



Handy Helper

Application Note #05

Automating Quality Control of Milk How ProtoCOL can help Prevent Unnecessary Waste

Introduction

Across the developed world, billions of gallons of milk are destroyed every year due, in part, to microbial contamination problems. Most dairy QC laboratories test for a range of microorganisms including *E.coli*, indicating faecal contamination, Psychrophilic bacteria (these break down milk proteins to produce putrid and off flavours) and more dangerous pathogens such as *Listeria monocytogenes*, a causal agent of bacterial meningitis. The laboratories also test for *Mycoplasma*, *Staphylococcus*, *Streptococcus* and *Pseudomonas* spp., which are all indicative of mastitis in the dairy herd. If milk is infected with significant numbers of any of these organisms, it is destroyed to protect public health.

There is also another significant reason why milk is discarded and this is because it is past the manufacturer's recommended sell-by date. This means that although the majority of it is still safe to use, retailers are legally bound to destroy it. To prevent some of this unnecessary milk wastage, many laboratories are assessing and implementing new automated methods to speed up the quality control process, thus ensuring milk is assigned a more accurate shelf life and also arrives at retail outlets more rapidly.

A Case Study on Improving Shelf Life Testing

At I & A Lab, a state licensed contract dairy testing laboratory based in California, USA, the microbiologists have developed a rapid method for determining a more precise shelf life of pasteurised milk. This analysis, which utilises a proprietary formulation of agar, can identify milk with a shelf life of ten days within 20 hours. Using their in-house software, the results of the analysis also allow the laboratory to predict how many days the milk will be in good condition if it is stored at 7°C and how long its shelf life will be if it is kept at 10°C.

Automating Plate Preparation and Colony Counts

For total colony counts, I & A Lab's microbiologists dispense milk samples onto agar plates using an automatic WASP spiral plater (Don Whitley, Shipley, UK), (Figure 1) and incubate the plates for 24 hours.

Figure 1: The WASP spiral plater used at I & A Lab for plating out milk samples.



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After incubation the microorganisms begin to grow as small but distinct colonies and this is when their numbers are determined using the ProtoCOL system (Figure 2). The ProtoCOL is so versatile it can enumerate colonies on spiral plates, as well as standard spread or pour plates. In just a few seconds, the ProtoCOL's camera produces a digital image of the plate and its integrated software counts the colonies to automatically produce results on screen. Since the ProtoCOL has a high resolution CCD camera, it can visualise and produce clear images of colonies as small as 0.2mm. This makes it ideal for enumerating bacterial colonies produced after short incubation times.

Figure 2: Synbiosis ProtoCOL system used at I & A Lab for automating counts of small colonies sampled from milk.



The information obtained through this analysis is automatically transferred into an Excel spreadsheet, a format that is easily incorporated into I & A Lab's own database. The information is used to provide timely reports to dairy plant managers and ensures they are able to determine which batches of milk need to be transported and put on sale first.

Manual Colony Counting

Prior to installing a ProtoCOL, microbiologists at I & A Lab would place plates on a light box, mark colonies with a pen and record the figures in a notebook, a process that could take anything up to 15 minutes per plate. To produce reports, all of this information was then keyed into I & A Lab's database and this provided the potential for errors to occur during data input. Since I & A Lab routinely tests 5000 milk samples per month, they estimate using a manual method would take them around 1200 hours, which is the equivalent of 178 working days just to count colonies. However, by using ProtoCOL, the colony enumeration process has been reduced to less than two working days. In addition, I & A Lab also has the added benefit of secure and accurate record keeping by having their results automatically computer integrated.

Conclusions

Automation, especially of colony counting is key to ensuring small numbers of qualified staff in dairy QC laboratories can quickly and easily perform high throughput testing of large numbers of milk samples. For example, to process 5000 samples each month, I & A Lab employs just nine licensed staff. They attribute being able to be so efficient solely to the use of laboratory automation.

The ProtoCOL system is especially suited to counting colonies from dairy samples because not only is it capable of testing thousands of samples with speed, but it is also able to detect small colonies with a high degree of precision. In addition, because ProtoCOL automatically transfers results to computer and can present them in a GLP compliant report format, it offers an accurate method of keeping records, which will comply with external audits by any quality assurance bodies. In summary, using a Synbiosis ProtoCOL automated colony counter will ensure any dairy QC laboratory increases its productivity to provide timely, accurate results in a highly cost-effective manner.