9

Short pastry

9.1 Why does our pork pie pastry go soft during storage and what can we do to make our pastry crisper?

The softening of pork pie pastry (and the pastry of many other composite products) arises because of the migration of water from the moist filling to the dry pastry. The driving force for this migration is the difference in the component water activities. Cauvain and Young (2000) give typical water activities for savoury pie components as pastry 0.24, jelly 0.99 and filling 0.98.

Key factors that influence the rate at which water moves between components in savoury pies and the rate at which the pastry softens include the following:

- The storage temperature (Butcher and Hodge, 1984); the lower the temperature, the slower the rate of moisture migration.
- The absolute difference in water activities between the components; the greater the difference, the faster the moisture migration.

Fat also migrates during the manufacture of pies but most of this occurs in the oven when all of the solid fat has turned to oil and is therefore mobile. At ambient or lower temperatures the solid component of the fat cannot move within the pastry matrix. In the past, part of the softening of pie pastry has been attributed to fat migration but if this occurs it is a minor contributor to pastry softening. In fact the migration of oil into the base pastry under the influence of gravity in the oven probably contributes to keeping the base pastry from softening. The oil fills many of the microscopic voids formed in manufacture in the base paste and probably acts as a waterproofing agent so preventing the ingress of significant quantities of water.

As discussed above the main cause of lack of pastry crispness is associated with the movement of water from the moist filling to the drier pastry. The most common way to reduce this problem is to manipulate component water activities to reduce the ERH differential. However, in the case of savoury pastry reformulation of filling and pastry tends to be a limited option so that other means of maintaining pastry crispness must be sought.

One way of achieving a crisper pastry is to increase the initial crispness of the pastry so that even though it softens at the same rate, the crispness at any given storage time will be greater than normal.

In summary the opportunities for improving pastry crispness are:

- lower the temperature to slow the rate of moisture migration;
- reduce the absolute difference in water activities between the components;
- use the hot paste method which gives an initially crisper pastry;
- increase the protein content of the flour used in the manufacture of the paste;
- cool the pies thoroughly before adding the jelly.

References

BUTCHER, G.J. and HODGE, D.G. (1984) Pastry technology: the softening of pork pastry during storage. *FMBRA Report No. 116*, CCFRA, Chipping Campden, UK.

CAUVAIN, S.P. and YOUNG, L.S. (2000) *Bakery Food Manufacture and Quality: Water control and effects*, Blackwell Science, Oxford, UK.

9.2 We are producing unbaked meat pies but find that the short pastry lid cracks on freezing. The cracks become larger when the product thaws and during baking the filling may boil out, leaving an unsightly blemish on the surface. Why is this and what can we do about it?

In the freezer the fat in the unbaked pastry contracts by about 10% in volume whereas the aqueous phase expands. This differential in expansion causes stresses to build up in the paste which may exploit any microscopic weaknesses in the paste, turning them into visible cracks. The movement of air across the unbaked product during the freezing operation removes a small amount of moisture from the surface until ice is formed. This drying out of the paste also exacerbates the problem.

The level of gluten formation in short pastry is relatively modest compared with that developed in puff paste or bread doughs. This means that the gluten lacks any significant degree of extensibility and so during sheeting or blocking there is a tendency for the gluten network in the paste to become ruptured, if not visibly then certainly at the microscopic level. The cracks formed are most obvious on the lid because they are readily visible but almost certainly occur in other parts of the product.

In addition to being extensible the gluten network should not be elastic since this increases the stress on the paste. Increased elasticity is most likely to come from overmixing of the paste. The use of a stronger flour may have some advantage in reducing the problem.

Robb (1985) suggested a number of practical remedies for the problem. They included:

- increasing the paste water content;
- reducing the fat content;
- keeping paste mixing times to a minimum consistent with forming an homogeneous paste;
- blast freezing the pies and trying to minimise moisture losses during storage;
- keeping the proportion of trimmings in the lid pastry to a minimum. Incorporating trimmings into the base paste whenever possible.

With some products where the paste fits tightly around the filling, for example sausage rolls and Cornish pasties, there may be some advantage in lowering the filling moisture content to reduce the degree of any physical expansion.

Reference

ROBB, J. (1985) Pastry technology: cracking of frozen meat pie pastry. *FMBRA Report No. 126*, CCFRA, Chipping Campden, UK.

9.3 Our baked pastries and quiches are baked in individual foils. Why do they have small indents in the base, which project upwards and are pale in colour?

This problem has a similar cause to that described for fermented products in pans (see 6.2), namely that steam is trapped between the pastry and the foil case during baking and since it cannot escape then pressure builds up in some areas and forces the pastry upwards. Since the pastry has not coloured it is likely that this event has occurred early in the baking process.

