EXTENSION

Why Peanut Oil is Good for Frying Food

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Peanuts (*Arachis hypogea*), also known as groundnuts, are the edible seeds of a legume. The name of the domesticated peanut species comes from two Greek words: *Arachis* meaning a weed and *hypogaea,* an underground chamber referring to a weed growing below soil surface. Although a peanut is technically considered a pea and belongs to the *fabaceae* of bean/legume family, it is generally included amongst the oilseeds because of its high oil content.

There are thousands of peanut cultivars but the most popular ones are Spanish, Runner, Virginia and Valencia. Cultivar selection for particular application is important because of the differences in flavor, oil content, size and shape of each peanut type. For example, the cultivar Virginia is preferred for in-shell peanut marketing and in-shell gourmet snacks; Spanish peanuts are favored for making candy, salted nuts and peanut butter; Runner cultivars are mostly used to make peanut butter; and Valencias are selected for their large size, attractive bright-red skin and very sweet taste. They also are good for fresh use as well as boiled or roasted peanuts.

Peanuts are rich in protein, oil and fibers. Depending on the variety, climate, maturity and agronomic practices used, peanuts may contain 40 to 50% oil. The oil extraction process is very similar to the techniques used for other oilseeds (See OSU Fact Sheets FAPC-158 Oil and Oilseed Processing I and FAPC-159 Oil and Oilseed Processing II). In summary, shelled peanuts are cleaned, dehulled, cracked, and heat and moisture conditioned prior to extraction. Peanuts are usually flaked before solvent extraction. For large scale processors, oil extraction using hexane is the preferred method due to its high oil yield. Mechanical pressing produces lower oil yield.

Similar to the other vegetable oils, peanut oil mainly constitutes of triacylglycerides (Table 1). Although phospholipids (polar lipids) have some health benefits, they are usually removed during refining because they precipitate out of the oil during storage and handling and adversely affect the functionality of the oil due to their surface active properties. Crude oil may contain up to 1% polar lipids, while refined oil would have less than 30 ppm phospholipids. Tocopherols are recognized as natural antioxidants. Crude peanut oil contains relatively high amounts of tocopherols, 175-1300 mg/kg. There are a number of clinical studies indicating that phytosterols may lower cholesterol levels in blood. Phytosterol content of crude peanut oil is quite high, 901-2854 mg/kg. Unfortunately, tocopherols and phytosterols are lost during conventional edible oil refining, and they end up in by-products. Quality of edible oils is assessed by measuring its free fatty acid (FFA) content. Lower FFA content in crude oil lowers refining losses and increases oil stability. FFA of crude peanut oil less than 1%, which is within the acceptable range by industry. Good quality refined peanut oil would contain about 0.01% FFA.

Peanut oil fatty acid composition may vary depending on the maturity, genotype and growth location. Typical fatty acid distribution for regular and high oleic peanut oil is shown in Table 2. Fatty acid composition of oil is the main criteria for choosing an oil for a given application. Regular peanut oil has higher saturated fatty acid content than many other commodity oils such as canola and soybean oil. That is one of the reasons peanut oil is good for high temperature applications such as frying. Although unsaturated fatty acids are better for health, highly unsaturated oils are less stable and prone to oxidation. The rates of oxidation of unsaturated fatty acids increase with increasing unsaturation. For example, if it is assumed oxidation rate of a saturated fatty acid is 1, relative oxidation rates of unsaturated fatty acids with the same number of carbon atoms but 1, 2 and 3 unsaturated bonds on the molecule would increase 10, 100 and 200 times, respectively. Hence, high concentration of monounsaturated fatty acids, such as oleic acid (one unsaturated bond on the molecule), is preferred in oils to be used for food applications, specifically for applications requiring cooking and longtime high temperature exposure such as frying.

Fatty acid composition of many oilseeds have been modified to meet requirements of various applications, i.e. cooking/frying oil, industrial applications, dietary supplements, etc. New cultivars of peanuts with modified fatty acid composition also have been released. Oleic acid concentration in traditional or regular peanut oils range from approximately 41 to 67%, whereas in high-oleic peanut oils, this fatty acid content is close to 80% (Table 1). A primary functional benefit of high-oleic oils is an extended shelf life. Oleic acid enrichment in peanuts has been achieved through classical breeding techniques. The research carried out at the Oklahoma State University Robert M. Kerr Food and Agricultural Products Center on high oleic peanut varieties developed for the southern U.S. states including Oklahoma indicated conventional genetic selection for high-oleic concentration did not cause any significant unintentional change in peanut nutritional composition.

