

INVESTIGATING FLOURS (Suggested responses)

Method 3

Aim

Investigating what happens when a gelatinised starch is frozen.
Repeat Investigation 1 (with plain white flour), cornflour and arrowroot.

Equipment

As in Investigation 1, plus cling film, freezer, refrigerator.

Investigation

- Cover the 3 (clearly labelled) small bowls with cling film and place in the freezer and leave overnight.
- The following day, remove from the freezer and allow to defrost in the refrigerator.
- When defrosted, observe the appearance and texture of the gel – firstly in the bowl, and then removed from the bowl (tipped on to paper as in Experiment 1).

Results

Create a table to record your results.

	Plain white flour (wheat flour)	Cornflour	Arrowroot
			
Surface appearance	Spongy, a little cracked, 'feathery', wet.	Flat, glassy, like fondant icing.	Soft, slightly uneven.
Texture of the gel	Wet, soft, spongy, falls apart easily when touched.	Soft, spongy, very wet.	Soft, not crumbling – it stays together, feels wet but is not leeching water.
General observations	The defrosted wheat flour thickened solution has not held the water well. The surface appearance once defrosted is 'feathery' and it looks grainy. When you squeeze it, it falls apart easily.	The defrosted cornflour thickened solution has not held the water well. The surface appearance once defrosted is flat and free from marks. When you squeeze it, it keeps its shape well, although a lot of water is released.	The defrosted arrowroot thickened solution has held the water well. It feels soft and gloopy, and holds its shape pretty well, but breaks up if you squeeze it firmly. Free water is not released.

Conclusions

What do you see on the surface of each gel? Refer to observations sheet above

Then, remove the gel from the bowl and tip on to the white paper.

Again, what do you see? How do the defrosted gels feel? I can see free water leeching out from both the wheat flour and cornflour thickened solutions, the paper is wet. The arrowroot gel feels soft and wet, but there isn't any free water leeching out. The paper is less wet than the wheat and cornflour paper.

Can you explain what is happening? When making and freezing sauces with certain starches, freezing and then defrosting can cause the gel to 'weep'. What happens is that the liquid leeches out from the gel, causing the gel to become less stable. This is known as retrogradation.

How do you think caterers and food manufacturers would apply this knowledge when making dishes and products that are to be frozen before serving? If they were making a sauce using wheat flour, and planning to freeze it, it must be reheated before serving, e.g. a lasagne with a wheat flour thickened béchamel sauce. Arrowroot is the most freeze-thaw stable of the three starches tested. Food manufacturers use modified starches in their dishes, which have been specifically formulated to avoid free moisture leeching.

Extension task

Find out if there are any recommended ingredients that caterers and food manufacturers may use when making a product that uses starch, and the finished product is to be frozen. Hint: research the ingredient 'modified starch'.

Expand this investigation with other flours, such as potato flour and rice flour. Can you think of any other flours? Which starches perform least well after freezing? How will this affect the eating qualities of the finished dish?