TECHNICAL ARTICLE

How to push puff pastry margarine performance

BRINGING GOOD THINGS TOGETHER

Palsgaard®

If there were ever a competitive sport for margarines, puff pastry margarines would be the elite athletes, powerful, flexible and able to perform almost on command, delivering a top-quality result every time. Of course, like top athletes, to keep up with the competition and follow the evolving rules of the game, puff pastry margarines need to make the most of new practices and technologies. So, what are the factors driving these changes? And how can they best be addressed?

Pastry's Prima Donna

Let's face it. Puff pastry margarines have never been easy to produce. They might look like any other margarine, taste like them and pour with similar consistency, but there the comparison stops. Unlike your run-of-the-mill margarines, a puff pastry margarine must be specially formulated to:

- Have a non-greasy surface, making it easy to work with by hand and in the extrusion process
- Be very plastic, so it can be folded without breaking (avoiding insufficient lift and flakey structure)
- Provide high functionality for optimal expansion

In recent years, this list of demands has grown to include new, health-oriented needs, such as:

- Reduced fat content
- No trans fats
- Sustainably sourced ingredients
- Less or no lecithin
- More lean declarations

If the need to maintain or raise product quality weren't an issue, then answering all these demands would be much simpler. But quality is very important. Which is why sourcing the right products from suppliers who have deep expertise is a must-do rather than a nice-to-do. This article examines what it takes to resolve some of the most important issues.

Baking basics

First, let's remind ourselves what happens during the baking process. Puff pastry is characterised by its laminated structure of baked layers of dough separated by single, thin layers of margarine or fat – just as Figure 1 shows.

When baked, steam expands each layer, as illustrated by Figure 1. The degree of expansion and height achieved are then key to describing the quality of the pastry.

Slip into something more workable

Puff pastry margarines are characterized by high plasticity, allowing the margarines to be worked with, folded and extruded without breaking or becoming greasy. The composition of the margarine, the processing and the tempering of the margarine are all important parameters in achieving just the right level of plasticity. And, if the margarine is used in a traditionally manufactured puff pastry dough, the plasticity of the margarine after production and tempering is particularly important.

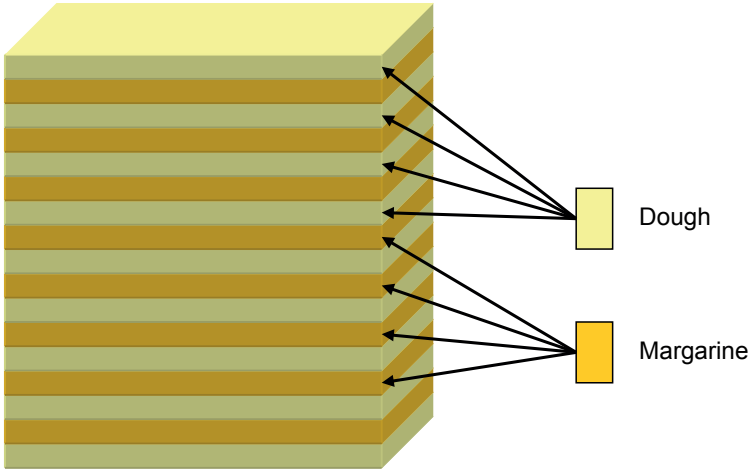


Figure 1: Puff pastry dough with layers of dough and margarine

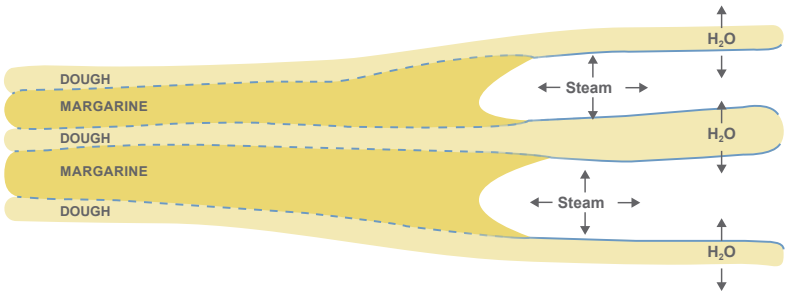
Puff pastry margarine usually gets its fats from palm and liquid oils, using different combinations to achieve good plasticity. Palm fats are slow crystallizing fats and polymorph fats, a fact that places special demands on the puff pastry margarine process: The margarine must be completely crystallized and most of the primary bondings removed and exchanged to secondary bondings in order to keep the plasticity of the margarine after production. Subsequently, puff pastry margarine is tempered for two days to a week before distribution to obtain optimal plasticity.

There's one, quite simple principle in the drive to create non-greasy margarines: Create more and smaller crystals. This increases the surface area available to absorb the liquid oil created when working with the margarine. To do this it's common, for example, to use polyglycerol esters of fatty acids, (E-475) in combination with distilled mono- and diglycerides of fatty acids, or mono- and diglycerides of fatty acids (E-471).

