TECHNICAL ARTICLE

How to make non-palm margarine with success

BRINGING GOOD THINGS TOGETHER

Palsgaard®

Margarine manufacturers wanting to introduce non-palm products need to do much more than simply swap lipid ingredients. Solving the challenges takes a systematic and holistic approach to everything from sourcing alternative oils and emulsifiers to coping with higher melting points.

When it's properly cultivated, palm oil is the most sustainable, best-functioning vegetable oil on the planet. It uses far less land per tonne of product than, for example, the soy bean oil from which lecithin is won. Traditional palm oil production, however, has been shown to have far-reaching consequences for the environment and for local communities. From massive deforestation to abusive working conditions, many oil palm plantations have become a severe problem.

Wildlife, too, is impacted by unsustainable plantage practices, with orangatuan numbers now vastly reduced in Borneo, Indonesia, one of the world's primary sources of palm oil raw materials. Correspondingly, consumers – among them the more environmentally conscious Millennial generation – have become increasingly aware of palm oil as a potential liability in their shopping carts. And the resulting pressure in countries such as France, the UK, Norway, Sweden and Germany, in particular, has seen many margarine manufacturers looking for alternatives to palm. Today, viable alternatives have emerged in the marketplace, even for more challenging recipes.

Not so simple

No one said going non-palm was going to be easy. Converting margarine recipes, for example, from using palm-based oils and palm-based emulsifiers to non-palm equivalents isn't an overnight switch.

Let's start with the emulsifiers – a small part of the recipe but an extremely important one. If you remove palm oil as a raw material for emulsifiers, you need to replace it with something else. Essentially, you need to lose the palmitic acids and replace them with stearic acids from rapeseed or soya beans, for example. As a result, the melting point will increase, and the hydrophilic and lipophilic balance should also be expected to change slightly.

Of course, to achieve a non-palm product that properly meets the shopping list of concerned consumers, you may need to replace other oils in the recipe, too. So, at the end of the day, you're likely to be left with an end-product that will be noticeably different to the palm-based version.

Sustainability dilemma

These were some of the issues facing Palsgaard's R&D scientists when, to support margarine manufacturer customers, our company decided to swing into action with a complete, end-to-end portfolio of non-palm alternatives to our highly functional, palm-based emulsifiers.

It wasn't a decision made without a certain amount of internal resistance. That's because, unlike many emulsifier manufacturers around the globe, Palsgaard's entire range of emulsifiers is already available in compliance with the Roundtable for Sustainable Palm Oil (RSPO)'s Segregated model and sustainably produced in a carbon-neutral plant.

Offering non-palm alternatives based on less sustainable raw crops, therefore, goes somewhat against the grain at our more than 100 year-old, socially responsible company. But customer needs are prioritised, and the Palsgaard R&D team were determined that, if non-palm products were going to gain market share, then they should be produced with the same strict attention to responsible supply chain practices and carbon-neutral production as the company's other emulsifier products.

Two directions

Non-palm margarines aren't commonplace in today's marketplace. At least, not yet. As a global emulsifier manufacturer, we can see two basic directions taken by margarine manufacturers and the industrial bakers they serve: Either RSPO Segregated (SG) palm oil or non-palm.

For those who aren't prepared to make the investment required by certified RSPO Segregated production, going the non-palm way might seem easy. In reality, and depending on the product, this may well be the more difficult of the two paths to take. Producers of pastry margarine for laminated doughs, for instance, will need palm-based ingredients to achieve the results that only high and controllable plasticity can deliver.

To take the non-palm road, it's necessary to build up experience from scratch. And the learning curves are likely to be steep. Part of the journey requires the manufacturer to source new raw materials, establish new supplier relationships, and learn as much as possible about the materials and exactly how they function. And fully hydrogenated oils should be avoided wherever possible, as their high melting point results in a brittle end-product. Then there's the price issue, of course, with more exotic oils such as chestnut or mango offered at a significant premium.

