

Heat treatment alternatives to high temperature-short time pasteurisation of milk

This technical information note provides guidance on determining the minimum holding time and milk heating (time/temperature) combinations used for batch (low temperature-long time) pasteurisation that are equivalent to high temperature-short time (HTST) treatment.

In accordance with the requirements of the Australia New Zealand Food Standards Code, all *milk* (for human consumption) must be pasteurised, unless otherwise stated under an applicable State or Territory law¹. In Victoria, there are no exceptions, and all milk must be pasteurised. Similarly, the Code also stipulates that dairy products need to be processed using a microbial kill step equivalent to pasteurisation, if the milk used in production has not already been so treated. A specific exemption to this requirement does, however, allow some cheese products to be manufactured under certain conditions using alternative heat treatment protocols².

There are three processing options available to meet the regulated equivalent of milk pasteurisation. These include:

- Heating to a temperature of at least 72°C and holding for at least 15 seconds. This process is generally referred to as high temperature-short time (HTST) treatment.
- Heating, using any other time and temperature combination different to HTST which has an equal or greater lethal effect on any pathogenic microorganisms in the milk. This process is generally referred to as batch pasteurisation, or low temperature long time (LTLT) processing.



Batch pasteurisation vat

- Any other process that provides an equivalent or greater lethal effect on any pathogenic microorganisms. Such a process needs to be validated by the business and verified by the regulatory authority (DFS) before it can be adopted.

To determine the required minimum time and temperature combinations equivalent to HTST treatment, an extrapolation from 63°C for 30 minutes and 72°C for 15 seconds can be calculated using the following equation³.

$$\text{Log}10t = -0.23102T + 16.03139$$

Where: T = minimum temperature in °C
t = minimum holding time in minutes.

Alternative minimum holding time and temperature combinations for a batch pasteurisation process, derived from this equation, are listed in Table 1.

Note that the equation is only valid at temperatures, including and between 63° and 72°C. Pasteurisation **must always** be undertaken at a temperature of 63°C or above, and a continuous recording device used to monitor temperature.

Effective heat transfer throughout the product is essential to ensure all milk particles receive the minimum heat treatment, so agitation will be required to ensure this is achieved. Cool air above the milk in a batch pasteurising system may result in not all of the milk meeting the required minimum time and temperature treatment. Vessels should therefore be enclosed during processing to ensure that both the milk and headspace temperatures meet those specified in the company's approved food safety plan. Holding times of less than one minute for a batch process are not appropriate, due to the difficulty in assuring that every milk particle will reach and be held at the required temperature.

Table 1 – Alternative minimum batch/LTLT treatments

Min. holding time (Minutes)	Min. temperature (°C)
1	69.4
2	68.1
5	66.4
10	65.1
15	64.3
20	63.8
25	63.3
30	63.0

This information is relevant **only** to milk with a fat content of less than 10%, with no added sweeteners (e.g. sucrose or flavoured sugar syrups) or particulates (e.g. fruit). Time and temperature combinations to pasteurise products containing high fat, sugar or solids will need to be validated separately to ensure effective time and temperature combinations for heating are achieved. References are available to assist in calculating equivalent heating treatments⁴.

Key points to consider

- In Victoria, all milk for human consumption must be pasteurised.
- Some specific cheese products can be manufactured from milk that is not pasteurised, but only those defined in Standard 4.2.4 of the Australia New Zealand Food Standards Code².
- There are various time/temperature combinations available for batch/LTST processing that are equivalent to HTST pasteurisation.
- For products other than whole milk, careful consideration needs to be given to higher heat treatments and the validation of any such treatment.



Enclosed batch pasteuriser

References

1. Food Standards Australia New Zealand, *Australia New Zealand Food Standards Code: Standard 4.2.4 clause 15 – Processing of milk and dairy products*, Commonwealth of Australia, Canberra, 2013.
2. Food Standards Australia New Zealand, *Australia New Zealand Food Standards Code: Standard 4.2.4 clause 16 – Processing of dairy products to make cheese and cheese products*, Commonwealth of Australia, Canberra, 2013.
3. New Zealand Ministry for Primary Industries, *Operational Guideline: Dairy Heat Treatments*, NZFSA, Wellington, 2003.
4. Australian New Zealand Dairy Authorities' Committee, *Guidelines for Food Safety: Validation and Verification of Heat Treatment Equipment and Processes, Appendix B. Heat treatment equivalence to pasteurisation for common types of dairy produce*, ANZDAC, Melbourne 2007.

Further information

Further food safety technical information is available at www.dairysafe.vic.gov.au

Or contact Dairy Food Safety Victoria on (03) 9810 5900 or info@dairysafe.vic.gov.au

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