



## Innovation Report

# The next generation of bakery shortenings

A look at the new products and processes  
designed to meet the changing needs of your customers.

# Exploring tomorrow's bakery shortenings. Today.

Over the past decade, palm oil (including its fractions), interesterified fats, fully hydrogenated oils, and high oleic oils have all largely replaced PHOs as shortening components of choice for bakery manufacturers. Palm oil, for example, has many functional and supply chain benefits, which is why it has largely become an industry staple. As we continue to learn more about nutrition, bakery functionality and manufacturing needs, there is opportunity for new innovation to respond to trends in the bakery space.

This report provides an overview of shortening solutions and takes a closer look at some of the ways the baking industry is addressing current opportunities with bakery shortenings: the new products, emerging processes and innovative approaches underway to tackle functional and palm sustainability issues—while still delivering on the health benefits and taste today's consumers demand.

## WHY IS IT CALLED SHORTENING, ANYWAY?

Before shortening, baked goods were made largely from animal fats, namely lard and tallow. Vegetable oil-based shortenings came along in the late nineteenth century and were made initially from cottonseed oil. The modern-day shortening was made possible via the invention and use of the hydrogenation process. Shortening prevents the cohesion of wheat gluten strands during mixing. This action physically shortens the strands of gluten resulting in less elastic and sticky doughs.\*

### Cracking the code on bakery fats

Baking fats are designed to deliver high functionality. Unlike foundational liquid oils used in cooking or frying applications, the shortenings used in baking applications require solids and melting profiles that deliver the desired structure, texture and taste that characterize today's quality baked goods. For example, shortenings enable mixing and machinability of doughs during production—and in finished goods, provide the desired eating texture.



### Choosing the right shortening is both a science and an art that requires experimentation

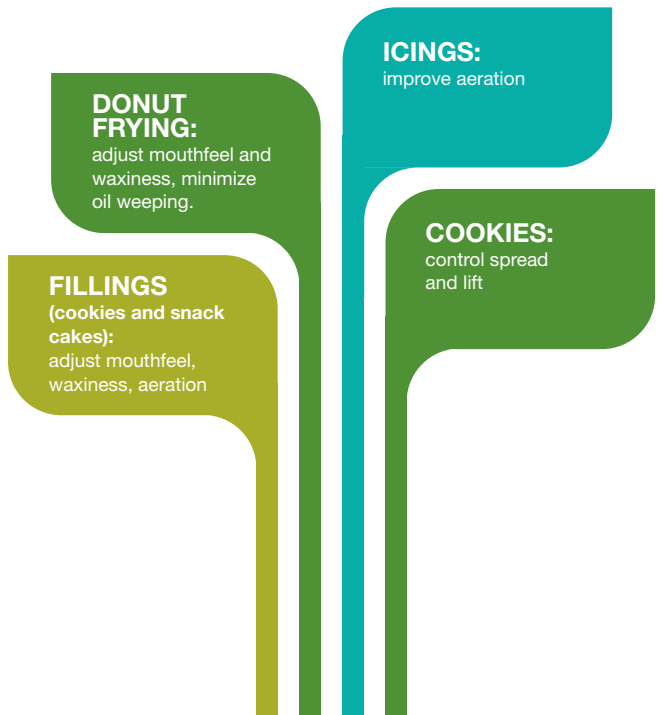
There are several factors that make a fat functional in a bakery application, which can make choosing the right shortening for the right product a bit challenging. The functional properties of the fat affect the properties of the end product—influencing characteristics like shelf life, mouthfeel, appearance, and ultimately consumer acceptance.

A few of the key functional attributes to consider are:

- **MELT POINT:** the temperature at which solid fat melts and becomes liquid
- **PLASTIC RANGE:** the temperature at which the shortening will retain its plasticity and stay workable
- **LABELING:** certain terms may be more acceptable to consumers than others
- **NUTRITION:** the fatty acid profile, especially the level of saturated and unsaturated fat

## Health and taste preferences are driving new product formulation.

As consumers' attitudes about health and taste evolve, ingredient manufacturers are adapting to create the next generation of structuring fats. With more than half of consumers closely monitoring fats and oils in foods,\* it's critical to provide products that function, while meeting desired nutritional needs such as less saturated fat. Functionally, shortenings can accommodate a wide range of baking applications and corresponding characteristics such as those displayed in the graphic below.



## Palm oil: A reliable option

### Pros

- High level of solids for structuring
- Oxidatively stable
- Versatile

### Cons

- Brittleness, especially when stored at cold temperatures
- Sustainability concerns
- Sourced offshore with a long supply chain
- Saturated fat level may affect nutritional profile of finished application

## Palm oil is still a dominant player.

Palm oil remains a dominant base oil due to its versatility in bakery applications.

Solid at room temperature, palm oil's high melting point accounts for its technical utility with baking manufacturers.