Lecithin (E-322) is also used to improve plasticity because it also is an emulsifier and will further improve the solubility of the distilled mono- and diglycerides of fatty acids/ mono- and diglycerides of fatty acids (E-471) in the fat blend.

When producing puff pastry dough, the margarine must be worked by hand or through extrusion. If the water-in-oil emulsion is unstable, free water will be created, decreasing the plasticity of the margarine and causing cracks that make it difficult to produce puff pastries of the right quality. Here, distilled mono- and diglycerides of fatty acids/mono- and diglycerides of fatty acids (E-471) can come to the rescue, reducing interfacial tension so that the final margarine, which is a water-in-oil emulsion, will contain a stable homogenous distribution of small water droplets that cannot agglomerate.

Figure 2: Puff pastry dough during the baking process



Testing plasticity

We decided to put theory into practice, examining the effects of three distinct emulsifier blends on a margarine with 80% fat content:

1. A combination of distilled mono- and diglycerides of fatty acids/ mono- and diglycerides of fatty acids (E-471) and polyglycerol esters of fatty acids, (E-475) (Palsgaard® 1304) and lecithins (E-322).
2. Distilled mono- and diglycerides of fatty acids/ mono- and diglycerides of fatty acids, fully saturated type, (E-471) (Palsgaard® DMG 0093) and lecithin (E-322).
3. Distilled mono- and diglycerides of fatty acids/ mono- and diglycerides of fatty acids, (E-471) partially unsaturated (Palsgaard® DMG 0291) and lecithin (E-322).

The puff pastry margarines were produced on a scrape surface heat exchanger and the margarines were tempered 1 week before evaluation.

We've summed up the results in Table 1, which shows that the choice of emulsifier has a direct impact on the margarine's surface and consistency. And, therefore, its suitability for producing both doughs and baked puff pastries.

EMULSIFIER BLEND	CONSISTENCY	SURFACE
A	Plastic	Very dry
B	Stiff	Dry
C	Soft	Greasy

Table 1: Results of plasticity testing with different emulsifier blends

The trials demonstrate the differences in expansions (shown in Figure 3) when different types of emulsifiers are used. The results partly reflect the different qualities of the margarines and partly the functionalities of the different emulsifiers during baking.

More is better?

Finally, we wanted to know whether increasing the amount of emulsifier would make a difference. In theory, because of the lamination process the emulsion in the margarine will be stressed and a strong emulsion is necessary, so that no free water from the margarine will occur. And, as a basic rule of thumb, the more emulsifier used, the stronger the emulsion will be.

To test this, we decided to determine the optimal dosage of emulsifier. In this trial, the dosage of lecithin was 0.50 % and the pH was 3.8. And the results are summarised in Figure 4.

Perhaps not surprisingly, we managed to confirm that a higher dosage of emulsifier will improve the baking result. But there's more to the equation, including the effects of different dosages of lecithin and the pH of the water phase – both with a marked impact on pastry expansion.

To test these dimensions, we created a test that used 1.00% of Palsgaard 1304 and a lecithin content from 0.00 to 1.00 %. And we again used a margarine with 80% fat content.

As shown in Figure 5, the combination of 0.50% lecithin and a pH of 3.8 performed best. One note of caution, however: When lowering the pH, the oxidation of the fats and oils needs to be carefully monitored!

From the above-mentioned trials, made with puff pastry margarine with 80% fat content, it can be concluded that using combinations of emulsifiers makes the margarine more suitable for use in pastry production. And that an emulsifier dosage of 0.80 - 1.00 %, (**Palsgaard® 1304**) with a lecithin dosage of 0.50 % and a of pH 3.8 is likely to provide the best baking results.

