

whitepaper



Ver. 01

The innovative WAVE system

SANOVO WAVE: a New System to Obtain High-Quality UHT
Products? Preliminary Trials and Marker Analysis

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TECHNOLOGY GROUP

Research Focus

In dairy and milk products industry, high-temperature thermal treatments (UHT) are necessary to obtain products with a very extended shelf life. However, high temperature has negative consequences on the final product quality.

There are some innovative methods to obtain high-quality products in high-temperature sterilization, to reduce the fouling and to maintain good nutrition and colour properties. Is SANOVO Wave a comparable method, capable to enter in competition or overcome the current best technologies?

That's one of the ongoing projects of the R&D team of Sanovo Technology Italy

Research Method

We have performed two different trials using our own test plant:

- A conventional pasteurization system using a tubular heat exchanger (the most common technology adopted worldwide)
- A comparison with the same process specification, using SANOVO Wave in combination with the tubular heat exchanger

The differences between the two technologies can be appreciated by some visible indicators as less fouling or better milk colour.

However, we searched for a clear and unique numerical index, commonly accepted as an indicator of good high-quality sterilization methods. We have chosen to measure the concentration of furosine in the final pasteurized product. Measuring the concentration of this molecule in the treated milk we had a quite surprising result.

First of all, what's furosine and why using this substance as an indicator?

Furosine is generated after a heat treatment in the milk as a sub-product of the Maillard reaction.

Maillard reaction is related to browning effects, caramelization and generation of some tastes appreciated in most cooked or roasted foods

Unfortunately, during thermal sterilization, the same modifications happen on milk sugars and this can be the main responsible for bad colour, bad taste and bad smell in milk treated with high-temperature processes.

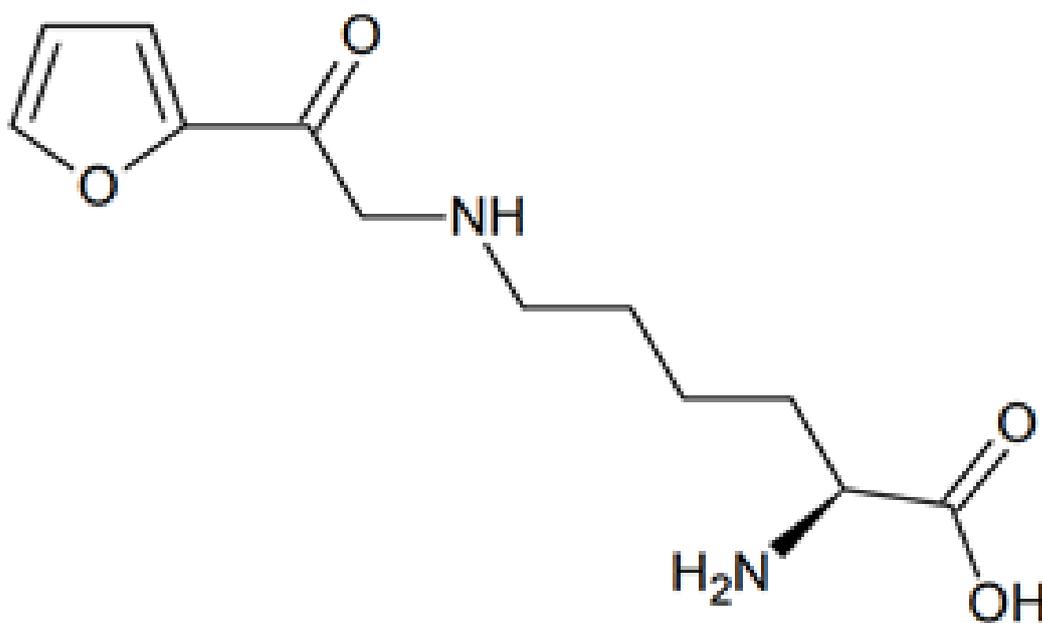


FIG. 1 CHEMICAL STRUCTURE OF FUROSINE

Furosine is one of the most important indicators on the progress of Maillard Reaction and it's widely used as a marker of products degradation. The presence of furosine is an indication of protein biological value loss.

Results

In the experimental trials, we processed a certain volume of raw cow milk and we perform several re-pasteurizations to emphasize the effect of degradation phenomena, having a more and more stressing process on the milk.

The process specification for the conventional heating and wave heating processes was:

	Conventional Process	Sanovo Wave Process
Pasteurization Temperature (1st to 5th re-pasteurization)	85°C	85°C
Pasteurization Temperature (6th and 7th re-pasteurization)	95°C	95°C
Holding Time	20 seconds	20 seconds
Outlet/Sampling Temperature	5°C	5°C

The thermal cycle of the two processes are shown in the following figures:

