SUNFLOWER KERNELS

Research Department

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SUNFLOWER KERNELS IN BAKERY FOODS

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INTRODUCTION

A variety of seeds (sesame, poppy, dill, and caraway, for example) and nuts are traditionally used in bakery products. Sunflower seed, more appropriately the sunflower kernel (hulled seed), is now also gaining popularity and becoming readily available for use in bakery products. Sunflower kernels have a pleasant flavor, a nutty texture, and they are nutritious. In fact, according to a recent Gallup Survey, sunflower kernels were perceived by consumers to be healthier than various other commonly used nuts. This bulletin provides some information on the production and availability of sunflower kernels and their use in selected bakery products.

HISTORY

The sunflower, like corn and pumpkin, is native to North America. Evidence of cultivated sunflower dates back as far as 900 B.C. as found during archeological explorations. The American Indian tribes all across the Northern U.S. found many uses for the sunflower; while used primarily as a food source, sunflower was also used as yellow dye, hair dressing, and as a cure for certain ailments.

Europeans apparently first became acquainted with the sunflower in the 16th century when Spanish explorers took it back to the continent. Planted first in Spain, sunflower use gradually spread north and east through Europe. At the time, sunflower was seen more as a curiosity than food or oil source and was often used for medicinal purposes.

In the 19th century, sunflower outgrew its curiosity status in Russia and came to be adopted as an alternative food to certain other foods decreed restricted during Lent and before Christmas. As a result, Russia became the world's largest sunflower producer and has led world production of total sunflower ever since. Currently, the majority of the Russian crop is grown for the oil.

Sunflower has been produced commercially in the U.S. since World War II, but it did not become an important crop until the early 1970s. In the late 1970s, the U.S. sunflower oilseed industry grew dramatically in response to European demand. The demand for sunflower oilseed and kernel continues to grow both in the U.S. and Europe. The sunflower kernels are widely used in a variety of foods in Germany. Sunflower kernel bread is the most popular use; the kernel is also used as a topping for rolls and related products similar to how sesame and poppy seeds are currently used in the U.S.

PRODUCTION

There are two types of sunflower grown in the U.S. — confection sunflower and oil sunflower. Confection sunflower is normally gray with white stripes and larger than the oil sunflower; oil sunflower has a solid black shell. The hull is loosely fixed to the inside kernel of the confection seed; in the oil sunflower, the hull is tightly attached. The confection sunflower is used in three ways (Table I). It comprises 15 to 25% of the total sunflower production in the U.S., but it is experiencing the greatest growth. Confection sunflower is grown primarily in North Dakota with about 70% of the U.S. acreage. Other production states included Kansas, Minnesota, South Dakota, Texas and Colorado.

TABLE I
USE OF CONFECTION SUNFLOWER SEEDS

Size	Use
Largest	Roasted and salted in the shell (eaten as a snack).
Mid-Size	Hulled to produce kernels (used as a snack and as an ingredient in baked products and other foods).
Small	Used as bird food.

PHYSICAL AND CHEMICAL PROPERTIES

Sunflower kernels are low in moisture and function, technically, like most other nuts and seeds. For the most part, sunflower kernels can be substituted for any nut in formulations and recipes. In fact, sunflower kernels' small size is an advantage in baked goods, eliminating the need for chopping.

Sunflower kernel contains three polyphenol compounds — chlorogenic, caffeic, and quinic acids. Chlorogenic acid causes an irreversible olive green color to develop under alkaline pH conditions. This change in color is harmless. A variety of simple formula modifications and recipe development changes can be made to compensate for this characteristic. For example, use a formula that is a dark color by nature to cover any discoloration (rye or whole wheat recipes, recipes containing brown sugar, molasses, and chocolate) and/or keep the formula as acidic as possible. This can be achieved by adding a citrus juice or vinegar where possible, using baking powder instead of soda, substituting brown sugar, honey, or molasses for white sugar, and adding other acidic ingredients such as cream of tartar, raisins, dates, and most fruits.

QUALITY STANDARDS AND AVAILABILITY

The United States is the world's largest exporter of sunflower kernels and they are recognized as possessing the highest quality available.

