A SIMPLIFIED COLIFORM TEST FOR MILK PRODUCTS

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Editorial Note: Quality control personnel concerned with detection and control of coliform bacteria in the processing of various milk and other food products undoubtedly will be interested in this brief account of the usefulness of the simplified presumptive test reported herein. While this procedure was published many years ago, its redescription with comments relative to its application over a long period of usage was thought to serve the interest of many JMFT readers.

In 1915, M. H. McCrady, Director of the Quebec Provincial Health Laboratories introduced the coliform test for milk, using the fermentation tube method. Later, McCrady and Archambault (3) further refined the test to assess plant sanitation as reflected in recontamination of pasteurized products. The experience of the past 50 years has proven the value of the test for this purpose, as indicated by Archambault (2).

While official testing must follow the details prescribed in "Standard Methods for the Examination of Dairy Products" (1), there is need for a simplified procedure especially adapted to use in a plant laboratory. Where serious contamination of product has occurred, speedy discovery is extremely important. The most precise and elaborate test loses much of its value if the product has been marketed before the results are known.

The fermentation tube method, officially employed in Quebec and Ontario, calls for the use of inverted vials to detect gas production by coliforms. This has its drawbacks. First, the amount of gas collected in the inverted vial is not representative of the total inoculum, as only 10 to 50% of the inoculum finds its way into the inverted vial (4). Second, the official method prescribes that the brilliant green lactose bile broth be distributed in tubes containing inverted vials, then autoclaved to sterilize it. Third, the washing of the inverted vials is time-consuming. To overcome these objections, the following simplified procedure was developed in 1930. Since that time our laboratory has performed over 600,000 coliform tests using this procedure, which was published in 1935 (4).

SIMPLIFIED AGAR PLUG COLIFORM TEST PROCEDURE

The brilliant green lactose bile broth (2%) is boiled for 30 min. (More than 10,000 negative controls have shown that autoclaving is not necessary.) The medium is cooled to room temperature, then 9, 18 or 27-ml portions are carefully introduced into sterile test-tubes. A solution of plain agar (1-2%) is also boiled for 30 min and cooled to about 50 C. Tubes of broth are then inoculated as follows:

- 9 ml medium + 1 ml milk
- 18 ml medium + 2 ml milk
- 27 ml medium + 3 ml milk

Tubes are swirled to mix the contents, then 2 ml of the melted agar solution is poured slowly down the inside wall of the tube to form a layer over the inoculated medium. On solidification the agar forms a seal which traps any gas formed within the medium during incubation at the prescribed temperature (4). In a positive test, tiny bubbles of gas form a layer of foam under the agar plug; then as the volume of gas increases the agar plug is forced upwards.

ADVANTAGES OF THE SIMPLIFIED COLIFORM TEST

Because of the simplicity of preparation it is possible to set up 100 tests per hour even in the most modest laboratory.

Positive gas production corresponds to the full amount of the milk tested, not just a portion of it. Because all the gas produced is trapped beneath the agar seal, a small bubble is readily seen. With heavy recontamination, this may be in 8 hrs or less, while with the ordinary degree of recontamination the agar seal has been forced upwards in 16 hrs or less. (It must be borne in mind that some strains of coliforms are not very active gas producers, hence the volume of gas liberated is not always proportional to the initial number of coliform organisms.) Thus serious recontamination can be detected and remedial action taken much earlier than is possible with the official plate or tube methods.

Further advantages of the agar plug method are that no plug or other closure is required for the tube during incubation; tubes are washed much more easily than are inverted vials; and the difficulty, especially with cream, of seeing whether or not gas has formed in the inverted tube when the inoculated broth is so opaque, is entirely avoided.

For the plant laboratory, the agar plug procedure enables a close check to be made on the sanitary condition of equipment beyond the pasteurizer. An efficiently operated plant will rarely have a sample showing more than 10 coliforms per 100 ml (2), a much more realistic standard than that currently being considered for the forthcoming edition of the Pasteurized Milk Ordinance of the U. S. Public Health Service.
Simplified Coliform Test

References

PROBLEMS OF AGING BULK TANKS

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Bulk cooling of milk has been an established fact for at least a decade. People used to say that farmers would never pay that kind of money for a bulk tank when their old can cooler was still doing a good job. But that was before farmers began installing bulk tanks, pipeline milkers, CIP systems, gutter cleaners, and a host of other new mechanical tools in the barn and milkhouse at a rate none of us could even believe possible.

There was, and is, a lot of pride in these installations that farmers purchased, many times at the expense of postponing needed improvements in the homes. In much of the country, adjustments have been made and a major portion of our milk is cooled in bulk tanks. Our milk quality as a whole is considerably improved over that delivered ten years ago. There is no question in anyone's mind that bulk tanks are here to stay.

We have had our problems during the past 10-12 years. The automatic improvement in milk quality which was supposed to happen overnight just did not quite happen that way. Our research and that of several other workers have shown that quality problems with bulk cooling of milk on farms can not be truly evaluated using the standards of a decade ago. Through the years we are learning there is more to milk quality than a low standard plate count, but it has not been an easy message to get to the several segments of the dairy industry.

After a decade of bulk handling, a new problem comes along to bother the dairy industry. Equipment wears out. Usually controls wear out quicker. No one knows just when a given tank or its controls will cease to function properly but it is recognized the day must come. Faulty fat tests and quality problems will occur with increasing frequency and intensity as more and more tanks reach this uncertain age when continued usage under varying conditions of temperature, moisture, and care begins to "take its toll."

With increasing age of tanks, there is a loss of this pride of ownership which was so evident when tanks were new. Unless milk producers are properly instructed, sanitation slips and remains unnoticed because plate counts do not indicate sanitation errors as they did with can cooling. Deposits of milkstone or water minerals remain on the tank surface. Pitting takes place under these films and a continuing sanitation problem exists. Milk quality suffers because the bacteria which thrive in these films will grow at refrigeration temperatures and are capable of breaking down milk fat and protein.

Milk quality would suffer less if tanks would operate properly until they wear out and then just stop. The condition would be obvious and something could be done about it immediately. Unfortunately, this is the exception rather than the rule. The controls may function improperly or erratically for months without anything being noticed. Such improper functioning may cost the producer considerable money from low fat tests and cause the milk handler to suffer serious decline in the sales appeal of his milk products.

When bulk tank controls cease to operate properly, either freezing or churning of the milk is likely, to occur. The milk loses its normal physical character. However, close attention to the operation of the tank can save the industry a lot of unnecessary expense from fat losses and quality problems.

The bulk milk collector must be made aware of the problems of improperly functioning bulk tanks. In many cases, he is the only one aware that something is wrong. At least, if he is alert to his responsibility to the producer and the milk plant, he can be the first to observe the effects of erratic tank operation. Bulk milk collectors should look at the bottom of the tank after the milk has been collected and before the tank is rinsed with water. The presence of butter particles (sometimes as big as peas but anything you can see is "too big") or flakes is a good indi-