Shelf-life Testing

Shelf-life testing is important not just to reassure consumers that the milk is safe to consume, *but also to set an expectation for the consumer on how long it should* taste good.

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Thus, there are two elements to consider when establishing the shelf-life of raw drinking milk:

1. That it is free from pathogens
2. That the organoleptic (taste & smell) properties remain per consumer expectation

The process of establishing durability for raw drinking milk should only be started once a Food Safety Management System (FSMS), based on HACCP principles, has been set up and at least one set of compliant microbiological tests, for both hygiene indicator organisms and pathogens, at end of production has been undertaken.

Organoleptic Tests

Once you feel comfortable that you have established good hygiene and control processes and your initial microbiological tests have validated your FSMS, then start by doing your own simple organoleptic tests to give you an idea of longevity. Milk your cows and bottle your milk as if for sale, with no special precautions. Put five or more bottles of this milk in your domestic fridge, to represent how the consumer might keep it.

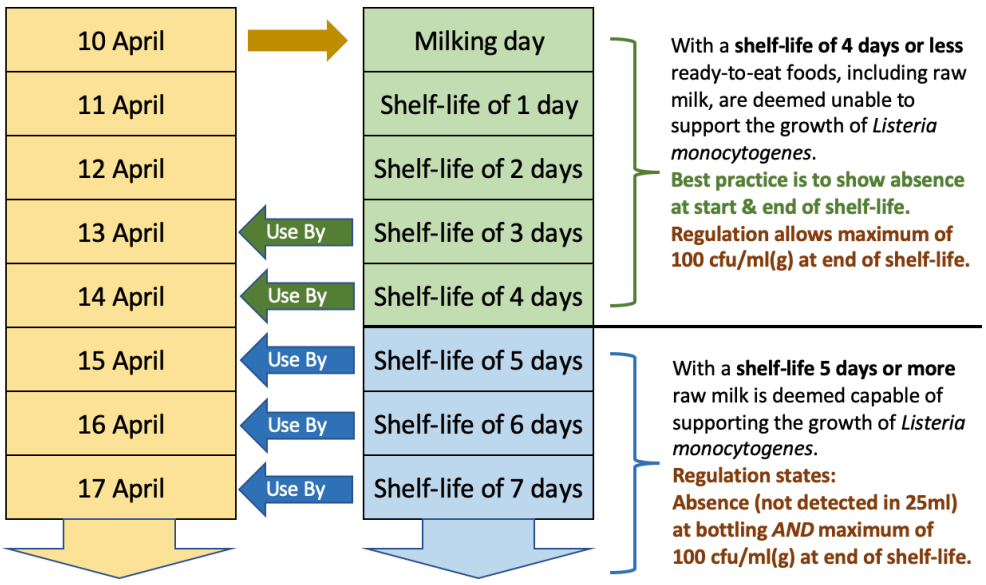
Three days later take out one of the bottles, shake it gently to mix the cream. Pour a nice cold glass and have a taste, sommelier style: warm it in your mouth, swill it around your cheeks and over your tongue, feel the viscosity then swallow. Make a note of the taste and smell. Immediately, do the same with a glass of fresh milk from that morning's milking, chilled to the same temperature. See if you can detect any difference between the two. Sip back and forth between the two glasses – do they taste, smell, feel the same in your mouth?

Repeat this process over the following days, always comparing to a bottle of fresh milk from that day's milking chilled to the same temperature. It is standard practice to include on milk bottle labels "once opened consume within 3 days" to take account of the temperature variations of domestic removal and replacement of bottles from the fridge. However, for the purposes of shelf-life testing you are aiming to find the maximum durability of an unopened bottle. So, once opened, do not reuse that same bottle for organoleptic testing on a subsequent day, always open one of the other bottles stored from the first day.

At some point you'll start to notice a change. This can be due to souring as a result of lactose-fermenting organisms gradually turn the milk sugars into lactic acid, or as a result of spoilage organisms such as *Pseudomonas*.

