing 50 to 100 parts of active chlorin to 1 million parts of water is recommended when it is to be used for rinsing or for pumping thru large equipment. A solution containing 70 to 100 parts of active chlorin in 1 million of water is recommended for dipping; and for spraying a solution containing about 200 parts of chlorin to 1 million of water is recommended. Directions for preparing these solutions are given on pages 4 to 6 in this circular.

Chemical sterilizers are generally intended to be used with cold or lukewarm water but their effectiveness increases in warmer water. It is not advisable, however, to use water having a temperature of over 120° Fahrenheit.

The sterilizing solution should be applied preferably just before the utensils are to be used. The solution must come into contact with all surfaces long enough for the chlorin to kill the bacteria. This means 10 seconds or longer.

Chemical sterilizers are effective only on utensils that are absolutely clean and free from all traces of milk and grease or other dirt.

A sterilizing solution should not be used a second time for dairy utensils, but because it still contains some active chlorin, it can be saved and used for other purposes less exacting.

Do not attempt to use chemical sterilizers for treating milk. They will impart undesirable flavors and will not be effective in hindering the growth of bacteria in the milk.

Chemical Sterilization of Dairy Utensils

By M. J. PRUCHA, Chief in Dairy Bacteriology

On dairy farms one of the many chores is the washing and sterilizing of milk utensils. In dairy plants also, the washing and sterilizing of the equipment is an important part of the operations. The washing is not difficult; neither is it difficult to tell by examination whether it has been well done, for traces of milk, and films of grease not removed are easily seen.

To sterilize utensils, however, that is, actually to free them from bacterial life, is not so simple. The bacteria that adhere to the surfaces of utensils are too small to be detected by the eye and one cannot tell, therefore, by merely looking at utensils whether they have been sterilized or not. This being the case, there is only one way to be sure that utensils are *sterile* and that is to follow certain prescribed methods which have given good results.

Steaming or scalding with hot water are two methods that have been commonly used for sterilizing dairy utensils. Either of these methods when properly applied gives good results, but both have their limitations, especially when used for such equipment as external tubular coolers and large vats. Even in plants steam is not always available in sufficient amount for these pieces of equipment, and on most dairy farms steam is not available at all and neither is hot water in sufficient quantity for satisfactory results. This is especially true in the busy months of summer, when sterilization is most important.

In recent years a new scheme, that of chemical sterilization, has come into use. In case this method of sterilization is generally adopted, it is important that all persons engaged in dairy operations, either on the farm or at the milk plant, understand which of the chemical sterilizers are satisfactory, how and when to use them, and what their limitations are.

Chlorin Sterilizers Best Suited for Dairy Use

Not all chemical compounds known as disinfectants or sterilizers are fit to be used for sterilizing dairy utensils. Some are poisonous and some have bad odors. A group of compounds known as the chlorin sterilizers seem to be best suited for the purpose; these are:

1. Calcium hypochlorite, commercially known as bleaching powder or chlorid of lime.
2. Liquid sodium hypochlorite, sold under various trade names such as BK, Germ X, Hypochlor, Belle disinfectant, etc.
3. Solid sodium hypochlorite, sold under the name of Diversol. The sodium hypochlorite in this product is combined with alkaline phosphate in crystals, thus combining both the sterilizing and cleansing properties.

4. Chloramine-T, sold in powder or tablet form under such names as Santamine, Sterilac, Chloron, Chlorazene, Hoover 40, etc.
5. Chlorin gas compressed in steel cylinders.

All of the chlorin sterilizers have one property in common; namely, they all contain a certain percentage of chlorin and it is this chlorin, sometimes called the *active* or *available* chlorin, that kills the bacteria. This active chlorin is continually escaping from most of these sterilizers, with the result that they gradually lose their sterilizing power.

Different commercial products vary in respect to the stability of the chlorin, some losing their strength much faster than others. Calcium hypochlorite is very unstable. The different liquid sodium hypochlorite preparations vary, some being fairly stable while others are not. The solid sodium hypochlorite and the various preparations of chloramine-T are quite stable. This quality of stability is very important, since uniformly good sterilization cannot be obtained with products that are continually and rapidly losing strength. For farms and milk plants where facilities for testing the strength of the solutions are not available, the commercial preparations that are stable are much to be preferred.