Refined palm oil gives products a long shelf life and has high oxidative stability, which means it has a greater resistance to reacting with oxygen and breaking down. Stable at high temperatures, refined palm oil helps to give fried products a crispy and crunchy texture. It's a highly versatile product that can be used in many applications without compromising the finished products' characteristics.

Palm oil is the world's most widely used vegetable oil, and a number of companies are looking for ways to source it responsibly. Cargill is one of North America's first large-scale suppliers of segregated palm oil that is certified by the Roundtable for Sustainable Palm Oil (RSPO).

An expanded supply means that more baked goods may soon contain sustainable palm oil.





As manufacturers and product developers continue to explore new ways to create oil products with more favorable ingredient profiles, three processes—hydrogenation, interesterification, and fractionation—are playing key roles.

## Intesterification, a tool for enhancing functionality

Intesterification is a process being used by ingredient manufacturers in which the oil or oil blend’s fatty acids are rearranged, and the positions of fatty acids on the glycerol backbone are changed to alter its melting properties and optimize the functionality.

There are two types of interesterification processes: Chemical interesterification, which produces complete randomization of fatty acids, and enzymatic interesterification, which allows more control of the positions on the glycerol backbone that are rearranged.

While interesterified oils give food manufacturers the promise of a high-performing product, the biggest challenge may be earning trust from skeptical consumers who may be quick to reject the unfamiliar term “interesterified.”

## Hydrogenation as a tool for enhanced shelf stable and functionality

Hydrogenation is a process in which a liquid oil turns into a solid fat. The hydrogenation process uses a catalyst (often nickel) to make unsaturated fatty acids saturated. Premature termination of the hydrogenation process was used in the industry for many years to make partially hydrogenated fats (containing artificial trans fats, which raises LDL, or “bad” cholesterol). Fully hydrogenated fats are trans fat-free. These fully hydrogenated fats have high stability and provide structuring in applications.

### THE SKINNY ON FULLY HYDROGENATED OILS

#### Pros

Efficient and proven technology for designing functional fats  
 Converts a liquid oil into a structured fat that can be used in bakery applications

#### Cons

Very brittle  
 Associated with the manufacture of artificial trans fats  
 Consumer perception of processed ingredients

## What to know: interesterified oils

### Pros

Better consumer perception than hydrogenation

### Cons

Still largely untrusted because of the highly technical nature of the word



# Examining consumer perceptions of bakery fats and oils

While sustainability is a growing concern for consumers, the nutritional component of palm oil seems to be a bigger concern.

Thirty-three percent of consumers say they are likely to check for palm-free claims on products. Of those, 51% say it's because they are trying to avoid saturated fats.\* (Fig. 1)

## Reasons for checking for a palm-free claim

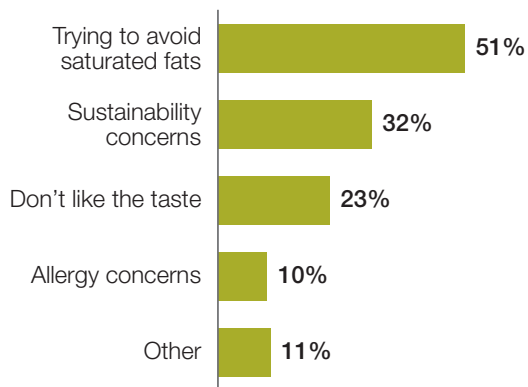
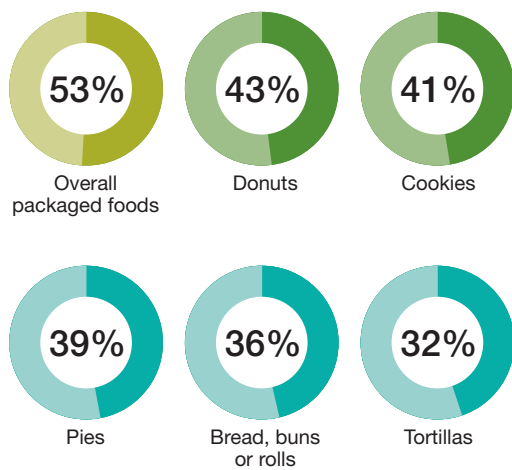


Fig. 1

When purchasing a bakery product, consumers pay less attention to the type and amount of oil it contains compared to the overall packaged foods segment.\* (Fig. 2)

*“To what extent do you pay attention to the type of oil or amount of fat in each of the following food categories before you choose to purchase a particular packaged food?”*



[% of people who pay extremely close attention/close attention]

Fig. 2

Consumers don't seem to distinguish between the terms partially hydrogenated oil and hydrogenated—and seem to associate the term “hydrogenation” with trans fats. Nearly the same percent of consumers say they would be less likely to purchase a product containing partially hydrogenated oil or hydrogenated oil. However, consumers view interesterified oils less negatively than partially hydrogenated or hydrogenated oils. (Fig. 3)

FATS & OILS	2020 GEN. POP.
Sunflower Oil	17%
Coconut Oil	16%
Canola Oil	3%
Safflower Oil	0%
Vegetable Oil	-1%
Butter	-2%
Soybean Oil	-11%
Palm Oil	-26%
Intesterified Oil	-39%
Partially Hydrogenated Oil	-48%
Hydrogenated Oil	-51%
Lard	-69%

Net score = More Likely to Purchase (top box score) minus Less Likely to Purchase (bottom box score).