Before hulling, the medium-sized seed is passed through an air separation chamber to remove foreign materials. The separation of the hull and kernels is accomplished by a combination of forced air and gravity. After the hulling process, each kernel is passed, often twice, through an electronic sensing device which re-

TABLE II

PRODUCT SPECIFICATIONS

	Standard Sunflower Kernels or Chips
—Physical	
Flavor	Good, typical sunflower kernel flavor, free of strong, stale, flat or rancid flavors.
Odor	Good, typical, free of off-odors.
Texture	Firm, not brittle or soggy.
Color	Off-white, gray.
Size	NMT[a] 650/ounce (kernels); over 8/64 RHS[b] (chips).
Foreign Material[c]	NMT 0.1%.
Broken Kernels	NMT 10% (kernels).[d]
Damage	NMT 0.5% heat damage and NMT 2% insect damage (kernels); NMT 5% including heat and insect damage (chips).
—Chemical	NMT 10% and not less than 4% moisture.
—Microbiological	All tests, including aflatoxin testing will be done in strict compliance with the latest specifications from the AOAC methods manual and also the bacteriological analytical manual for the food by the FDA.
—Extraneous Material (macro/micro)	Free of rodent activity and live post harvest insect infestation.
—Pesticide Residues	Meets all state and federal regulatory requirements.
—Fumigants	Only FDA approved fumigants may be used as considered necessary. Residues may not exceed FDA approved tolerance.
—Chemical Additives	No preservatives or chemical additives may be used.

[a] Not more than (NMT).

[b] Round hole sieve (RHS).

[c] Including shell and unshelled seeds.

[d] Broken sunflower nut meat is any portion less than ½ of the whole sunflower meat.

jects discolored kernels. This assures a high quality product for food use.

Sunflower kernels are typically packed in 50 pound, multi-wall bags with other sizes available. To assure a fresh supply, sunflower seeds are hulled year-round.

Kernels are available raw or roasted as well as roasted and salted. Sunflower kernel pieces or "chips" are also available and can be ideal for some bakery applications. Table II lists the product specifications for sunflower kernels and chips.

STORAGE AND HANDLING

The oil in sunflower kernels is highly polyunsaturated, therefore the kernels are susceptible to oxidation after processing. However, sunflower kernels are also high in vitamin E (alpha-tocopherol) which acts as an antioxidant.

TABLE III

NUTRIENT CONTENT OF SUNFLOWER KERNELS[a]

	Amount (Per 100 g Edible Portion)
Energy, Kcal	570
Macronutrient, g	
Protein (N × 5.3)	22.8
Water	5.4
Ash	3.5
Fat	49.6
Polyunsaturated (69%)	
Monounsaturated (21%)	
Saturated (10%)	
Cholesterol	0
Dietary Fiber	13.5
Carbohydrates (excluding fiber)	5.2
Minerals, mg	
Calcium	116
Iron	6.8
Magnesium	354
Phosphorus	705
Potassium	689
Zinc	5.1
Copper	1.8
Manganese	2
Sodium	3
Vitamins, mg	
Thiamin	2.3
Riboflavin	0.3
Niacin	4.5
Vitamin A, IU	50
Vitamin E	47

[a] From reference 4.

Because of the shelf-life of the bread and many other bakery products is shorter than the shelf-life of the added sunflower kernels, shelf-life is usually not an issue for sunflower kernels in baked products. Even when stored at much higher than normal temperatures for testing purposes, off-flavors were not detected in sunflower kernels baked in bread until after 10 days had passed. (1).

For storing sunflower kernels before additon to baked goods, controlling moisture, temperature and exposure to oxygen will prolong shelf-life of sunflower kernels stored before addition to baked goods (2). Raw sunflower kernels keep very well, especially when they are kept cold and dry. Sunflower kernels with a moisture content of 10% or less can be stored up to 12 months when storage temperatures are maintained at 60°F or less with 40 to 60% relative humidity.

Roasted sunflower kernels generally have a shorter shelf-life. Protecting roasted kernel from exposure to oxygen, as well as controlling temperature prolongs shelf-life. For example, packing roasted kernels under nitrogen atmosphere and in metallic polyester bags retains freshness and high quality (2). Freshness of roasted sunflower kernels in these conditions can easily be maintained for 6 months, and have retained freshness beyond 12 months. Researchers are also experimenting with a coating process that further protects the sunflower kernels from exposure to oxygen. They have found that coating kernels with an edible hydrocolloid film effectively extends the shelf-life of the roasted kernels (3). This process is still experimental at this time.

NUTRITIONAL QUALITY

Sunflower kernels are considered a "healthy" product. This is amply supported by the compositional data shown in Table III (4). The fat in confectionery sunflower kernels is primarily polyunsaturated and like other fats from vegetable sources, contains no cholesterol. Sunflower kernels are also rich in protein. Sunflower kernels qualify for a meat alternative in programs such as USDA's National School Lunch Program.

Among the micronutrients, the kernel's strongest asset is its high iron, zinc, potassium and magnesium content. Sunflower kernel is also a good source of vitamin E.

Fiber is another strong point of sunflower kernels. The total dietary fiber content of sunflower kernels is over 13 grams (g) per 100 g edible portion. Every ounce of sunflower kernels provides about 4 g of fiber. This is similar to the fiber content of the typical bran flake cereals and is more fiber than an apple.

