



## **Analysis of Bacterial Levels in Bulk Milk**

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### **ANALYSIS OF BACTERIAL LEVELS IN BULK MILK – THE FIRST STEP IN THE INVESTIGATION OF MASTITIS AND MILK QUALITY PROBLEMS**

Recent years have seen a move away from the bacteriological analysis of individual milk samples for mastitis and a change towards the use of bulk tank samples. This article explains some of the reasons why this has occurred and some of the results obtained. The major advantage of bulk tank samples is that they give a quantitative reflection of the major organisms present in milk, and this is of great value in the investigation of mastitis and Bactoscan problems. The main disadvantage is that the samples must be kept cool during transport from the bulk tank to the processing laboratory, and special procedures are required to achieve this.

### **SOURCES OF BACTERIA IN MILK**

Bacteria in milk come from three sources

- ?? The milking plant
- ?? external contamination of cows' teats
- ?? mastitis

If there is a problem with cooling and refrigeration of milk, all three sources will contribute to an increased Bactoscan or total bacterial count (TBC).

## BACTERIAL COUNTS

An example of the organisms counted and the standards currently in use by our laboratory are:

	Target value
Total bacteria count	5000 cfu/ml
Thermoduric/LPC	<175 cfu/ml
Coliforms	<20 cfu/ml
Pseudomonads	<500 cfu/ml
Streptococcus uberis	<200 cfu/ml
Total staphylococci	<200 cfu/ml
Staphylococcus aureus	<10 cfu/ml

In addition a semi-quantitative screen is carried out for all other bacteria isolated from that sample

## INTERPRETATION OF RESULTS.....

### THERMODURIC OR LABORATORY PASTEURISED COUNT.

The number of *thermoduric organisms* present is an indicator of poor milking plant cleaning. This may be caused by inadequate quantities of hot water (less than 18 litres per milking unit), inadequate water temperatures, a lack of swirling and jetting during the washing routine, inadequate amounts of dairy chemical used, or particularly hard water leading to inactivation of the circulation cleaner. Many farms are now able to achieve a thermoduric count of 10cfu/ml or lower, although with problem herds the count may rise to above 800cfu/ml.

### COLIFORM COUNTS

Coliform counts are taken as an indication of the amount of faecal contamination on teats. This could therefore indicate a problem with poor premilking teat preparation, poor housing or both. High coliform counts could also arise from cows clinically or subclinically affected by *E. coli* mastitis, with the mastitic milk entering the bulk tank. This could occur, for example, where foremilk is not practised and mastitis detection is poor. Fluctuating cell count and BactoScan values are often associated with increased levels of environmental mastitis.

## **PSEUDOMONAS COUNTS**

Whereas the coliform count gives an indication of the level of faecal contamination of milk, Pseudomonads [non- enteric coliforms] are used as an indicator of general environmental contamination. As with coliforms, values increase with poor premilking teat preparation, poor environmental conditions and mastitic milk entering the bulk tank.

## **STREPTOCOCCUS UBERIS**

Evaluation of Strep uberis (SU) counts in bulk milk has proved extremely useful. High SU counts can be associated with either cell count or Bactoscan problems. There does not seem to be any way of telling whether an increase in SU will produce a raised SCC or a raised Bactoscan. High levels of SU may be due to carrier cows with subclinical infection or missed cases of mastitis due to poor detection. Clinical Strep uberis can have up to 100 million organisms/ml of milk Removal of SU carrier cows from a herd can often produce a dramatic reduction in both cell counts and Bactoscan.

## **STAPHYLOCOCCUS AUREUS**

High Staphylococcus aureus counts are commonly found in herds with high cell counts and indicate that additional attention to hygiene is needed during the milking process to prevent the spread of infection. In a proportion of herds the *S. aureus* levels in bulk milk are quite high and yet cell counts are acceptable. Advice given in these circumstances is that the herd is at risk from a rising cell count, and that there are probably a number of carrier cows present in the herd. To avoid future somatic cell count increases in such herds, strict hygiene during milking and careful post-milking teat disinfection are vital to prevent the transfer of infection. An investigation to check all mastitis control measures are in place is also recommended.

## **TOTAL STAPHYLOCOCCAL COUNT**

The total staphylococcal count was introduced because in recent years there has been an increasing number of herds with high cell count caused by coagulase negative staphylococci (CNS). This range of organisms includes *Staphylococcus epidermidis* and *Staphylococcus haemolyticus*.. Increases in CNS values are sometimes associated with poor teat skin quality.

## **DIFFERENTIAL SCREEN**

The differential screen is a semi-quantitative assessment of other bacteria present in the milk sample. The bacteria commonly found include:

- *Streptococcus dysgalactiae* has been associated with poor teat skin condition, particularly in heifers. This may be due to problems with the milking machine or associated with the use of

poor quality teat dips. High levels of total staphylococci or *S. aureus*, may also be present, as both organisms are associated with poor teat skin condition.

- *Streptococcus agalactiae* is sometimes identified from herds that did not even know that the cows were infected. It is a highly contagious organism and can be the cause of increased bulk milk tank somatic cell counts and high and fluctuating BactoScans.
- *Corynebacterium bovis* has been associated with suboptimal post-milking teat disinfection. If staphylococci levels are rising and *C. bovis* is identified in significant numbers in bulk milk samples, then it would suggest that additional attention needs to be paid to post-milking teat disinfection.
- other organisms include *Streptococcus faecalis*, bacillus species, yeast and moulds. A wide range of environmental organisms is often associated with high coliform and Pseudomonas counts and with an increased incidence of clinical environmental mastitis. Poor housing and/or poor premilking teat preparation could be involved.

## **TAKING BULK TANK SAMPLES**

Ensure that the bulk tank has been thoroughly agitated and the sample is collected into a sterile sample pot. It is essential that the milk remains cool from collection until arrival at the Laboratory. Using thick polystyrene boxes, containing two freezer packs (Icebrix, IB8, SW Scientific), and ensuring that the box is taped air-tight and forwarded by overnight delivery, the majority of samples arrive at between +4c and +8c, which is adequate for processing. Samples at higher temperatures than this are generally discarded.

## **INDIVIDUAL QUARTER SAMPLES**

Although bulk tank bacteriology is very useful, it is not to be used to the exclusion of individual quarter samples, and the correlation between bulk tank results and the prevalence of infected quarters is by no means precise. Additional information can be gained by submitting 6 -10 individual quarter samples at the same time as the bulk tank sample. For example, if the problem is a high cell count, then submission of individual quarter samples will help to confirm the bulk tank results. If a high incidence of clinical cases, then take pre-treatment samples, add 10% glycerol, and store in the deep freeze until they can be sent off as a batch. It is, of course, vitally important to obtain a sterile sample. To achieve this, cleanliness is essential, and also make sure that you forestrip the quarter 6 – 8 times to remove all of the teat canal organisms.

**SLIDES (reduced numbers can be used).**

1. Straw on the milk filter suggests poor premilking teat preparation. It is likely that coliforms and/or Pseudomonads would increase.
2. Washing teats without drying them prior to the application of the machine is a classic cause of raised coliform counts, increased BactoScans and increased coliform mastitis.
3. Poor plant cleaning, as in the case of the butterfly valve (right) from the base of the jar, is a classic cause of raised thermotolerant counts.
4. Poor post-milking teat disinfection can lead to increased *C. bovis* and *Staphylococcus* levels and a subsequent rise in cell counts.
5. Poor teat skin condition can lead to increased levels of staphylococci, *Staphylococcus aureus* and *Streptococcus dysgalactiae*, all of which contribute to rising cell counts.

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