Warming the Christmas cheese takes time

Questions should be of general interest and be about temperature measurement techniques and/or heat transfer.

QUESTIONS ANSWERS

QUESTION: A key feature of the traditional Scandinavian Christmas smörgåsbord is a large round of hard cheese, often set in pride of place on the table. It's common knowledge that cheese should be eaten at room temperature rather than straight out of the fridge. But with such a large piece of cheese – in this case weighing 2 kilos – how long would it take to warm the refrigerated cheese up to room temperature?

ANSWER: Once outside the fridge, the temperature of the cheese will vary according to both the position inside the cheese and the time. Heat is transferred to the cheese by conduction from the underlying surface on which the cheese is sitting, plus by convection and radiation influencing the other surfaces of the cheese. Figure 1 shows the temperature distribution within the cheese while it is warming up, and Figure 2 shows the temperature of the cheese as a function of time.

A numerical solution to the thermal conductivity equation with the pertaining conditions is of course possible. The geometry is simple but the cheese mass is not homogenous and the boundary conditions are complex. The simplest procedure is to measure the temperature of the cheese using an insert probe for food.

If we measure the temperature of a cheese of 2 kg we find that it takes about 12 hours for the temperature at the centre of the cheese to rise to a few degrees under room temperature. The temperature of the cheese surface rises faster, so in practice we do not have to wait so long to start eating the cheese at the "right" temperature.

Determining the temperature of foods always requires special consideration. Long response times, plus the length and diameter of the insert probe, are factors that influence measurement error.

If you have comments or questions, contact Professor Dan Loyd at the Institute of Technology at Linköping University: dan.loyd@liu.se

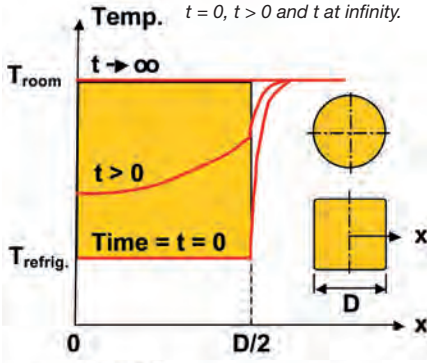

Fig. 1. The temperature distribution inside and outside the cheese at different times: t = 0, t > 0 and t at infinity.

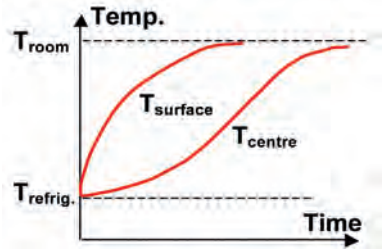

Fig. 2. Time curves for the temperature at the surface respectively the centre of the cheese.