Strength of Sterilizing Solution Needed

Sterilizers, as a rule, are prepared by the manufacturer in a concentrated form. They are mixed at the plant or at the farm with water to make solutions of the desired strength. The strength of the solution is usually expressed as so many parts of chlorin per million parts of water. It is not necessary to heat the water for making these solutions altho in warm water up to about 120° F. they work more effectively than in cold water. It is not advisable to go above that temperature.

Solutions made from calcium hypochlorite and from the different preparations of sodium hypochlorite when mixed in the proportion of 50 parts of active chlorin to a million parts of water will effectively destroy most of the bacteria in the utensils. When any of the chloramine-T preparations are used, the solution should be very much stronger, in order to get a quick and effective sterilization.

How to Prepare Solutions of Desired Strength

Sodium Hypochlorites and Chloramine-T. The different preparations of sodium hypochlorite and of chloramine-T (groups 2, 3, and 4 above) are readily soluble in water. A solution of any strength can be prepared by simply adding the necessary amount of the sterilizer to a given amount of water. The amount to be added can be calculated as follows:

Divide the percentage of active chlorin in the sterilizer by the number of parts of chlorin per million parts of water desired in the solution, then multiply the quotient by 10,000. The product obtained indicates the number of ounces of water to be used for each ounce of sterilizer. Any other unit of weight can be substituted for the ounce.

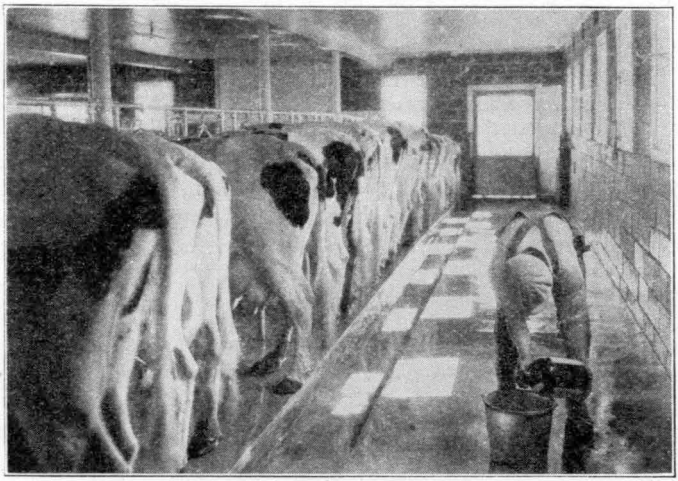

FIG. 1.—PREPARING A STERILIZING SOLUTION FOR WASHING COWS' UDDERS

The cows' udders furnish the first source of external contamination for milk. They should be thoroly cleaned and made as sterile as possible before the milk is drawn. Chemical sterilizers are valuable for that purpose. They come in concentrated form and are mixed with water to make solutions of desired strength.

To illustrate: A solution is to be prepared which will have 50 parts of chlorin in 1 million parts of water, a commercial product being used which contains 2.5 percent chlorin:

$2.5 \div 50 = .05$

$.05 \times 10{,}000 = 500$ (ounces of water to 1 ounce of sterilizer)

Hence, to make a solution the strength of which is to be 50 parts of active chlorin in 1 million parts of water, from a sterilizer containing 2.5 percent of active chlorin, it is necessary to use 1 ounce of the sterilizer to 500 ounces of water.

Calcium Hypochlorite. Calcium hypochlorite, or bleaching powder, is not so soluble in water as are the other preparations. When put into water it forms a heavy sediment of lime. Since this sediment is very objectionable in sterilizing solutions, it is advisable to prepare first a strong solution and let it settle. The clear solution is then mixed with water for sterilizing purposes. To do this—

Mix 1 pound of bleaching powder with 2 gallons of water, using a glass or glazed earthenware jar.

Allow this mixture to stand undisturbed for several hours.

After the sludge settles, pour off the clear liquid and discard the sludge.

The above liquid loses its strength very rapidly. A more stable liquid may be prepared as follows:

Mix 1 pound of the bleaching powder with 1 gallon of water.

Next mix 26 ounces of sal soda or 10 ounces of soda ash with 1 gallon of water.

When dissolved, add the soda solution to the bleaching powder solution.

After the sludge settles, which takes about 10 or more hours, pour off the clear liquid and discard the sludge.

(This liquid has the chlorin in sodium hypochlorite form.)