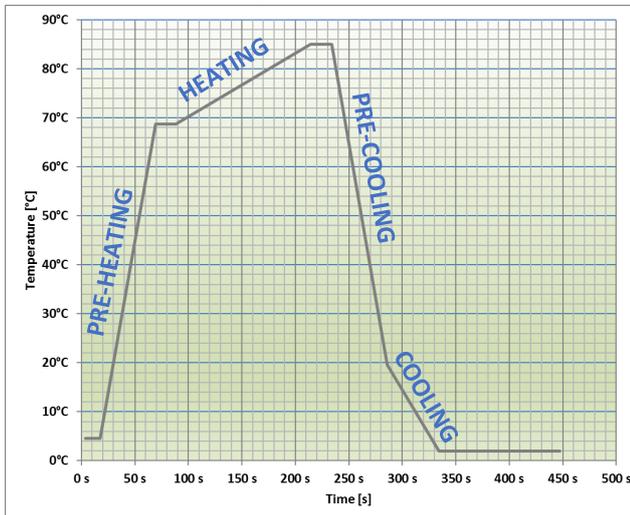


FIG. 2 TEMPERATURE PROFILE IN CONVENTIONAL PROCESS

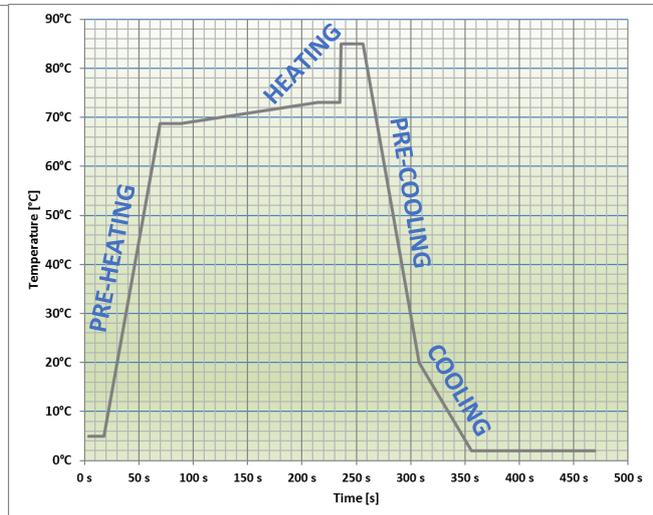


FIG. 3 TEMPERATURE PROFILE IN WAVE PROCESS

From the temperature profiles, it's clear how immediate is the wave heating. The permanence of the product at high temperatures is reduced, compared to the conventional process. The denaturation reactions have a less development rate, due to this condition.

In every test, there have been collected some samples to measure several properties useful for our researches activities. Here we reported the concentration of furosine since, as we said, it's a clearly comprehensible marker of denaturation phenomena.

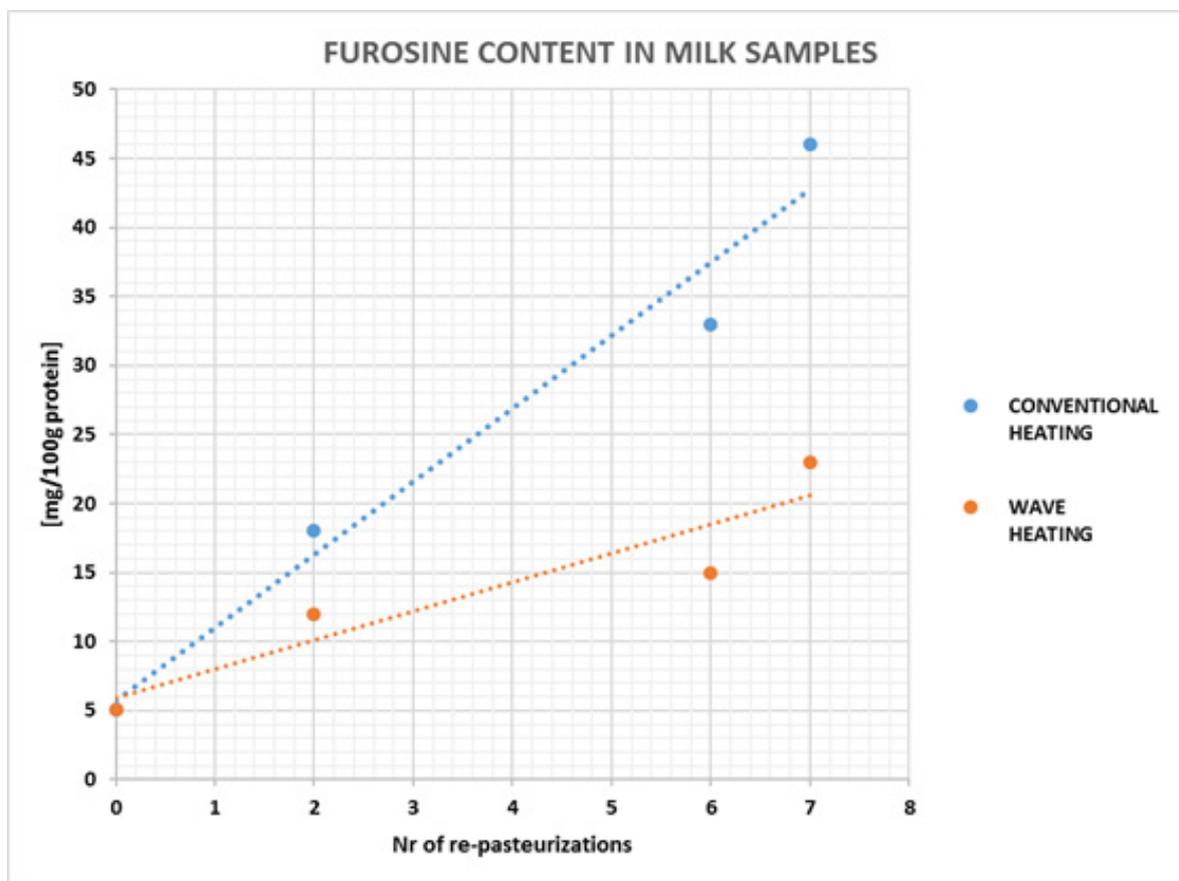


FIG. 4 FUROSINE CONCENTRATION TRENDS

Conclusions

A clear trend is visible in the two different technologies. Wave heating is extremely rapid and the Maillard reaction is less developed than common tubular heating. This means that it is possible to obtain a final product with better colour, better flavour, less protein denaturation and less fouling on the piping walls.

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