BAKERY APPLICATIONS OF SUNFLOWER KERNELS

Sunflower kernels add a unique mild taste and a crunch to baked goods. They can be substituted for any nut in a formulation — often at a price advantage. In fact, their small size and texture make sunflower kernels especially well-suited for addition to baked goods. Table IV lists ideas for sunflower kernel used in baked goods.

Other tables (Tables V-IX) show formulas for selected baked goods where sunflower kernels were added. Since four of these tables list formulas in terms of commonly used household units, information in Table X would allow converting these units to pounds (lb) and ounces (oz) for large-scale production.

Sunflower Wheat Bread

The formula presented in Table V is for a one pound (16 slices) loaf. Sunflower kernels are added in the formula at 20% level, flour basis. Sunflower kernels can also be sprinkled on the loaf after first brushing the baked loaf with honey.

Sunburst Loaf (Hearth Bread)

The formula presented in Table VI is again for a one-pound loaf. Here, sunflower kernels are added to the bread dough and also sprinkled on top of the loaf before baking.

Sunflower Kernel Bagels

Sunflower kernels can be used in different varieties of bagels — 30% wheat bagels, light rye bagels, onion bagels, onion-dill, and pumpernickel-onion bagels. Table VII provides a formula for plain bagels.

Sunflower Cookies

Cookies are great snack items. They are a good source of energy and with ingredients such as sunflower seeds, they provide essential nutrients also. Table VIII lists a formula for cookies which, as a dough or prepared product, can be easily frozen and stored for use at appropriate occasions later.

Sunflower Pumpkin Muffins

As shown in Table IX, sunflower is used in muffins both as oil and as kernels. Kernels are used in the dough as well as toppings.

SUMMARY

Sunflower seeds have a pleasant flavor, a desirable texture and an impressive nutritional profile. Products containing sunflower kernels are likely to be thought of as healthy products with desirable eating characteristics. Sunflower kernels are, thus, quite well-suited for addition to a variety of bakery products.

Note: For additional information, contact the National Sunflower Association, 4023 N. State Street, Bismarck, ND 58501-0690; telephone: 701/224-3019; telefax: 701/224-2798.

TABLE IV

USES OF SUNFLOWER KERNELS IN BAKED GOODS

- —As a nut added to caramel or cinnamon rolls.
- —Sprinkled on the top of rolls, bread sticks, and loaves for an added crunch and eye appeal.
- —Whole or coarsely chopped as a filling for pastry.
- —Added to batter for carrot cake, quick breads, or muffins.
- —Baked into bagels.
- —Decorative toppings for cakes, cookies, brownies.
- —Any other item which uses a nut to improve texture, taste, or appearance.

TABLE V

SUNFLOWER WHEAT BREAD (16-Slice Loaf)

Ingredient	Amount	Processing
Flour		In a large bowl, combine the top 7 ingredients and blend well. Add milk and egg; stir just until ingredients are moistened. Stir in sunflower kernels. Pour into greased 9″ × 5″ bread pan. Bake at 350°F for 50 min. or until bread tests done. If necessary, cover loaf with foil during the last 15 min. of baking to prevent overbrowning. Cool in pan for 10 min.; turn out onto wire racks and allow to thoroughly cool before cutting.
Whole Wheat	1.5 cup	
All-Purpose	1 cup	
Quick Cooking Rolled Oats	0.5 cup	
Brown Sugar, Packed	0.5 cup	
Finely Shredded Orange Peel	1 Tbsp	
Baking Powder	0.5 tsp	
Salt	0.5 tsp	
Buttermilk	1.75 cup	
Eggs (Slightly Beaten)	1	
Sunflower Kernels	0.5 cup	
Honey	Garnish	Brush top of loaf with honey and sprinkle with additional sunflower kernels, if desired.
Sunflower Kernels	Garnish	

TABLE VI

SUNBURST LOAF

Ingredient	Amount	Processing[a]
All-Purpose Flour	2.5 cup	In a mixing bowl, combine 1 cup flour and the other 3 top ingredients and mix well. In a small saucepan, heat the milk until hot to touch; stir in sunflower oil and molasses. Add the warm liquids to the dry ingredients above. Beat at low speed of electric mixer for 0.5 min., scraping sides of bowl. Beat 3 min. at high speed. Stir in (by hand) the oatmeal and sunflower seeds, and as much of the remaining flour as possible. Turn out onto a lightly floured surface and knead in remaining flour. Place dough in greased bowl; turn once to grease all surfaces. Cover, let rise until double (30 min.), punch down, cover again and let rest (10 min.).
Brown Sugar, Packed	2 Tbsp	
Rapid Rise Yeast	1 packet	
Salt	0.5 tsp	
Milk	1 cup	
Sunflower Oil	2 Tbsp	
Molasses	2 Tbsp	
Oatmeal (Regular or Quick Cooking)	0.5 cup	
Sunflower Seeds (Raw or Roasted)	0.5 cup	
Egg (Beaten)	1	
Sunflower Seeds	Sprinkle	