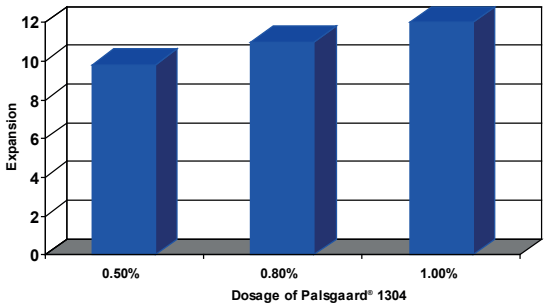


Figure 3: Test of different emulsifiers in puff pastry margarine

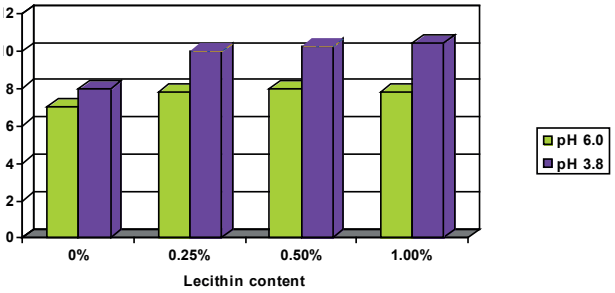


Figure 4: Test of different dosages of an emulsifier in puff pastry margarine

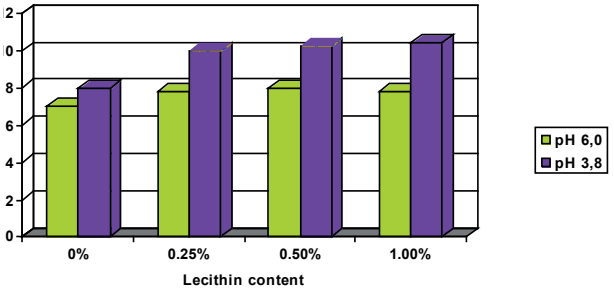


Figure 5: The influence of lecithin and pH value

Reducing total fat content

Most puff pastries are high in fat – around 35% is typical. And most of that fat comes from traditionally formulated puff pastry margarines with a fat content of at least 80%. Today, both from consumer and production cost perspectives, fat reduction is a serious and urgent priority for bakers. Reducing fat, however, if no other adjustments are made, will certainly affect the quality and performance of both the margarine and the baked product. So, what does it take to make it happen without losing your customers?

To get to the heart of the matter, we decided to conduct yet another trial. The aim was to see if we could reduce the fat content of the margarine from 80% to 60% (and fat content in the final product with 6-7%) without affecting its quality or performance in the final, baked product. And we were also interested in seeing whether we could do this with a similar process to that used for a higher fat content margarine.

To do it, we chose the non-trans fatty acid containing fat blend fat blend shown in Table 2 and the recipes shown in Table 3.

The two resulting types of margarine with different fat content were then evaluated and both showed a good and similar plasticity and a non-greasy surface. We then ran the two trials, producing puff pastries with 288 layers to compare their height and expansion. As Table 4 shows, there was very little difference between pastries baked with high or low fat content margarines. Both also showed good distribution of layers and a crispy surface.

Answering the sustainability trend

Recipes based on sustainable ingredients help to answer consumer and manufacturer health, safety and environmental concerns. And they can open doors to new markets, too. But sourcing and incorporating trustworthy, fully sustainable ingredients isn't easy. But there is a quick win for margarine manufacturers looking to introduce sustainable ingredients: Sustainable emulsifiers.

In Palsgaard's view a sustainable emulsifier must as a minimum fulfil two main criteria: Its palm oil ingredients comply with the Roundtable for Sustainable Palm Oil (RSPO) 'Segregated' (SG) level – and it is produced in factory with a strategic focus on reducing energy consumption and CO_2-emissions.

Sustainable, vegetable-based emulsifiers are a perfect way to lift your recipe's sustainability: They're a minor part of the ingredients list, yet they figure just as clearly on the label. They are easily documented as being sustainable, although labelling as an SG product does require SG certification, and they are usually a replacement rather than a reformulation.

INGREDIENT	%
Palm stearin	46 %
RBD palm oil	46 %
Liquid oil	8 %

Table 2: Recipe for the non-trans fatty acid containing fat blend used in the trials.

	60 % PUFF PASTRY MARGARINE	80 % PUFF PASTRY MARGARINE
water phase		
glucose	1.00 %	1.00 %
salt	1.00 %	1.00 %
water	38.00 %	18.00 %
colour, flavourings, sorbate and/or benzoate might be added		
pH	3.8	3.8
fat phase		
Palsgaard® 1311	1.00 %	0 %
Palsgaard® DMG 0298	1.00 %	0 %
Palsgaard® 1304	0 %	0.80 %
lecithins	0 %	0.50 %
fat blend	58.00 %	78.70 %

Table 3: Recipes used in trials

	60 % PUFF PASTRY MARGARINE	80 % PUFF PASTRY MARGARINE
Height (average)	510	505
Expansion (average)	11.3	11.2

Table 4: Comparison of height and expansion.

A workable balance

In conclusion, it is very important to choose the right type of emulsifier in order to obtain the best puff pastry margarine and the best baked goods – in the right dosage, as our tests have shown.

As the inventor of the modern, vegetable-based emulsifier over 100 years ago, Palsgaard is uniquely able to help its customers to determine the right ingredients and processes for producing puff pastry margarines that can deliver what the markets of today – and tomorrow – demand. And with fully equipped pilot labs around the world, we can help to test emulsifier performance in customers' margarines and baked goods to ensure success.

CONTACT US

Contact us to order samples of **Palsgaard® 1304**, **Palsgaard® 1311** and **Palsgaard® DMG 0298** to try out in our vast library of puff pastry margarine recipes, or visit **www.palsgaard.com** for more information.