Cheesemaking Practice

HTST vs. Batch: The Ongoing Pasteurizer Debate

Before any cheese maker makes his or her first pound of cheese he or she will make this decision: raw or pasteurized. The next decision will be HTST or Batch. The debate is ongoing so I will attempt to explain without bias how the two systems differ.

Batch Pasteurizer

HTST: High Temperature Short Time Pasteurizer

Any cheese maker can be pasteurized by smaller cheese makers and the number one criteria that carries the most weight is capital cost; a batch pasteurizer may cost less than an HTST. In many cases the model that is emulated in the US is one that may mirror the small farmstead operator in Europe who used to make raw milk cheese and has been forced by regulation to first pasteurize their milk before making cheese.

On this scale a batch pasteurizer can likely be introduced into their operation with the least amount of modification to the existing infrastructure.

Principle Of Heat Transfer

A batch pasteurizer is in essence a tank surrounded by a cavity of water or a tank with very small film of water being pumped across the surface.

In the case of cavity vessels hot water may be heated with an electric element, steam or the hot water may be heated with an electric heating element, steam or a tank with very small film of water being pumped across the surface.

The temperature of the water in these systems is unlikely to be greater than 212° F and is typically between 180° F and 200° F.

The water heats the stainless steel liner of the batch pasteurizer which in turn heats the milk. The temperature differential across the stainless steel wall ranges from 130° F when the milk is cold to 40° F when the milk is at 145° F in the pasteurizer at the end of heating.

In one installation viewed recently I observed that this particular batch pasteurizer was being heated with steam above the condensate causing extensive burn on the wall of the tank at the milk to air interface; this is because the temperature on the stainless steel wall of the vessel was being exposed to a temperature approaching 300° F. I believe this to be an incorrect use of steam and changes will be made. The Delta T in this situation ranged from 260° F to 150° F. Low temperature treatments given to the milk, warming up, final heating and cooling down. The milk is cooled down to the desired temperature required for culture and coagulation in the cheese vat.

In an HTST the milk is exposed to less elevated temperature for less time than a batch system. The consequences of this are less denaturation of the whey proteins when milk is treated with an HTST than a batch.

The negative consequences of protein denaturation are: poor coagulation in sweet curd cheeses and poor drainage characteristics for acid drained curd such as Quark, Chevre and laddled acid curds. When milk is heated whey proteins form an attachment to the casein in the milk in such a way as to interfere with the action of rennet on the casein and prevent it from forming a good set.

In the batch system the milk then has been cooled down to the desired temperature for arrival at the cheese vat. This step, unlike the HTST, requires additional equipment in the form of a source of cool water.

Initial cooling may be done with cool ground water and finished with a chilled water source which will have required the use of refrigeration chiller or ice bank system. If this step is completed in the batch it will be quite slow and energy intensive.

A greater modification for cooling milk after batch pasteurizing is to run it through a dedicated cooling plate en route to the cheese vat and counter flow cold water from an ice bank or chiller. Through correct sizing it is possible to have the milk in the cheese vat in say 10 minutes at the desired temperature.

Many operators of batch pasteurizers fail to add the cooling equipment necessary to get the temperature down quickly. They save some capital but have a milk that is more damaged (denatured) by heat than an HTST; have milk that often has an elevated sweetness and lightly caramelized flavor due to milk break-down of the sugar and mild Maillard reaction, a reaction between lactose and milk protein, and have an increased energy cost in the form of gas or electricity, and considerably more labor cost.

All theses have their pros and cons, and HTST may cost more but not much more than a good batch system setup with appropriate cooling.

To pasteurize a fixed volume of milk in one hour a batch system requires double the heating energy of an HTST; add to this the energy to cool and you see that the operational cost to operate a batch pasteurizer is two to three times, not a green option.

The plates are placed very close to each other, creating a thin film of milk millimeters thick. In addition the plates are not flat but ribbed, causing the milk to remain in very close contact with the plate and causing very efficient heat transfer.

The milk entering the regenerative section at 35° F will be exposed to milk on the other side of the plate at approximately 140° F, a Delta T of 105° F. This milk then enters the heating section where it will likely be exposed to a plate backed by counter flowing hot water at a temperature of between 5 and 10 degrees above the desired temperature of the milk.

Where the desired temperature is 162° F the water temperature may be as low as 167° F but for this exercise let’s assume 163° F is the desired temperature and 169° F is the water temperature, a Delta T of 6° F for not less than 16 seconds.

In an HTST there are three brief

FROM OUR ARCHIVES

50 YEARS AGO

Feb. 13, 1959: St. Paul, MN—Some important clues in studies on “cold storage” bacteria called “psychrophiles” – the kind that cause milk, cottage cheese and other dairy products to spoil even though refrigerated, were recently reported by the University of Minnesota.

Madison—Bacteria used for cheese starters can be spray-dried effectively, according to UW-Madison bacteriologists. This was a simpler and less expensive process than the freeze-drying methods now used for making dried lactic starters.

25 YEARS AGO

Feb. 17, 1984: Alexandria, VA—Dairy industry representatives from across the US gathered here this