FAPC-134

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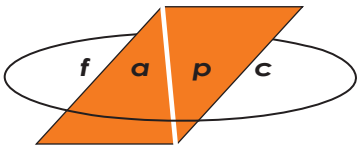

FOOD TECHNOLOGY FACT SHEET

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Formulating Food Products with Low Trans Fats

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Edible oils and fats mainly consist of triacylglycerides, which are compounds with three fatty acids esterified onto a glycerol backbone. Fats and oils of animal origin, such as butter and lard, are primarily composed of saturated fatty acids. Plant derived oils and fats mostly contain monounsaturated and polyunsaturated fatty acids, which include, respectively, one or more double bonds in their chemical structure. In the presence of oxygen, monounsaturated and polyunsaturated fatty acids can deteriorate and go rancid. Manufacturers can reduce deterioration and improve food texture by partially hydrogenating the unsaturated fat. Most naturally occurring unsaturated fatty acids have *cis* structures at their double bonds. Hydrogenation eliminates some double bonds and rearranges others, converting them to the *trans* configuration. The extent of hydrogenation determines how much a fat's melting point is raised. Thus, liquid vegetable oils are converted into products ranging from soft margarines to solid shortenings. A previous FAPC Fact Sheet (FAPC-133 *Trans* Fats, Health, and Nutritional Labeling of Foods) reported detailed information on the health effects of *trans* fatty acids, *trans* fat content of commercially prepared foods, and a new Food and Drug Administration rule regarding listing of *trans* fat on nutrition labels. This fact sheet focuses on the alternatives to *trans* fat for food applications.

Edible oil quality is defined by its oxidative stability, functionality, and nutritional value. Various fat modification techniques: hydrogenation, interesterification, fractionation, and combinations thereof are used to improve oil functionality and stability. Plant breeding and biotechnology have also been used extensively to develop oilseeds with required agronomic properties and oil functionality. Over the past several decades, a number of oilseeds have been introduced with modified fatty acid compositions. Some of these oilseeds are canola and soybean with low linolenic acid content; corn, soybean, sunflower, and peanut with high oleic acid content; and soybean with high and low saturated fatty acid contents. Many of these oils have potential in *trans* fat reduction. A number of laboratory frying studies with high oleic and low linolenic oils demonstrated superiority of modified oils over traditional oils. Although most of these modified oils are commercially available today, cost and production problems hinder their use in commodity food product.

Palm oil can be fractionated into olein and stearine fractions, which can be further fractionated into harder and softer products. Some manufacturers replace hydrogenated oils in their product with palm oil stearine (saturated fat fraction). Both types of fats, *trans* fat and saturated fat, increase low-density lipoproteins, which contribute to atherosclerosis and high cholesterol. Hence, the reformulated *trans* fat free product is not healthier than the food containing *trans* fat. Palm oil crystallizes slower than the other fats and oils. This leads to a phenomenon known as post hardening, which the product becomes harder during storage. *Trans*-free margarines prepared with sunflower and cottonseed oils interesterified with palm oil, palm kernel oil, palm stearine, and palm kernel olein minimize post hardening. There are studies indicating preparation of skim milk containing emulsifiers prior to crystallization retards post hardening in blends containing high palm oil and palm kernel oil. Random interesterification of soybean, corn, peanut, cottonseed, canola, and palm with completely hydrogenated soybean also yields products that are suitable for formulation of zero-*trans* margarines and shortenings.

Fluid shortenings are stable suspensions of 2 to 20 percent hard fat in liquid vegetable oils which may or may not be hydrogenated. These products have been used in baked goods where high solid contents are not required, such as fillings, cakes, and breads. Fluid shortenings improve tenderness and lubricity and serve as carriers for emulsifiers needed for aerating cake batter or giving crumb strength to bread. The other advantages of liquid shortenings are they are pumpable and can be easily metered into the process. Some reduction in *trans* fat can be achieved by substituting fluid shortenings in food formulations.

The current emphasis on *trans* fat reduction in foods without compromising their quality and taste has accelerated development of new ingredients that can be used as *trans* fat replacers in a variety of applications, such as pastries, breads, fried foods, soups, and sauces. *Sans Trans Ultra* (Loders Croklaan, Channahon, IL) is a palm-oil-based emulsifier system with lower saturated fat content that can be used in bakery products. This product is nonhydrogenated, hence does not contain *trans* fat. According to the supplier, the system contains solid fats which crystallizes readily, helps aeration, and creams easily with sugar. Its melting point and profile make it suitable for cakes, muffins, and bakery fillings. The same company also markets *Durkex*® NT 100, which is a nonhydrogenated liquid oil with high stability and low solid profile. This product can be used as a flavor carrier, anti-dusting agent for seasonings, spices, drink mixes, or any powder and coating for dried fruits and nuts.

In the United States, medium-chain-triacylglycerides, or MCT, oils have traditionally been used in special dietary formulations and supplements. MCTs are not fully metabolized, therefore deliver fewer calories. These oils are not hydrogenated, hence they are *trans* fat-free products. There have been reports indicating that a MCT-based product *Neobee*® MLT-B (Stepan Co., Maywood, NJ) may be used as a replacement for partially hydrogenated vegetable oils in bakery applications.

TransEND® (Cargill, Minneapolis, MN) is a high-stability *trans* fat-free canola-based shortening that is claimed to match the functionality, mouthfeel, and shelf-life stability of conventional all-purpose shortenings, roll-in shortenings, cake and icing shortenings, and microwave popcorn shortenings. *NovaLipid*™ (Archer Daniels Midland Co., Decatur, IL) is a line of low- or no *trans* oils and shortenings designed for use in baked goods, frying applications, confections, snacks, cereals, and margarines. According to the company, these products include naturally stable oils, blended basestock oils, and enzyme-interesterified oils and can be incorporated into food applications without compromising functionality and nutrition. *Vream Right* and *Vreamay Right* are two reduced *trans* fat shortenings developed by Bunge Foods (Bunge Foods, Bradley, IL). These products have been evaluated in various applications. Reportedly, little difference was observed in chocolate chip and sugar cookies, pie crusts, and biscuits as compared to the original formulation. The same low *trans* fat products performed very similarly to the control in white, yellow, and devil's food cakes and butter cream icing.

As mentioned in a previous FAPC Fact Sheet (FAPC-133 *Trans* Fats, Health, and Nutritional Labeling of Foods), Unilever Canada reformulated Imperial™, I Can't Believe It's Not Butter!™, Blue Bonnet™, Golden Girl™, and Eversweet™ as *trans*-free products. Becel margarine has been free of *trans* fat since its launch in1978. Canola Harvest Premium Margarine, Fleischmann's Light Margarine, and Smart Balance Light buttery spread are also *trans* fat-free products launched since the announcement of the FDA *trans* fat labeling rule.

Steps to Take Before Reformulating Products as Reduced or No Trans Fat

It is recommended that food manufacturers consider the following steps before they start reformulating their products as reduced and/or no *trans* fat products:

1) Talk with fat/oil suppliers about the types of alternative ingredients they offer and how much they will cost.
2) Determine how reliable the chosen oil/fat supply is and in what range its price fluctuates. Some suppliers may not have scaled-up their process for *trans* fat-free oil production from pilot plant level to full-scale production. If the demand for *trans*-free foods increases, there might be a temporary deficit in supply.
3) Compare processes and ingredients by testing the product in the lab or pilot plant. Remember that specific taste and texture profiles and the feasibility of obtaining the same results with the new oil are the key for the success of the business.

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