In the case of the pastry the blocking process itself helps to create the impermeable seal necessary for the steam to remain trapped. It may be that some of the indent is created as the die withdraws, though even hand-blocked products have been known to show the problem.

The most obvious solution to your problem is to use foils with small perforations in the base. However, you should look closely at the location of the holes which should be at the lowest point of the foil, or if the foil concerned has more than one low point then holes should be present in each of the low areas. Even though the holes are small in size, typically, 1 mm, the pressure generated by the hot gases will still allow the steam to diffuse through them.

If the problem persists you should look at your baking conditions. The problem is always exacerbated by baking at high temperatures for short times and with high bottom heat. If you suspect that this is the case then try reducing the temperature and increasing the baking time.

Allowing the pastry case to rest after blocking and before filling and baking can also reduce the problem.

9.4 How can we make the sweet pastry that we use with our apple pies crisper eating?

The cause of sweetened short pastry softening is the same as that discussed for savoury pastry, namely that it is because of movement of moisture from the moist filling to the drier pastry. In contrast to the situation in a savoury product there are many more potential ways to extend the crispness of sweetened pastry products because of the greater potential for recipe reformulation.

Potential ways of keeping your pastry crisper include the following (Robb, 1991):

- Lowering the storage temperature.
- Reducing the differential in ERH between pastry and filling through reformulation. This can include the addition of sugar to the pastry or filling, or the addition of humectants such as glycerol to the filling.
- Omitting baking powder from the pastry formulation.
- Ensuring that any stabiliser in the filling has had sufficient time to become effective. Some stabilisers may require several hours to achieve optimum control over water activity.

Another possibility is to include a barrier between the pastry and the filling. Any such barrier must be edible and should not significantly change the product character. Cauvain (1995) provided some examples of suitable moisture barriers (see Fig. 26):

- A protein solution – egg albumen – sprayed on the pastry before depositing the filling.

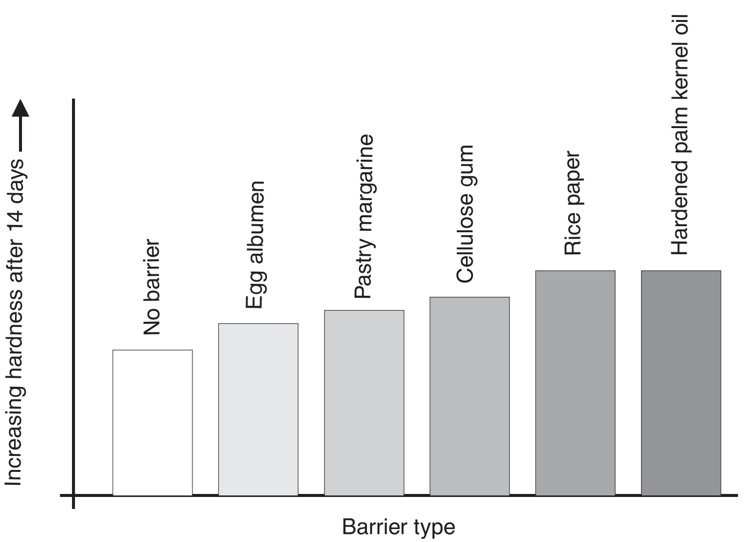

Fig. 26 Effect of barrier on short pastry crispness.

- A gum solution – carboxy methyl cellulose – sprayed on the pastry before depositing the filling.
- A rice paper disc placed on the pastry before depositing the filling.

References

CAUVAIN, S.P. (1995) Putting pastry under the microscope. *Baking Industry Europe*, pp. 68–69.

ROBB, J. (1991) Moisture migration in apple pies. *FMBRA Report No. 145*, CCFRA, Chipping Campden, UK.

Further reading

CAUVAIN S.P. and YOUNG, L.S. (2000) *Bakery Food Manufacture and Quality: Water control and effects*, Blackwell Science, Oxford, UK.

9.5 From time to time we experience problems with the sheeting of our short paste; in particular it cracks or fails to remain cohesive. Why does this happen?

Gluten formation in short pastry doughs is not normally considered necessary. Traditional multistage methods of dough mixing were evolved to try to minimise the potential for gluten formation by 'waterproofing' the flour proteins with fat. While the degree of gluten formation required in the manufacture of short pastry is considerably less than is required in breadmaking, some is desirable so that the paste units or sheets remain intact during the forming and sheeting processes, otherwise cracks may form on the surface of the pastry. In extreme cases the crack may extend through the pastry sheet, causing it to break into two separate pieces.