FACT BOX:
The effect of removing palm from margarine recipes

- Higher melting points
- Higher emulsion temperatures needed
- Higher temperatures on heating jackets needed
- Change of crystallization speed
- Change of process parametres needed
- Tendency to create more brittle margarines
- Post crystallization or overworked margarine
- More lipophilic emulsifiers with higher melting points needed

Non-palm portfolio

During the three years it took to develop our new range of non-palm emulsifiers, Palsgaard's R&D team and application specialists were able to amass considerable know-how. We experimented with many different oil types, and examined the entire production process from re-mill temperatures to heating jackets and more.

Making a non-palm margarine emulsifier involves more than simply ensuring the oil used is non-palm. You also have to consider the glycerol component. And the antioxidant system needs to be non-palm, too.

We installed special glycerol tanks for producing non-palm glycerol, then went further to ensure all the antioxidants were free of palm oil, too. Emulsifiers for puff pastry margarine were next to be developed, using combinations of monoglycerides and polyglycerol. And citric acid esters were replaced with non-palm alternatives. We made polyglycerol monosterate (PGMS) in a non-palm version and much, much more.

Developing non-palm emulsifier systems for liquid margarines was high on our wishlist, too. This is a growth area, spurred on every time new coronary research urges consumers and the industry to cut back on solid and saturated fats.

During the process, we carefully noted the effects of changing melting points and equipment temperatures, discovering, for example, how important it is, when dealing with oils that have a higher melting point, to carefully control temperature parameters from end to end. This is particularly important if it's necessary to stop the machinery for packaging or similar production steps. The higher melting point of some nut oils, for example, sets off a potential avalanche of issues that starts at the heating jacket and doesn't stop until it has touched every point along the production line.

Recipe suggestion for 80% non-palm liquid margarine

INGREDIENTS	%
Palsgaard® Citrem 3206	0.80
Palsgaard® DMG 0091	4.00
Liquid oil	75.20
Salt	1.00
Water	18.89
Sorbic acid	0.10
Flavour	0.005
Colour	0.005
	100.00

DIRECTIONS

1. Adjust the temperature of the liquid oil to approx. 55-60°C
2. Dissolve Palsgaard® Citrem3206 and 0091 in 5 parts of oil at approx. 70°C and transfer into the oil blend.
3. Dissolve salt in the water phase and adjust the temperature to 55-60°C.
4. Adjust the pH-value of the water phase to approx. 5.5 by means of lactic or citric acid.
5. Emulsification temperature: approx. 55-60°C.
6. Passage through tubular cooler
7. In order to facilitate the after crystallisation, the emulsion should rest for 15 min.
8. Stirring for 30 min.
9. Packing

Note:

The after crystallisation is very important to avoid any separation of oil during storage

A challenging journey

In bakery margarines, the results are rather dependent on the ratios of non-palm fat types. We spent a lot of time changing these ratios and playing with different process parameters until we could see that each solution functioned as intended. A key learning along the way was that some of the fats easily became overworked and didn't give the stability we had expected.

There are certainly many differences to be aware of. For example, non-palm emulsifiers don't provide the same variation in fatty acids. And longer, non-palmitic fatty acid chains make for more fat-friendly emulsifiers – something that becomes very noticeable at melting point.

As you might imagine, there's no shortage of permutations in an exploration of this kind. In fact, we found it to be somewhat like trying to build with

Recipe suggestion for 80% non-palm puff pastry margarine

INGREDIENTS	%
Palsgaard® 1304	0.80
Interestified non-palm fats	47.40
Liquid oil	31.60
Salt	0.70
Water	19.50
Flavour	As desired
Colour	As desired
	100.00

DIRECTIONS

1. Melt the oil/fat blend and adjust its temperature to approx. 55-60°C
2. Dissolve Palsgaard® 1304 in 5 parts of oil/fat at approx. 65°C and transfer into the fat blend.
3. Adjust the pH-value of the water phase to approx. 3.5 by means of lactic or citric acid.
4. Emulsification temperature: approx. 55 - 60°C

Table 1:
As shown below, the melting points of non-palm fatty acids and triglycerides originating from rapeseed, soy and sunflower will be higher than that of their palm-based counterparts. This is caused by needed hydrogenation and interestification of the soft oil that generates more high-melting stearic acid in the fat composition.

