THE MEASUREMENT OF PRODUCT PASTEURISATION HOLDING TIME

History

There is a requirement for reliable methods to assess the integrity of p**asteurisation holding times** to enable liquid food processors to examine the pasteurisation time taken for a product to flow through a holding tube or conduit, during the production process without stopping production. The heat treatment of milk and other liquid food products prior to packaging for liquid consumption or manufacture into other products is an important critical control point to ensure that potentially pathogenic organisms are killed. It also ensures that spoilage organisms are eliminated, or at least reduced in number, for optimum keeping quality.

The heat treatment process will vary in temperature and time of heating according to the type of product, packaging and the required shelf life under anticipated storage conditions. Pasteurization processes are normally used for products with a limited shelf life under refrigerated conditions, and for the treatment of milk during milk product manufacture, for example powder, cheese sterilization and UHT processes are normally used for products designed to be stable at ambient temperature.

A pasteurised product as defined is one which has been pasteurised as such, as distinct from a product manufactured from milk, skimmed milk and/or cream which has been pasteurised. A negative phosphatase test is considered to be equivalent to less than 2.2 micrograms of phenol liberated by 1ml of sample (IDF Standard 63: 1971) or less than 10 micrograms of p. nitro-phenol liberated by 1 ml of sample. Environmental health departments and other authorities around the world require holding time tests to be carried out on a regular basis to ensure parameters that may affect pasteurisation of the product are adhered to in accordance with current regulations.

In the past, the industry standard for assessing pasteurisation holding time has been the Conductivity method

This method requires the product to be removed and replaced with water, and measuring the time taken for the water to flow from one point to another point. The dwell time of the water is measured by adding salt, and using electrical detection methods relying on the conductivity differential between the pure water and the water with added salt. Thus the dwell time is determined to be the time taken for the added salt to travel from one point to another point downstream. This test is unrepresentative, because specific heats, viscosities and densities in the various products will differ. Milk for example cannot be expected to behave in the same way as water. Moreover, the plant breakdown needed to exchange fluids could introduce contaminants and could vary the flow characteristics of the plant, so that this disturbance could invalidate the test result.

After many years of experience in the NDE business, Managing Director Mike Bowling who qualified at Cambridge in Ultrasonics, Radiology, MPI/LPI, Weld and casting engineering, Mike decided to challenge this methodology. Having spent considerable time developing various inspection techniques in the aerospace and nuclear industries, this was a good background for the challenge.

In the early 1990s Mike Bowling was Managing Director of a test laboratory, who carried out many examinations in the liquid food processing industry, including conductivity testing of pasteurisation holding times, realising the limitations

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of this technology, and the extended product shut down time needed to carry out the tests, Mike decided to explore a completely different system capable of checking these times accurately and without stopping production.

So, the task was to produce an instrument that could scan the product travelling through the tube from outside, being completely non invasive, robust, quick and simple to operate, and could determine the pasteurisation holding time, logging the results for future upload onto a p.c. program for certificate generation. This was the birth of an instrument technology now known as PASFLO, superseded in 2008 by Pasflo 'W' having Satellite links.

PASFLO 'W'

This method is able to validate the pasteuriser holding time, without stopping production, being completely non-invasive, and having repeatable test results. There are 4 sensors, 2 are connected to the start of the holding tube, and the other 2 are positioned at the end of the holding tube, all sensors are placed on the outside of the tube. Then switching on the Control unit after receiving GPS connection, the next task is to switch on the 2 sensor transmitter units and monitor the flow characteristics when all 3 instruments are linked together through radio telemetry. Once the system is placed into test mode, all recording commences, the test period will continue until the holding time is calculated, normally less than 30 seconds, but occasionally as long as 5 minutes for some processes.

Test accuracy and sensitivity has been checked many times, through industry standard pasteurisation systems, when accurate knowledge of the tube internal dimensions, calibrated product flow rates, and other validations have been available. Test accuracy has also been carried out at a large number of dairy processing factories in UK, when comparing the test results using conductivity, and having the system filled with water, examples of these comparisons are listed below;

COMPARISON TESTS IN UK BETWEEN INDUSTRY STANDARD CONDUCTIVITY AND PASFLO DURING 2004

	Inline flow @ 5,000 ltrs/hr	Inline flow @ 10,000 ltrs/hr	Inline flow @ 15,000 ltrs/hr	Inline flow @ 20,000 ltrs/hr
Conductivity tester result	52.5, 52.0, 53.0 = Av 52.5	41.5, 40.5, 41.0 = Av 41.0	31.5, 31.0, 32.0 = Av 31.5	20.5, 21.5, 20.0 = Av 20.66
Pasflo tester result	52.0, 52.0, 52.4 = Av 52.13	40.2, 40.5, 40.5 = Av 40.4	31.3, 31.4, 31.3 = Av 31.33	20.2, 20.2, 20.4 = Av 20.26

The examples listed are taken from many hundreds of readings from both systems, and it must be emphasised that the Conductivity test sometimes had very random readings due to the amount of salt residues remaining in the system after test, these were not listed. Also, it is important to realise that some viscous products do not react in the same way as water; this has been proven when using the Pasflo system firstly with water, then with product at same parameters.

When site validations are carried out using Pasflo, the results are logged onto an interim report sheet, enabling the client to have test data on the day, and then test results are uploaded to p.c. for Certificate generation.

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