Too much gluten formation in short pastry commonly leads to problems associated with shrinkage during sheeting, blocking, forming and during baking. Getting the balance between too little – lack of cohesion – and too much – excessive shrinkage – requires careful control of recipe and mixing conditions.

As might be expected the level of water used in the recipe plays a major role in determining the rheological properties of the final paste (Cauvain and Young, 2000). Too little and the paste will not form a cohesive sheet, too much and the paste will be too soft to process. The final paste rheology is also affected by the added fat level and to a degree fat and water are interchangeable in their effect on paste firmness: more fat gives a softer paste which can be offset by reducing the added water level. However, fat and water have completely opposite effects on gluten formation with fat inhibiting gluten formation and water promoting it.

Taylor (1984) studied the effect of mixing method for the manufacture of puff pastry and found that cracking of short pastry was more influenced by the length of the mixing time than the mixing method used. Short pastes mixed on a high-speed mixer tended to be more friable and prone to cracking because of the short mixing times employed. These findings confirm the need to develop a limited degree of gluten in the paste in order to minimise cracking of the sheets.

We suggest that you first investigate the effects of increasing mixing time. You may notice a small increase in paste temperature which can be readily compensated for by lowering the water temperature. If you still have the problem when you have optimised mixing time then we suggest you try raising the added water level.

References

CAUVAIN, S.P. and YOUNG, L.S. (2000) *Bakery Food Manufacture and Quality: Water control and effects*, Blackwell Science, Oxford, UK.

TAYLOR, S.L. (1984) The mixing of short paste. *FMBRA Bulletin No. 5*, October, CCFRA, Chipping Campden, UK.

9.6 We are having difficulty in blocking out savoury pie paste in foils. There is a tendency for the dough to stick to the block, causing the base of the foil case to become misshapen. We do not have the same problem with our sweetened paste. Why?

The problem is most likely to be associated with the temperature of the block that you are using. In particular you are more likely to experience the problem when the block temperature is low, for example, at the beginning of the run or on cold mornings.

Soft pastes will exacerbate the problem so you will find an advantage in restricting the added water or fat levels, or both. The addition of sugar without changing the water level increases the solids to liquid ratio in the recipe, in effect producing a firmer dough.

9.7 Why is the hot water method preferred for the production of savoury pastry but not for sweetened pastry?

The use of hot/boiling water in the production of the savoury paste is known to increase the crispness of the resulting paste during storage (see Fig. 27) (see 9.1). The reasons why this should be are not clear. Adding the boiling water to the flour may cause limited gelatinisation of the starch present but there is no direct evidence that this contributes to the formation of a crisper paste. The high temperature may inhibit the activity of the amylase in the flour and reduce any potential effect on the gelatinising starch. Since many savoury pie pastes will stand for a period of time after mixing or blocking, the limitation of any enzymic activity may be very important.

The high temperature resulting from the addition of the hot water will melt the solid fat. This may aid its dispersion into the microscopic voids created during mixing. These voids carry through to the baked product and provide a route for water to move through as it migrates from the filling. If the voids are filled with fat then there is less opportunity for the movement of water as shown by the observation that the base paste of pies does not soften during storage (see 9.1).

If the hot water method is used in sweetened pastry production it tends to produce a soft and sticky paste which will be difficult to block.

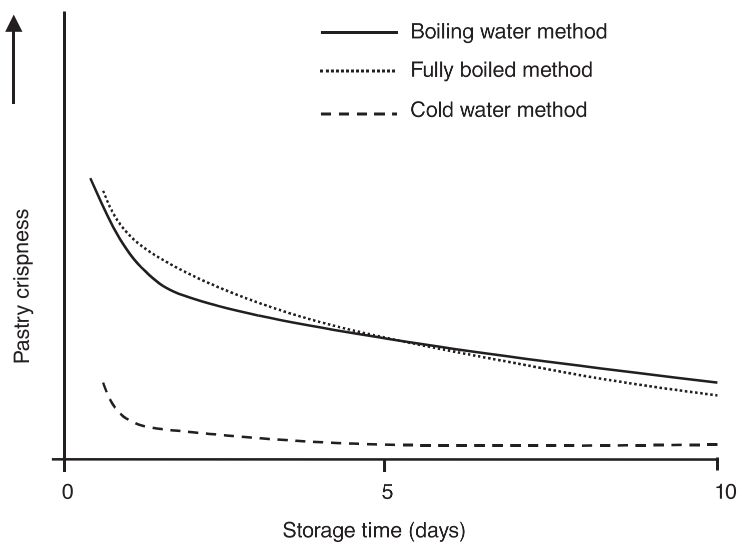

Fig. 27 Comparison of the effect of hot and cold pastry making methods on pastry crispness during storage.

