FACT SHEET

Agricultural Extension Service ● University of Minnesota

FOOD SCIENCE AND INDUSTRIES NO. 1

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The Microscope and Milk Quality

One method of evaluating milk quality is to count bacteria under a microscope. Technically, the method is referred to as the Direct Microscopic Clump Count. First, the bacteria are stained to make them more visible. Then, under the microscope they are magnified about 1,000 times. Clumps of bacteria are counted as one cell. Whenever individual bacterial cells are separated by less than the diameter of two cells, they are counted as one. A clump may contain a hundred or more bacterial cells, but it is counted as one.

There are good and bad features in all milk quality tests. This, of course, is true of the microscopic procedure. One advantage the microscope offers is a picture of the types of bacteria in the milk. Sometimes this picture can be used to help pinpoint the causes of high bacterial counts. Other times production practices and problems are revealed. In addition, it is possible to detect mastitis and to determine the extent of infection. Also, certain mastitis-causing bacteria can be recognized. Although some of these indicators are crude at best, they can be helpful in a milk quality program. Let's look at some examples of milk as it appears under the microscope:

MILK FROM DIRTY EQUIPMENT

Bacteria in milk are usually round or rod-shaped. They occur individually or in clusters or chains. When milk is handled in dirty equipment, bacteria growing on the surface are often swept off in large clumps. The cells may be round or rod-shaped. Under the microscope they look like clumps. Figures 1 - 4 are typical of milk which, during handling and/or storage, passed through dirty equipment, such as buckets, pipelines, cans, or bulk tanks. Clumps of bacteria are apparent. Keep equipment clean!

IMPROPERLY COOLED MILK

If milk is not cooled quickly or if it is allowed to warm up during storage, bacteria will grow very rapidly. Their numbers will be great, and they will occur most likely in pairs or short chains. Figures 5 and 6 show the small units of bacteria typical of poorly cooled or warm-stored milk. In bacterial growth, one bacterium splits into two. The two remain in close association with each other, thus, the presence of large numbers of pairs of cells.

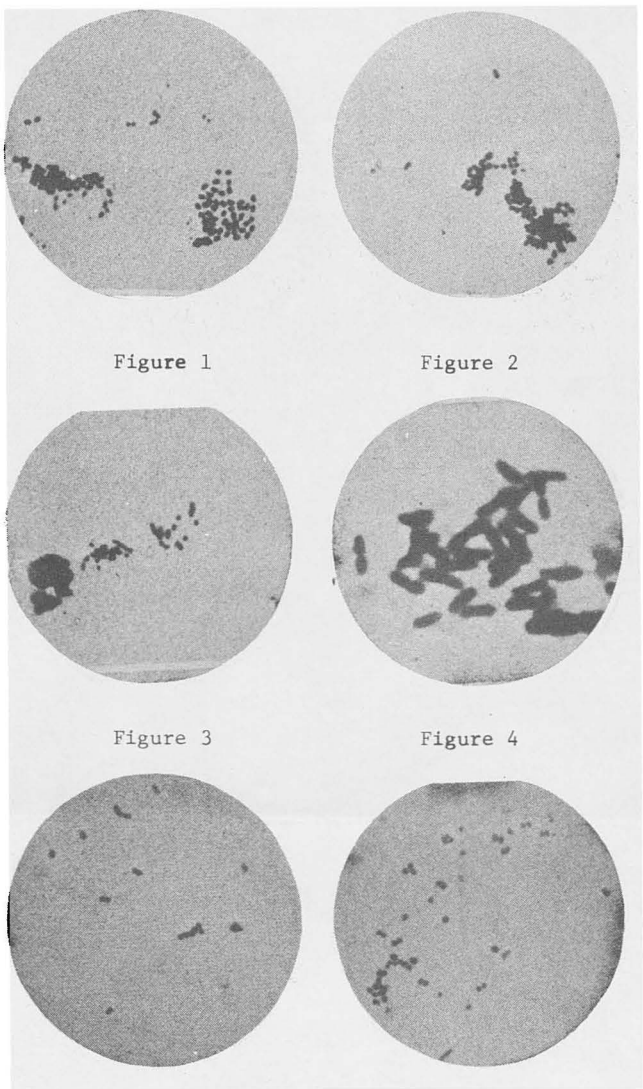

Figure 1 Figure 2

Figure 3 Figure 4

Figure 5 Figure 6

Cool milk to 40° or less within two hours!
Keep it cold!

DUSTY OR DIRTY ENVIRONMENT

Bacteria associated with dust or manure are often rod-shaped. It is not unusual to find large numbers of these bacteria in milk produced in dirty or dusty milking areas or from dirty, unclipped cows. Feeding hay or sweeping barns just prior to or during milking will seed the air, making it difficult, if not impossible, to prevent contamination of the milk. Presence of large numbers of rod-shaped bacteria, such as those in Figure 4, is evidence of such practices.

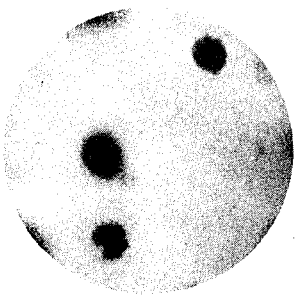

Figure 7

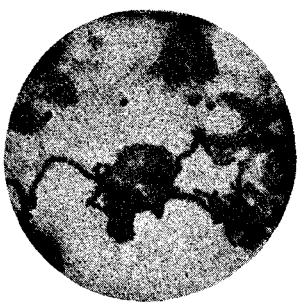

Figure 8

MASTITIS INFECTIONS

One effective use of the microscope is in the detection of white blood cells which are indicative of a mastitis infection. Blood cells can be counted with reasonable accuracy. Their numbers are related to the seriousness of the infection. Large numbers of white cells indicate an acute infection. Figure 7 shows three such cells. In Figure 8 both white blood cells and a long chain of bacteria can be seen. A string of bacteria in this form is typical of streptococcal mastitis infections. Other mastitis-causing bacteria cannot be recognized easily under the microscope.

The microscope is a laboratory tool. If used properly, it can be helpful in evaluating milk quality and determining causes of high bacteria counts. The laboratory technician, the fieldman, and the producer, working together, make a milk quality program effective. All are working to achieve a high-quality, easily marketed food product.

REFERENCE

Figures are from: Elliker, P. R., Practical Dairy Bacteriology. First Edition. McGraw-Hill Book Company, Inc. 1949. p. 102.

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