The Use of the Methylene Blue Test in the Grading of Milk for Cheese Factories

From Address by K. L. Hatch, before Southern Wisconsin Cheesemakers' Association—December 9, 1927

We now have three ways to grade milk—by physical, microscopical and chemical examination.

Physical Tests for Milk

The nose is always used in classifying milk. The receiver "sticks his nose into the can" and the odor immediately reveals sour, unclean, or undesirable milk. It is a crude method but one always used. Then the receiver uses his eyes, too. He looks for dirt, sediment, unclean cans, and the like. He may even taste of the milk. He finally takes the last pint in the can and forces it through a cotton disk. If there is dirt in the milk it is seen on the cotton. This little device, known as the "sediment test", serves a very useful purpose. All of these means are only devices for the physical examination of milk—means of seeing, smelling, or tasting something wrong with the milk. All, except the sediment test, have been in use for a long time, and all are essentially crude. As dairying advanced, more refined methods were found to be necessary.

Examining Milk with the Microscope

"Germs" exist in milk and certain of these "germs" cause bad odors and flavors in milk. They are too small to be seen with the naked eye. The quality of milk and its fitness for human food are almost wholly dependent upon these germs. But they can be seen only by the aid of high powered microscopes. Scientists have devised methods for **counting** the germs in a given quantity of milk by the use of the compound microscope. There are three ways ordinarily used for counting bacteria. All of these require a very small quantity of milk.

All of them require the use of figures that serve to multiply errors that may occur from 1,000 to 300,000 fold. All of them require costly equipment and skilled operators, and so much time as to make them impractical to use in grading milk used in the manufacture of cheese.

It was for reasons such as these that quicker and simpler methods were demanded.

Chemical Tests for Milk

The Babcock test was the first practical chemical test developed for the use of the dairy industry. The Babcock test uses a sample of milk of sufficient size to be a "fair sample", a method that can be understood by anyone and is quick, simple, cheap, and easy of application. But it determines only fat in milk. Another "Babcock Test" for counting the germs in milk was needed. Happily such a test is now available.

The Methylene Blue Reduction Test

The methylene blue test is such a test. It is based on the fact that the coloring matter known as methylene blue **is blue** in the presence of oxygen. When oxygen is removed from milk to which the dye is added, the dye immediately loses its color. The bacteria that are ordinarily found in milk, use oxygen in their growth and multiplication. Many germs will quickly use up all the oxygen, while a small number will require a much greater length of time. Fresh milk has a considerable amount of oxygen dissolved in it. If the dye, methylene blue, be added to fresh milk, it will give to it a blue color. This blue color will remain until all the oxygen is used up when the milk will almost immediately change back to white again.

The larger the number of bacteria in milk, the sooner will this change in color take place. Hence the use of methylene blue becomes a valuable test for determining the relative number of bacteria present in a given number of milk samples.

The Methylene Blue Test is Easily Made

This test is easily made by anyone of ordinary skill and intelligence. It is even less difficult than the Babcock test,

and is entirely practical in the hands of any cheesemaker. No special training is necessary. It is as easy to make as is the sediment test.

This Test Uses Large Samples

The microscopic methods of counting bacteria require the use of very small samples. On the other hand the methylene blue test uses large ones. These samples are placed in the incubator as soon as possible after they are drawn, and hence requires only ordinary care.

Makes Use of Simple Apparatus

Samples are taken with an ordinary small cream dipper which needs only to be rinsed after each sampling. These samples are placed directly in scalded test tubes. When all the samples have been taken in this way and placed in the rack, a few drops of the methylene blue solution is added to each tube with a sterilized dropper. The blue solution is prepared by dissolving one standard tablet of methylene blue in seven ounces of boiled water. All apparatus used in making the test should be thoroughly cleaned and scalded after each using.

Keeping Methylene Blue Test Samples Warm

There are several devices used for keeping the samples warm. They all require that the temperature of the samples shall be maintained at about 98 to 100 degrees Fahrenheit. This is done by the use of a gas stove, an alcohol lamp, an electric heater, or by using a thermos jug for retaining the heat. Roughly speaking, milk that **retains** its color for more than 4 hours is classed as "good" milk, while milk that loses its color in less than two hours is "poor" milk.