Bleaching powder, when fresh, has about 30 percent of chlorin. Being very unstable it quickly loses its chlorin, with the result that the product as found on the market varies in strength. The liquid preparations made from it according to the above directions will therefore

FIG. 2.—CARING FOR PARTS OF THE MILKING MACHINE

Immediately after milking, the rubber parts of the milking machine should be cleaned, then immersed in a sterilizing solution, and kept there until the next milking.

vary in strength at the time they are made and in addition they will lose their strength rapidly. Since no rule can be given as to the amounts of these liquid preparations needed to make an effective solution, it is necessary to test their strength just before they are used and then prepare a solution according to the results of the test.

Because of this variation in the strength of bleaching powder, it is better, especially where facilities for testing the solution are not available, to use products that are both standardized and more stable.

Chlorin Gas. This is used in two ways. By means of special apparatus it is added to water, in which it readily dissolves, and the solution is then used for rinsing the utensils. This method has been used mostly for sterilizing milk bottles. The effectiveness of the solution is about the same as that of sodium hypochlorite. By means of special apparatus it is also used for preparing liquid sodium hypochlorite, and this is used for sterilizing purposes in the same way as are the other sodium hypochlorite preparations.

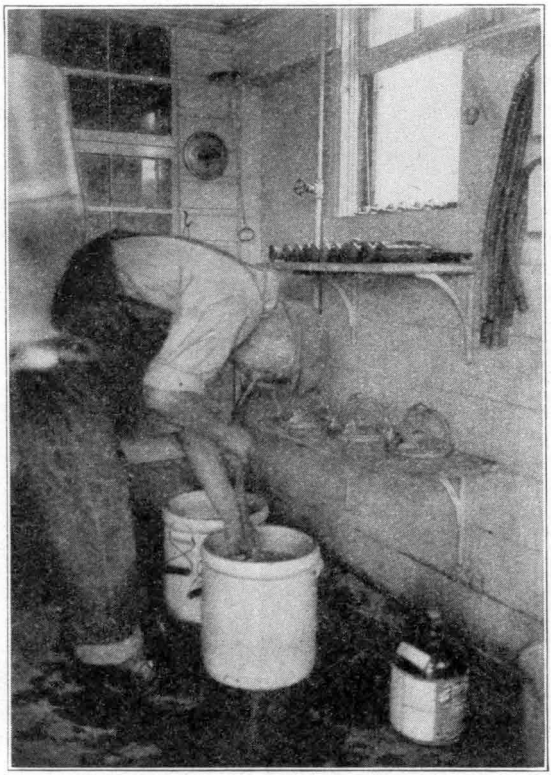

FIG. 3.—STERILIZING UTENSILS BY RINSING METHOD

The various dairy utensils may be easily sterilized by rinsing them with water which has been treated with a chlorin chemical sterilizer. The best time to do this is just before milking.

Best to Sterilize Utensils Immediately Before Using

The most convenient time to sterilize utensils is either right after washing or just before they are to be used, the latter being preferable. There are two reasons for this recommendation. In the first place, utensils that are sterilized immediately after they are washed may

become contaminated with bacteria before they are used. In the second place, solutions of some of the chemical sterilizers if left standing in the utensils tend to corrode them, and this in turn may cause undesirable flavors in the milk.

Four Methods of Applying the Sterilizer

The aim in applying a chemical sterilizer is to bring the solution into contact with the entire inner surface of the utensils. This contact should be made for not less than 30 seconds and preferably for longer. The following methods have been used with success:

Rinsing Method for Few Utensils. When the number of utensils to be treated is small, they can be sterilized by simply rinsing them with the solution. One or two gallons of solution having the strength of

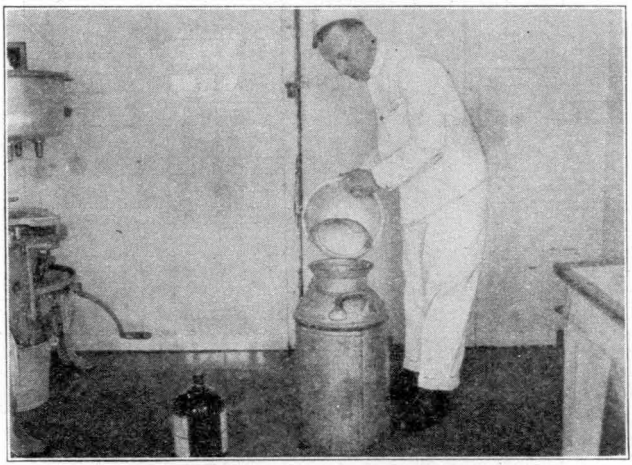

FIG. 4.—GIVING THE MILK CAN DUE ATTENTION

Investigations have shown that milk cans improperly cared for are one of the most serious sources of bacteria in milk. Sterilization of the milk can is therefore an important factor in producing clean milk. This can be done by rinsing with a chemical sterilizing solution.