	TRIVIAL NAME	MELTING POINT	TRIVIAL NAME	MELTING POINT
C12:0	Lauric acid	44.4°C (112°F)	Trilaurin	46.1°C (115°F)
C14:0	Myristic acid	54.4°C (130°F)	Trimyristin	55°C (131°F)
C16:0	Palmitic acids	62.7°C (145°F)	Tripalmetin	65°C (149°F)
C18:0	Stearic acids	69.4°C (157°F)	Tristearin	72.2°C (162°F)
C22:0	Bebenic acids	80°C (176°F)	Tribehenic	82.2°C (180°F)
C18:1 n-9 cis	Oleic acid	16.1°C (61°F)		
C18,1 trans	Elaidic acid	43.8°C (111°F)		
C18:2 n-6 cis	Linoleic acid	-6.6°C (20°F)		
C18:3 n-3 cis	Linolenic acid	-12.7°C (9°F)		

LEGO bricks of many different sizes and colours. And we also noted that you need to be very open-minded for a very long time to succeed!

When the dust had settled, we emerged with a palette of non-palm emulsifiers that can be used to replace whichever emulsifiers manufacturers are using today. We were now able to help them determine non-palm alternatives to the lipid content of their recipes, and supply the sustainable emulsifiers and know-how to make the best possible, non-palm end-product.

Responsible sourcing

When all is said and done, the process of developing the new emulsifier range was not particularly difficult (given the level of expertise we already have), but it was a long and systematic, trial-by-trial journey that simply took time to complete. A particular challenge was the effort it took to obtain the range of raw materials we wanted to test – and then working with them to understand how each material differs from palm oil.

Responsible sourcing was a necessary part of this latter process. Reflecting the procurement process our customers need to go through, the purchasing of raw materials wasn't purely about the technical aspects, but needed to be sufficiently sustainable, too. To ensure we could live up to Palsgaard's culture of sustainability, we worked closely with existing, trusted suppliers wherever possible.

Customer co-creation

With Palsgaard's non-palm range of emulsifiers now launched in the marketplace, customers have begun exploring their process parameters with us. In some cases, we're working on existing recipes, trying various avenues to achieve a product of similar quality in a non-palm format. For other customers, we are able to provide a ready-to-go margarine recipe that has been thoroughly tested in our pilot labs – all that is needed now is to apply a little know-how to bring the recipe to life on the customer's production line. And we can even use our experience to advise on potential supplier issues, having evaluated many of the commonly available oil alternatives.

Sustainable future

What will the future hold for non-palm products? Many of the food industry's largest brands and their ingredient suppliers have begun insisting on RSPO certified sustainable palm raw materials, forcing plantation owners in palm oil exporting countries to comply with strict rules. In February 2018, for example, industry giant Unilever made a ground-breaking announcement that it would publish a complete description of all the suppliers and mills from which it sources – a move that supports full palm oil supply chain transparency and represents a major milestone in the journey towards a more sustainable palm oil industry.

Whatever will happen, for manufacturers who want to meet non-palm margarine demand Palsgaard now has a non-palm alternative for each of our many margarine applications. We can offer fully functional recipes based on either palm or non-palm oil sources. And we've climbed most of the learning curves so our customers won't have to!

CONTACT US

Find out more at **www.palsgaard.com** and contact us today to order samples of our emulsifiers for non-palm margarine and try them in our extensive library of recipes.