

## Phase transition temperature of fats

### Introduction

The physical properties of fats such as butter and margarine are due mainly to the melting and solidifying behaviour of the triglyceride mixture. In general:

- unsaturated and polyunsaturated triglycerides have a lower  $T_m$  than those with saturated fatty acid residues of the same length; and
- triglycerides with short-chain fatty acid residues have a lower  $T_m$  than those with long-chain fatty acid residues.

The melting of a pure organic compound occurs at a well-defined and narrow range of temperature, but the melting of margarine and butter usually takes place over a range of temperature – often more than 30K. At any temperature within the melting range, there is a proportion of liquid and solid fat. The presence of a liquid component within the crystalline solid fat allows it to be spread – even when cold in the case of many margarines.

### Aims

Today, you will investigate the solidifying behaviour of some edible fat mixtures by determining their cooling curves. The fats to be studied include sunflower margarine, lard, chocolate (of course!) and, for comparison, octadecanoic acid (a pure organic compound). Datalogging equipment will be used to obtain a large number of temperature readings with minimum effort.

### Apparatus

Goggles	Stand with two bosses and clamps
Bench mat	Datalogging equipment with temperature sensor (alternatively use a thermometer and stopwatch)
250cm <sup>3</sup> beaker	
Boiling tube	
Bunsen burner, tripod and gauze	Sample of edible fat mixture ( <b>do not eat any!</b> )

### Methods

1. Clamp the boiling tube and spoon in your chosen fat to a depth of about 5cm.
2. Heat about 75cm<sup>3</sup> of water in the beaker until boiling, then move the stand so that the tube of fat enters the water.
3. Allow the fat to melt, then mount the temperature probe and place its tip in the melted fat.
4. Leave the equipment for a further few minutes to allow the temperature probe to equilibrate to the temperature of the fat.
5. Move the stand so that the tube of fat is no longer in the boiling water and begin taking readings.

### Results

Process your results into Microsoft Excel. Create and print out a suitable graph.

### Conclusions

Compare your results with those for the other fats and the octadecanoic acid. What do you notice? Explain your results in terms of the likely compositions of the fat mixtures (the labels may help).