9.8 Why does the filling of baked custards sometimes have a watery appearance in the cold product?

The formation of a stable gel in the filling of baked custards depends on achieving the correct conditions during baking. It is important to prevent the temperature of the filling going too high. The stability of the gel depends on the ability of the egg proteins (the albumen), and any starches or stabilisers present in the formulation to hold the water within their structures. The problem that you are seeing comes from breakdown of the gel and is often referred to as *syneresis* (see 13.3).

Under the influence of sufficient heat the egg proteins will coagulate and in doing so their spatial configuration changes in a way that reduces their ability to hold large quantities of water within the three-dimensional protein structure formed during mixing. As this water is 'lost' from the coagulated protein structure it needs to be taken up by the other custard components otherwise it will be released from the gel. The quantity of the released water that will be mopped up by the other components will be limited.

Most commonly this problem arises from baking the product for too long. The long baking time allows a greater input of heat into the filling and raises its temperature far higher than that of the coagulation temperature of the albumen. The baking *time* should be reduced and the baking *temperature* may have to be raised to ensure that the paste is fully baked. Raising the baking temperature will have less effect on raising the filling temperature than prolonging the baking time.

A common sign that the filling is boiling is that the top of the custard will become rounded in the oven.

If adjusting the baking conditions does not cure the problem then consider raising the egg or stabiliser level in the filling formulation.

9.9 How do we avoid 'boil-out' of our pie fillings?

The boiling-out of pie fillings is most readily controlled by adjusting the baking conditions you are using. Commonly we bake our products to colour but the rate at which we achieve the required colour depends to a large extent on the choice of baking temperature. Boil-out of the filling, however, will depend mostly on the length of the baking time. The longer the product spends in the oven, the higher the filling temperature will become and the greater the chances of boil-out. We suggest that you consider increasing the oven temperature and shorten the baking time.

If the crust colour of sweetened pastry becomes too dark then you may need to reduce the level of sugar used. If you are using glucose or another reducing sugar you may need to replace part or all of it with sucrose.

Alternatively consider lowering the ERH of the filling by adjusting the soluble solids of the filling formulation. The level of soluble solids in pie fillings controls the boiling point of the liquid in the filling; the higher the soluble solids content, the higher the boiling point (Cauvain and Young, 2000). You can therefore raise the boiling point by increasing the level of soluble solids. In the case of sweet fillings this may be through the addition of extra sugars. To avoid the filling becoming too sweet, you can use glucose rather than sucrose, since the former is less sweet on a weight for weight basis. Remember that if you use a glucose syrup then you must balance the water addition to compensate for that present in the syrup otherwise the filling ERH may not fall.

Reference

CAUVAIN, S.P. and YOUNG, L.S. (2000) *Bakery Food Manufacture and Quality: Water control and effects*, Blackwell Science, Oxford, UK.

9.10 We wish to reuse pastry trimmings but find that sometimes we experience a 'soapy' taste in the final product. Can you suggest a cause for the flavour and how best to reuse the trimmings to avoid this and any other potential problems?

The 'soapy' taste undoubtedly comes from the trimmings that you have been reusing. Soap is formed when some of the fat in the paste splits into glycerol and fatty acids, the latter combines with any alkaline material present to form soap. The fat splitting will be caused by microorganisms present in and on the trimmings. Contamination of the paste during processing is difficult to avoid because the microorganisms concerned will be in the bakery atmosphere, coming from external and internal sources. You should keep the trimmings as free from contamination as possible, especially sweeping clear any dusting flour which you may have used during their processing.

Since the problem is linked with microbial contamination you can expect that the problem becomes more prevalent when the bakery temperature is higher than usual. Usually you can control the growth of microorganisms present in the trimmings using low temperatures. We suggest that you transfer any trimmings at regular intervals into refrigerated storage, around 4 °C and try to use them within 24 hours of production. It is helpful to store the trimmings in thin sheets rather than in a large bulk because it will take some time for the centre of a large mass of trimmings to cool and during that period microbial activity may be sufficient to initiate an adverse reaction.

We recommend that you add the trimmings at the mixing stage to ensure that they are uniformly distributed throughout the paste sheet when it is processed. You should either allow the trimmings to warm before adding them to the mixer or compensate for the lower paste temperature by raising the added water temperature. Establish a production schedule that allows the trimmings to be used in strict rotation, otherwise you may still encounter problems. Limit the storage time of trimmings to about 24 hours. Periodically, say every 3 to 4 days, it is advisable to have a break in production which allows you to start with virgin paste to avoid progressively increasing the level of microbial activity in the paste.