Fig. 3

Cargill's proprietary consumer survey, called FATitudes™, tracks consumer perceptions, behaviors, and attitudes of fats and oils in packaged foods.

# Fractionation separates liquid and solid parts of fats

Fractionation is another option for creating structure and functionality for bakery shortenings. While we can think of fats as solids and oils as liquids, both are a heterogenous mixture of triglycerides. These triacylglycerols display high and low melting temperature profiles. The fractionation process utilizes this physical property and separates liquid and solid components of fats from their native form. This results in multiple products with varying physico-chemical and functional properties. For example, whole palm oil can be fractionated into two major components: (1) palm olein—liquid portion, which is used as a frying oil and (2) palm stearin—solid, used mostly a structuring fat.

## Pros

Multiple products can be produced from a single starting oil

## Cons

Fraction typically occurs with tropical oils that have a long supply chain



# Other players? Low saturated fat starches and liquid-solid blends

While we can think of fats as solids and oils as liquids, both are a heterogenous mixture of triglycerides.\* As a result, many ingredient manufacturers are also exploring the addition of starches to lower the saturated fat levels in shortenings. The starch acts as a structuring agent and essentially replaces the saturates in a solid fat. Liquid-solid blends are another approach to lowering saturated fat levels. Each solution offers the functional needs for baking applications—while improving the nutritional profile of the shortening product.



## STARCHES & LIQUID-SOLID BLEND ROUND OUT THE OFFERINGS

### Pros

Improved nutritionals

### Cons

May present challenges from a clean label perspective

May add complexity in the baking manufacturing process

# What's on the horizon? Here are a few predictions.

Innovations in packaged foods are anchored in consumer demands for products that meet their nutritional needs and align with their values. Cargill tracks these trends through its proprietary TrendTracker™. The two trends that will likely influence baking the most are **Healthy for Me** and **Conscious Consumption**.



*For more information about Cargill's TrendTracker contact your Cargill representative.*

## Healthy for Me Trend

Consumers seek health benefits in their food as well as avoid those they consider bad for their health. Plant-based protein, clean label and immunity fit into this trend. For the bakery segment, impacts may include an increasing interest in baked items boosted with plant protein, for enhanced immunity or for improved gut-health. However, there is also room for plain indulgence as a feel-good treat.

### HOW OIL AND SHORTENING INNOVATIONS MAY RESPOND TO THIS TREND:

- Ingredient systems to create solutions for plant-based protein inclusions into bakery products
- Blends and ingredient systems to reduce saturated fat levels or increase the nutritional value by adding fiber or antioxidants
- New crop hybrids that bring new nutritional value to oils, such as higher omega-3 or lower saturated fat content

## Conscious Consumption Trend

Consumers seek out brands that align with their values and may be willing to pay more for a product that has a compelling story. This may impact how consumers view ingredients in the packaged products that they purchase. Moving forward, sustainable palm oil supply chains and a commitment to the betterment of the environment will be important drivers for the bakery industry.

### HOW OIL AND SHORTENING INNOVATIONS MAY RESPOND TO THIS TREND:

- Enhancements in supply chain for palm and soil health programs provide avenues for storytelling about how your ingredients contribute to an improved environment
- New oil blends that increase options for non-palm shortenings

### BEYOND SUSTAINABILITY

Outside of responding to consumer trends, there is the perpetual need to formulate to meet operational and functional needs, such as for higher stability or increased plasticity. The industry continues to work on functional improvements through the use of different oil blends and technologies.

# Count on Cargill to deliver the oil solutions ideally suited to bakery.

## A dynamic portfolio of dependable oils to meet all your baking challenges

From our all-purpose, dependable Regal™ and Advantage® shortenings to next-generation oil and shortening solutions like PalmAgility®, count on Cargill's innovation, product breadth and expertise to help you identify the fats and oils that best meet the individual needs of your operation—easily and cost-effectively.

## An expanded food pilot facility to accelerate products to market

Our \$6.4 million facility expansion allows us to better partner with our bakery customers to develop innovative new products and quickly bring them to market.



## Trusted teams to move your business forward.

Our global tech service and applications teams are here to provide their expertise in helping you meet the demands of today's evolving bakery market.

Contact us today for the product breadth, proven capabilities and industry expertise to bring greater growth and improved performance to your operation. Or learn more at [www.cargill.com](http://www.cargill.com).