Physical properties of peanut oil determine its functionality in food formulations. For example, peanut oil solidifies from -1 to 3 degrees Celsuis, hence, it is not good as a salad oil (Table 3). The iodine value (IV) is a measure of unsaturation level of oil. IV of regular peanut oil is within the range reported for other vegetable oils. Density and viscosity are fundamental physical parameters that are important for various process engineering design calculations common in the edible oil industry. Viscosity is the relative thickness or resistance of the oil to flow. Both density and viscosity of the refined peanut oil fall within the range reported for those of other vegetable oils. High-oleic peanut oils are reported to have both lower densities and higher viscosities than those for regular peanut oils. The viscosity differences were most apparent at cooler temperatures. Main components of unsaponifiable fraction of oils are tocopherols and phytosterols. Peroxide value is a measure of the oil quality and the amount of primary oxidation products (OSU Fact Sheet FAPC-197 Edible Oil Quality). Good quality oils would have very low peroxide value. The smoke point is the temperature at which oil produces a continuous stream of smoke during heating. This parameter is very important for evaluating suitability of an oil for frying applications. In general, regulations specify 200 degrees Celsius as the minimum for frying oils. Smoke point of peanut oil is about 230 degrees Celsius, which is higher than the required 200 degrees Celsius.

Peanut allergies are due to specific proteins. In general, refined oils do not contain detectable amount of proteins. However, depending on the degree of processing and handling, minor amount of proteins might end up in oil.

Properties that Make Peanut Oil a Good Frying Oil

1. High smoke point is one of the main reasons peanut oil is preferred as frying oil. High temperature frying allows food to cook quickly resulting in a crispy coating with very little oil absorption.
2. Although crude peanut oil has a nutty aroma, refined oil is odorless. Hence, it does not interfere with the flavor of the formulated foods.
3. Off-flavor and odor development is quite low during frying with peanut oil.
4. Due to its relatively higher saturated fatty acid content, peanut oil is more stable than many other regular vegetable oils, such as regular soybean oil. Hence, peanut oil stands better to extended high heat exposure, minimizing the formation of harmful oxidation products.

Table 1. Constituents of peanut oil.

Constituent	*Regular Crude Oil*
Triacylglyceride (%)	*95 – 97*
Monoacylglycerides (%)	*0.03 – 0.09*
Diacylglycerides (%)	*1.3 – 2.0*
Polar Lipids (%)	*0.1 - 1.0*
Free fatty acids (%)	*0.2 – 0.6*
Unsaponifiables (%)	*0 – 1.0*
Tocopherols (mg/kg)	*175 - 1300*
Phytosterols (mg/kg)	*901 - 2854*

Table 2. Fatty acid composition of peanut oil.

Fatty Acid	***Regular***	***High-oleic***
Capric (10:0)	*-*	*-*
Lauric (12:0)	*0 - 0.1*	*-*
Myristic (14:0)	*0 - 0.1*	*-*
Palmitic (16:0)	*8.3 -14.0*	*7.0*
Palmitoleic (16:1)	*0 – 0.2*	*-*
Stearic (18:0)	*1.9 – 4.4*	*3.0*
Arachidic (20:0)	*1.1 – 1.7*	*1.0*
Behenic (22:0)	*2.1 – 4.4*	*4.0*
Lignoceric (24:0)	*1.1 - 2.2*	*2.0*
Oleic (18:1)	*36.4 - 67.1*	*76.0*
Gadoleic (20:1)	*0.7 – 1.7*	*2.0*
Erucic (22:1)	*0 - 0.3*	*-*
Linoleic (18:2n-6)	*14.0 – 43.0*	*4.0*
Alpha Linolenic (18:3n3)	*0 – 0.1*	*-*
Nervonic (24:1)	*0 – 0.3*	*-*
Total Saturated	*14.6 – 26.9*	*17.0*
Total MUFA	*37.1 – 69.3*	*78.0*
Total PUFA	*14.0 – 43.1*	*4.0*

Table 2. Physical properties of peanut oil.

Parameter	***Range***
Relative density (g/cm^3, 20°C/water at 20°C)	*0.914 - 0.917*
Refractive index (40°C)	*1.460 - 1.465*
Smoke point (°C)	*226*
Melting point (°C)	*-1 - 3*
Specific heat (J/g at 20°C)	*1.910 - 1.916*
Saponification number	*187 - 196*
Iodine value	*83 - 107*
Color (Lovibond)	*Yellow 16-25; Red 2.0*
Peroxide value (meq/kg)	*1.0*
Viscosity (at 21°C, mPas)	*71*

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