about 50 parts of active chlorin per million parts of water, is sufficient to treat several utensils. The solution is poured from one utensil to another and each piece is thoroly shaken so as to bring all of the inner surface into contact with the chlorin. The operation should not be hurried, for it takes time for the sterilizing solution to act. To get reasonably good results it requires one-half to one minute for each utensil. On the ordinary farm where there are two cans, two pails, and a strainer, it will take 3 to 5 minutes to treat them.

Dipping Method for Many Utensils. When the number of utensils is large, dipping each piece into the solution is more practical than

rinsing. For this purpose a large amount of the solution is prepared in the vat and then each utensil is dipped into it, being completely submerged for about 30 seconds. The utensils should be drained thoroly after they have been treated.

With this method it is advisable to start with a stronger solution than when rinsing, because this process takes longer and a sterilizing

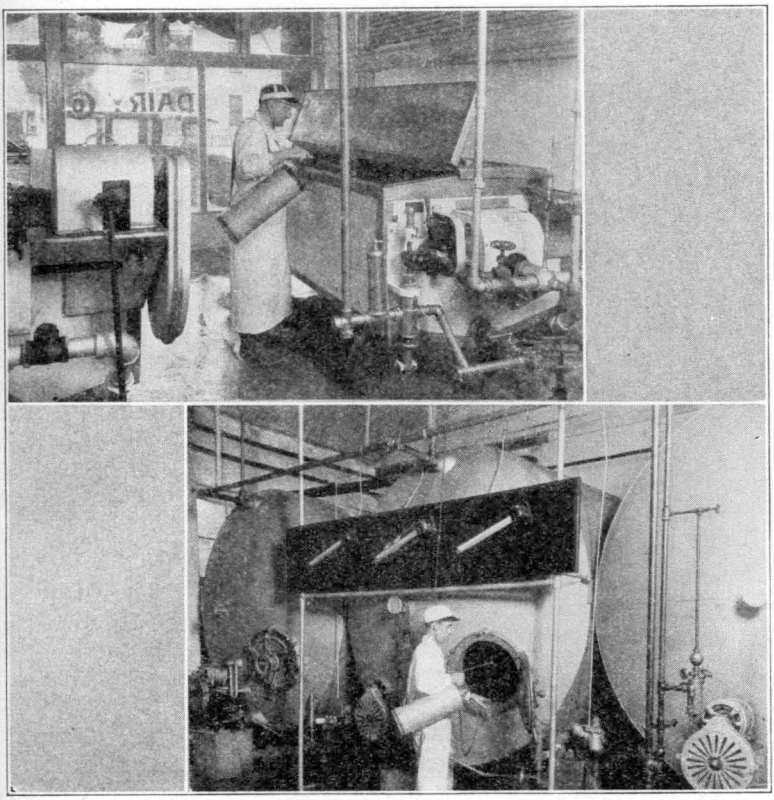

FIG. 5.—SPRAYING METHOD BEST FOR LARGE EQUIPMENT

Big vats and tanks in the dairy plant, which are difficult to sterilize with steam or hot water, can be easily treated with a chemical solution applied by means of a spray.

solution loses its strength quite rapidly. Seventy to 100 parts of chlorin to 1 million parts of water is recommended. If the same solution is to be used for one hundred or more utensils, it may be necessary to add more of the sterilizer after the solution has been used for a while. For effective sterilization the strength of the solution should not be allowed to drop much below 50 parts of active chlorin to a million parts of water.

Spraying Method for Large Utensils. The spraying method is especially adapted for treating large utensils such as vats. A stronger solution is probably necessary for this method than for rinsing. In one dairy plant a 2-gallon spraying pump, such as is used for spraying shrubs for insects, was used successfully in an experiment. A solution having about 200 parts of chlorin to a million parts of water gave