Pseudomonas are cold tolerant spoilage organisms which can be introduced from mains water in the milking machine or on the bottling line.

That may be on day 4, or 5, or 7, or even day 10. Whichever day it is, use the prior day as your shelf-life target. For example, if you notice the flavour deteriorating on day 6, then use 5 days as your target Use By date for



your subsequent lab tests. To obtain an accurate picture, repeat your organoleptic tests several times and with milk taken from different days of the week, especially on days when the cows may be milked by occasional or relief staff.

pH Testing

To add a little more science to your home trial, measure the pH of your milk each day when you do your organoleptic tests. Fresh milk, once chilled to 4C should be around pH 6.6. Jot down the pH each day, along with your tasting notes. The pH will drop in line with the speed at which lactose is turned into lactic acid: the more lactose-fermenting organisms in the milk, the faster the milk will sour.

Although raw milk inherently contains lactose-fermenting organisms, many of which are the beneficial sort which are fairly lethargic at fridge temperature, some spoilage ones are introduced by faecal contamination: *the more shit in the milk, the faster it will go off!*

Other non-lactose fermenting organisms, such as *Pseudomonas,* will affect quality without lowering the pH. Faecal contamination also increases the chances of pathogenic bacteria being present, which would put the safety of the product at risk.

Thus, a FSMS should prioritise processes that reduce, and ideally eliminate to as great an extent as possible, faecal contamination.
You can buy pH sticks which are easy to use but not so accurate as a pH meter. If you use a pH meter ensure you calibrate it before every use. The pH can change with temperature, so always take the reading at 4C. Health status and diet of the cows can affect the pH reading, so it's useful to get to know what reading to expect, as it's a good indicator of something being amiss.

Lab Tests

It is not possible to justify safety on the organoleptic inspection alone. Having established a target shelf-life from the organoleptic and pH testing repeated over several different batches of milk, the next step is to verify this with lab tests.
It's important to note that *Listeria monocytogenes* can grow at fridge temperatures. Therefore, regulation states different thresholds depending on shelf-life, see previous graphic.

If you are selling milk destined for pasteurisation, then your regular milk testing schedule is likely to include tests performed by your milk purchaser for somatic cell count (SCC) and bactoscan. These test results can be used to meet some of the respective FSA controls for the sale of raw drinking milk. However, as best practice it is strongly advised that raw drinking milk should not be syphoned off from the bulk tank, but should be produced and stored separately under strict hygienic conditions. This milk should be tested separately for coliforms, TVC and pathogens to demonstrate that your FSMS is effective.

It is important to remember that risk is controlled through processes, not tests. The tests are just validating the control processes are working. Understanding risks and putting in place mitigating control processes & validating those controls is what leads to greater safety.

Your documented organoleptic and pH tests should satisfy the requirement to meet consumer expectation for taste and smell. To validate your FSMS supports the desired durability, you need to have the following microbiological tests done at a laboratory at the maximum shelf-life date. Thus, if you propose a 6-day shelf-life you need to arrange to get milk samples to a lab to get the tests done on day 6.

Milk composition and production risks can change through the seasons for most producers and this can affect its durability. It is, therefore, a good idea to repeat your organoleptic and pH tests at regular intervals through the year, particularly at times of significant change to the diet or management of your herd, such as after housing or at turn-out, and reconfirm the shelf-life of your raw milk through further lab tests. Gathering results over time ensures that they are reflective of the milk quality all the time and not just a one-off.

Happy and safe milking!

FOOD SAFTEY TEST	Criteria at end of shelf-life	Approx cost*
Salmonella spp	absence in 25ml	£6
Campylobacter spp	absence in 25ml	£6
E.coli 0157:H7	absence in 25ml	£22
Listeria monocytogenes	<100 cfu/ml	£6
Coagulase positive staphylococci	≤20 cfu/ml	£9
	APPROX TOTAL COST	**£49**

***Costs based on prices from National Milk Laboratories**
cfu = colony forming units
< = less than
≤ = equal to or less than