The Thermos Jug a Handy Device

The thermos jug has been found to be a handy means of keeping the samples warm. It is compact in form, and easy to operate. When used with a specially fitted rack, the samples can be read without removing the tubes from the rack. Heat is supplied by hot water, inside the jug, kept at nearly constant

temperature. An ordinary dairy thermometer is the only control necessary and since there is no flame to adjust, there is no danger from fire nor from spoiling the samples by improper heating. Very little attention is required after the samples have been prepared. The jug may be kept in a warm place and covered by a blanket to prevent radiation. If at any reading the temperature of the water in the jug has fallen below 95 degrees F. hot water may be added to bring it back again to 100 degrees Fahrenheit.

Advantages of the Methylene Blue Test

1. All apparatus now in use for making the test is practically "fool proof", and can be used by any intelligent person without special scientific training.

2. Large samples are taken, thus eliminating many sources of error.

3. No expensive equipment is required, nor is a special laboratory necessary.

4. The use of the methylene blue test will enable manufacturers and others to grade milk where it is otherwise impractical or imposible.

5. The methylene blue test—for the great bulk of milk received—is much more accurate than any other method now in use. This, of course, is open to debate but proof is available.

6. The expense of making the methylene blue test is practically negligible. Microscopic counts cost money, are too expensive for ordinary use.

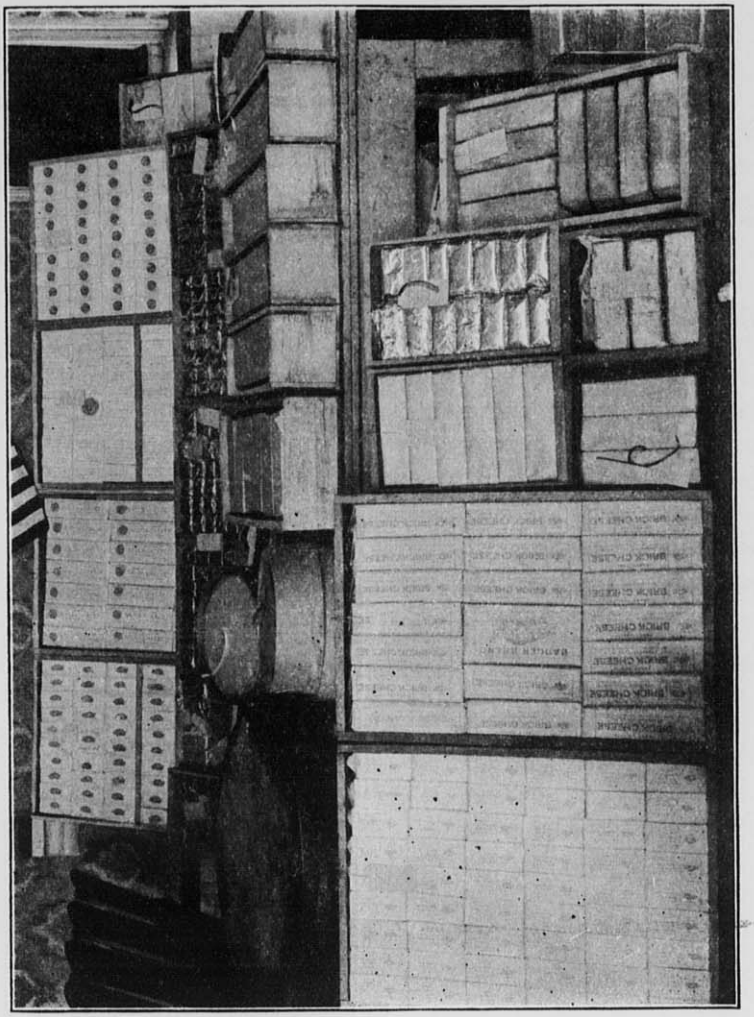
The Methylene Blue Test Used by Cheese Factories

The Wisconsin Cheese Producers' Federation has very recently adopted the methylene blue test as a means of controlling the quality of milk used in their factories. There is evidence already, however, that it is having a wholesome effect on the quality of raw milk delivered to their plants. Here is given a single case by way of illustrating its beneficial influence.

On a certain day in September a test was made of the milk of thirty patrons of one of their factories. The results were reported to each patron on cards. Three days later another test was made of the same patrons' milk. The influence of the first report was plainly marked in every instance except one as shown by the second test.

Four of these patrons had milk so poor that all color had disappeared in less than 20 minutes on the first test. On the second test two of these same patrons had good milk which held its color for 4 hours or more, while the other two had so improved their quality that the color held for nearly one hour.

Only one patron made no improvement, his milk testing exactly the same on the second as on the first test. All the rest moved out of the "poor milk" group over into the "good".



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