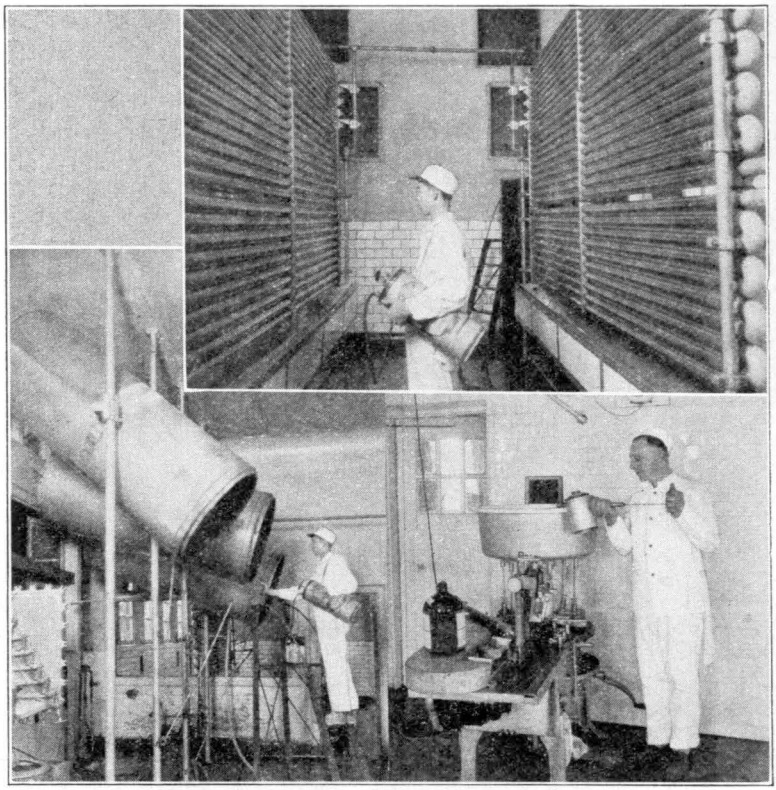

FIG. 6.—EXTERNAL TUBULAR COOLERS, LARGE MILK HOLDERS, AND THE BOTTLE FILLER ARE ALSO EFFECTIVELY STERILIZED BY THE SPRAYING METHOD

After treating the equipment with the solution recommended for spraying, it is a good plan to rinse it with clean water, preferably hot, before any milk is put into it.

good results. About 2 gallons of the solution was used for spraying two large pasteurizing vats, the weighing tank, the receiving vat, the tubular cooler, the sanitary piping, the bottle filler, and several smaller utensils. Only about 10 minutes were occupied in doing the work.

Pumping Method for Plants Having Pipes and Pumps. Dairy plants which are equipped with sanitary piping and pumps may take

care of their equipment by forcing the sterilizing solution thru the entire system. The solution is prepared in the weighing tank and then pumped thru all the equipment and into the bottle filler. The solution may be returned from the bottle filler to the weighing tank and pumped thru again to be sure that the job is thoroly done. A solution having 50 parts of active chlorin to a million parts of water will give good results.

Very effective sterilization of milk plant equipment can be accomplished by spraying the large equipment and then following that operation by pumping a solution thru the entire system. It is a good practice to discard the first few quarts of milk that pass thru the equipment, or to rinse the equipment with clean water after the treatment with the solution and before any milk is put into it.

Save Solutions for Other Uses

After the utensils have been sterilized, the solution may be used during the day for various other purposes. On farms it may be used for sterilizing the milker's hands, for wiping cows' udders, for treating the floors in the milk house and the barn, and for many other sterilizing purposes. In milk plants and other dairy establishments it is good practice for the operators occasionally during the day to wash their hands in such a solution. The floors in the plant, the inside of the refrigerator, the delivery trucks, and the milk wagons may well be treated with the solution. Much can be done by the use of sterilizing solutions to improve the sanitary condition of dairy plants and to control the usual dairy plant odors.

It should be stated that these sterilizers cannot be used for treating the milk itself. Large amounts of them are required in order to produce any effect on bacteria in the milk, and the milk will acquire an off-flavor and will be spoiled before the bacteria in it are affected.

Chemical Sterilization Not Effective With Dirty Utensils

Like any other scheme of sterilization, chemical sterilization has its limitations. It has been shown that utensils which are rusty, which have rough surfaces, and which have loose soldering are very difficult to sterilize. Apparently the sterilizing solution does not penetrate readily into rough surfaces and into crevices where bacteria collect.

It cannot be too strongly emphasized that successful chemical sterilization of utensils is dependent upon the mechanical cleanliness of the utensils when the solution is applied. Utensils that are properly washed are quickly and effectively sterilized. Utensils that have traces of milk, or a film of grease or any other dirt sticking to their surface cannot be expected to come out free from bacteria merely by the application of a sterilizing solution.