[a] To shape the rested dough, pat the dough out to a 10-inch circle and place it on a greased round pizza pan or 15″ × 10.5″ baking sheet. Using a knife, make 12, 2-inch cuts towards the center at equal intervals to form the petals. Brush the loaf with the beaten egg and sprinkle about one tablespoon of sunflower seeds in the center of the loaf. Cover and let rise again (20 min.). Bake at 375°F for 20 min.

TABLE VII

SUNFLOWER KERNEL BAGELS

Ingredient	Amount (g)	Processing
Bread Flour	1000	Mix all ingredients (Hobart A-200 mixer with McDuffee bowl and agitator) for 1 min. at low speed and 8 min. at medium speed (dough temp., 80 to 82°F). Scaling weight, 70 g dough per bagel. Ferment for 18 hours at 40°F (cover bagels to prevent drying), proof for 20 min. at 84°F, dip in boiling water (each side, 1 min.), dry for 5 min. at room temperature and bake (15 min. at 450°F) on sheet pans lined with silicone treated paper.
Vital Wheat Gluten	40	
Granulated Sugar	30	
Salt	20	
All-Purpose Vegetable Shortening	30	
Compressed Yeast	20	
Sunflower Kernels (Roasted, Unsalted)	100	
Water	540	

TABLE VIII

SUNFLOWER COOKIES[a]

Ingredient	Amount	Processing
Sunflower Margarine	1 cup	In medium size mixing bowl, combine margarine and sugars until well-blended. Add the vanilla. Stir together the flour, baking soda, baking powder and salt, add to the margarine mixture. Stir in oatmeal, coconut, and sunflower seeds. Drop by rounded tablespoons onto an ungreased baking sheet. Bake at 350°F for 8 to 10 min. or until cookies are brown around the edges.
Granulated Sugar	1 cup	
Brown Sugar, Packed	1 cup	
Eggs	2	
Vanilla	1 tsp	
All-Purpose Flour	2 cup	
Baking Soda	1 tsp	
Baking Powder	0.5 tsp	
Salt	0.25 tsp	
Oatmeal[b]	2 cup	[a] Makes about 4 dozen cookies. May substitute chocolate chips or raisins for coconut.
Flaked Coconut	1 cup	
Sunflower Seeds (Roasted, Salted, or Unsalted)	1 cup	[b] Old-fashioned or quick-cooking.

TABLE IX

SUNFLOWER PUMPKIN MUFFINS

Ingredient	Amount
All-Purpose Flour	2 lb
Brown Sugar	2 lb
Baking Powder	5 Tbsp
Pumpkin Pie Spice	2 Tbsp
Salt	1 Tbsp
Baking Soda	0.5 Tbsp
Canned Pumpkin	6 cup
Eggs (Slightly Beaten)	8
Milk	2 cup
Sunflower Oil	2 cup
Oatmeal	8 cup
Sunflower Kernels	4 cup
Topping	
Brown Sugar	2.66 cup
Melted Butter	0.25 lb
Flour	0.5 cup
Pumpkin Pie Spice	0.5 cup
Sunflower Kernels	1.5 cup

Processing

Stir together dry ingredients, add combined pumpkin, egg, milk, and oil and stir slightly. Add oats and sunflower kernels. Fill greased muffin tins 3/4 full. Mix topping ingredients until crumbly. Sprinkle muffins with topping. Bake at 425°F for 18 to 20 min.

Yield: 96 muffins.

TABLE X

UNIT CONVERSIONS

Ingredient	Conversion Equivalents[a]			
	Cup	lb	oz	Tbsp
Whole Wheat Flour	3-4	1	16	
All-Purpose Flour	4-4.5	1	16	
Brown Sugar	1	0.38	6	
White Sugar, Granulated	1	0.5	8	
Molasses			1	1
Salt			1	2
Baking Powder or Soda	1		6	
Milk	1		8	
Honey	1		12	
Sunflower Kernels	1		5	
Egg, Raw, Whole (1)	0.25		2	
Rolled Oats or Oatmeal	1		4	
Orange Rind, Grated	1		3	
Oil	2.2	1		
Butter or Margarine	1		8	
Pumpkin, Canned	2.5	1		
Coconut, Flaked	1		2.7	
Spices, Ground			1	5
Vanilla			1	1

[a] These are only proximate conversions. One tablespoon (Tbsp) roughly equals three teaspoons, and 16 Tbsp roughly equals one cup.

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