How a Data Logger Can Help You

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The most common request that I receive from processors is for help with a cooling deviation for a cooked product. The first thing that I will ask for is the times and temperature records that they have for the process in question. Sometimes processors will send me a dozen pages from their data logger, that has product temperatures recorded every 1 to 5 minutes. More often, processors will send me the 3 temperatures and times that they have recorded on their HACCP monitoring form.

The problem with the latter option is that the pathogen modeling programs require a minimum of 5 sets of times and temperatures to run the cooling models. There is a way that I can use the 3 sets of numbers to calculate a straight cooling line, however, cooling curves are not straight lines and the numbers that I generate are more likely to predict higher *C. perfringens* growth than if I had more numbers.
For example, a while back a processor contacted me about a cooling deviation and provided me with the following 3 cooling times and temperatures:

Clock Time	Process Time (hrs)	Temperature	Temperature
12:05 pm	0	135.1°F	57.3°C
1:15 pm	1.17	80°F	26.7°C
6:55 pm	6.83	39.9°F	4.4°C

From the process time, which is uploaded into the modeling program, you can see that it was the 80°F to 40°F time (5 hrs) which was exceeded during this cooling process. I was able to calculate the following additional temperatures that the model needed, using Excel:

Process Time (hrs)	Temperature	Temperature
0.05	114.8°F	467°C
2	92.1°F	33.47°C
4.5	63.1°F	17.37°C

I entered 5 times and temperatures into the Combase Perfringens Predictor, which predicted about 0.46 log of *C. perfringens* growth during the cooling process (See Fig. 1). As you know, the guideline for maximum *C. perfringens* growth is 1 log, so this cooling process is safe.

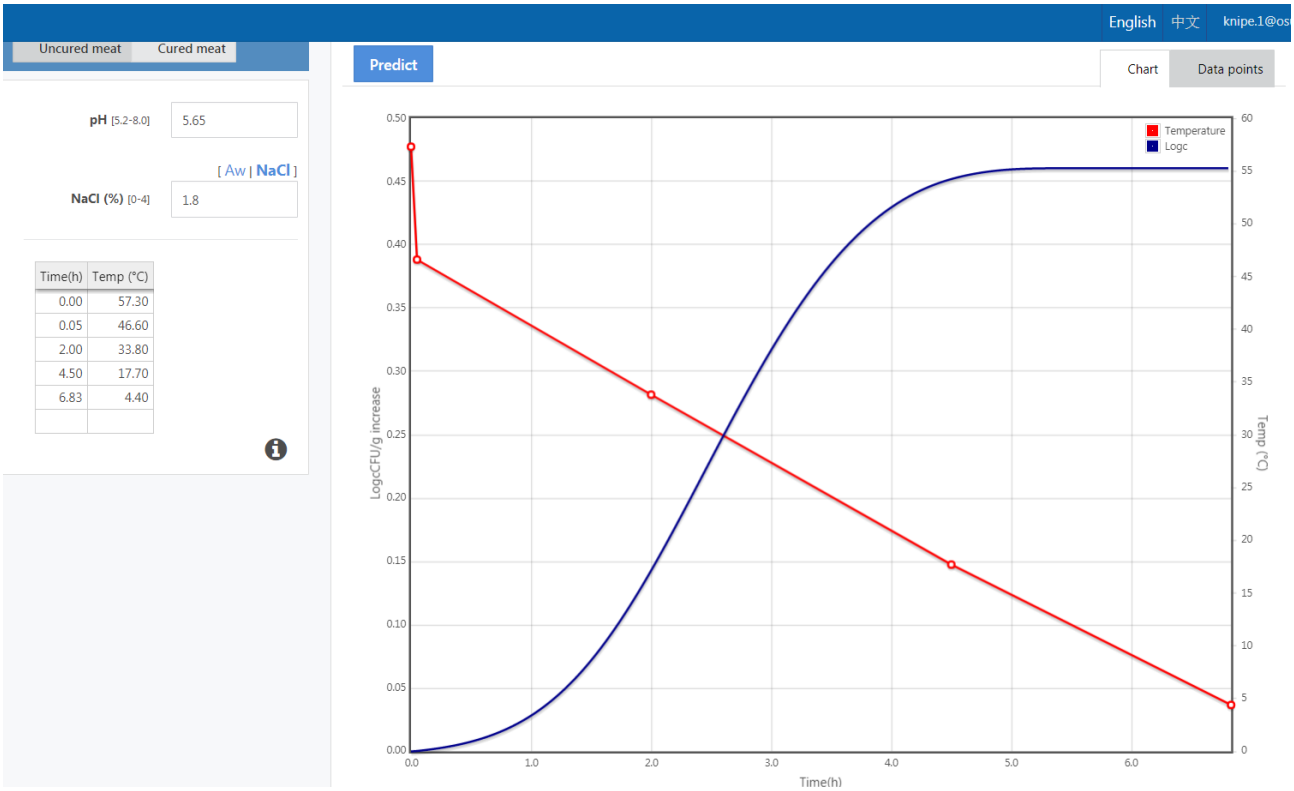

Figure 1. Combase Perfringens Predictor Results using 5 Times and Temperatures

The processor who had sent me the 3 times and temperatures in Fig. 1 later told me that he had a data logger, and he sent me his data logger temperatures/times for the product modelled in Fig 1. It is understood that the more temperatures that you have to enter in pathogen modeling programs, the smaller the predicted *C. perfringens* growth. I uploaded the data logger times and temperatures, starting with the "0 time" temperature of 57°C (135°F), and entering product temperatures that were recorded by the data logger every half hour. From these 15 times and temperatures, Combase calculated the following *C. perfringens* growth:

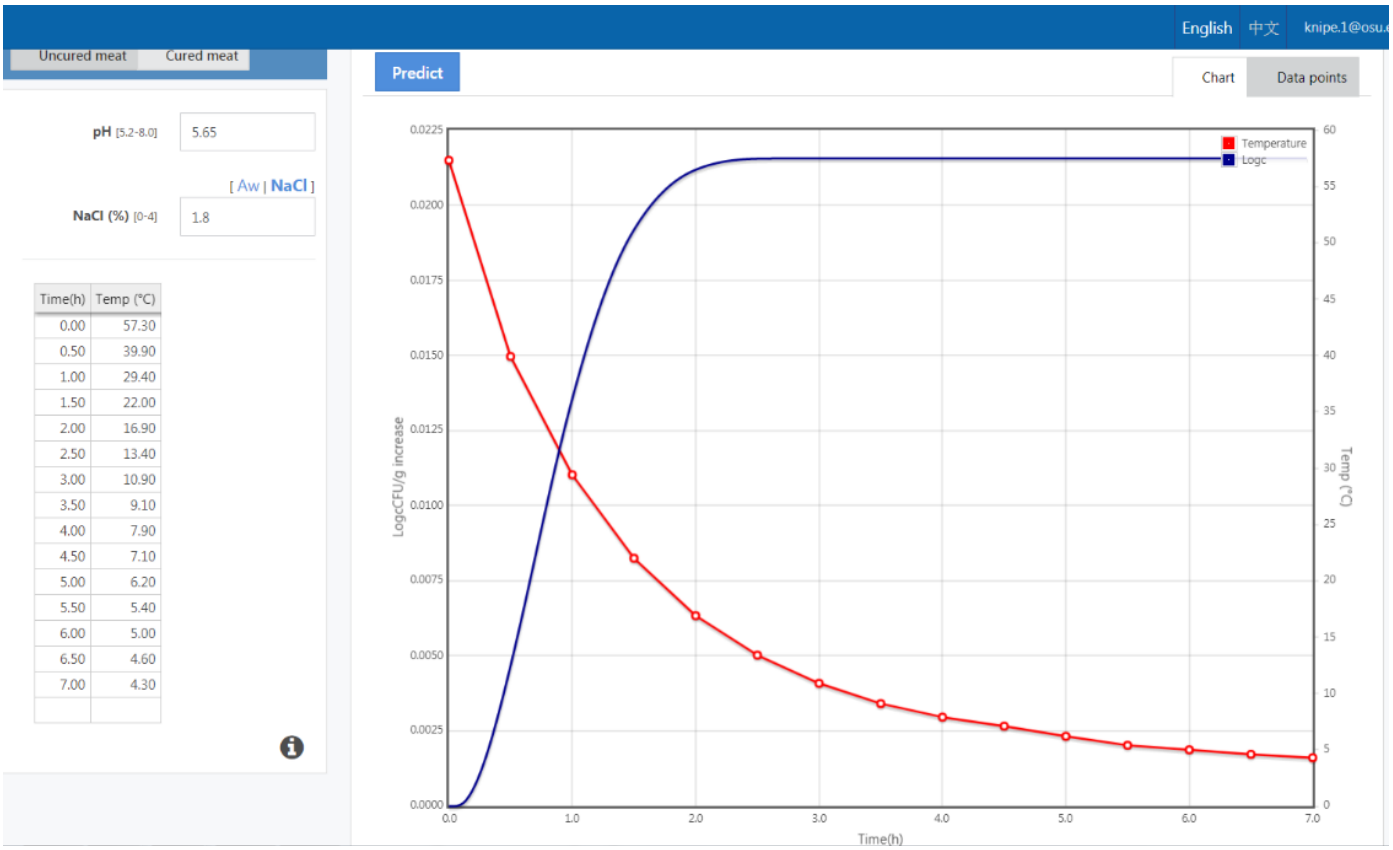

Figure 2. Combase Perfringens Predictor Results using 15 Times and Temperatures

This second model, in Fig. 2, where the time between temperatures is a half hour, predicted *C. perfringens* growth of 0.023 log, which is much lower than was predicted in the first model. In this example, both models predicted *C. perfringens* growth of less than 1.0 log.

The model, in Fig. 2, shows that additional actual times and product temperatures gives a curved line, rather than a straight line, as seen in Fig. 1. The curved line is due to the product temperatures dropping faster in the first couple of hours of the cooling process than they do later in the process when the product temperature is closer to the air temperature. A major factor in the speed of chilling is the temperature difference between the product and the air temperature where you are doing the chilling. The straight line used in the first model (Fig. 1), suggests that the product is cooling much slower, which would allow *C. perfringens* to grow faster. So, it is also to your advantage to have more times and temperatures.

For processors who can't justify purchasing a data logger system, I would encourage them to record every temperature that they take (along with the corresponding time), when they are waiting for their product to reach 80°F or 40°F. Then in the event of a deviation, they are more likely to have more than 3 times and temperatures, that they can use in a pathogen modeling program.

I also get phone calls and email messages from processors who have had either a smoke house or a cooler shut down, overnight, and the processors are trying to determine if the product which was in either the smoke house or cooler was safe to consume the next morning. It is often not clear how long the smokehouse or the cooler has been off, or how long the product temperature may have been in the danger zone (40-140°F). Chart recorders or data loggers could help with this problem, as long as they are recording.

Another possible solution to this problem is a temperature monitoring system, that has wireless alert capability. Such a system would text, or call you, on your cell phone when there was a temperature problem with your products, ovens or coolers. It could be monitoring internal temperatures of products in your oven or cooler, surface temperatures of carcasses in the chill box, as well as cooler and freezer temperatures. While this alert system might interrupt a good meal or a good night's sleep, you would know almost immediately when there is a temperature problem with one of your products. Catching such problems early could help to prevent costly product losses.