UTILIZATION OF SUNFLOWER IN HUMAN FOOD PRODUCTS

By

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In this time of exploding world population and expanding social concern, food technologists are feeling ever increasing pressure to develop new and better sources of foods, especially high protein foods. Oilseeds such as soybean, sunflower, peanut, cottonseed, rapeseed, sesame, and safflower seem to offer the cheapest and most promising readily available new source of protein for human foods.

Of all the oilseeds, sunflower is probably the newest and most exciting new protein source. Whole sunflower kernels and high protein sunflower meal can not only be incorporated into new human food formulations, they can also be combined with available inexpensive staples to develop nutritious enriched products that are traditionally accepted by the populations of various countries.

Efficient utilization of sunflower products could conceivably satisfy a large portion of the current high protein products market. The purpose of this study was to identify some problems and develop a technology for the utilization of sunflower in human foods.

Several types of sunflower products are now available. Whole sunflower seeds are used primarily for oil production and the birdseed trade. Dehulled kernels have found limited use in the snack food trade and the defatted meal is used primarily for livestock feeds. At the present time, oil is the most important economic component of sunflower seeds. In recent years sunflower seed oil has increased faster in world importance than oil from any other source. Since 1962, sunflower has climbed from fifth to second place in International oil production. The popularity of this oil is due to its attractive color, pleasant flavor, and good stability.

Materials and Methods

In this study dehulled sunflower kernels were roasted at 350°F in a Stabil-Therm forced draft overn for various periods of time and physical and organoleptic tests were made to determine the most desirable roast. An experienced taste panel indicated a definite preference for seeds with a 10 - 15 minute roast. Correlation coefficients were then computed to determine the relationships between the various attributes of the roasted sunflower kernels.

Shear value was determined on 1 gm. samples using an Allo-Kramer shear press with a 500 pound test ring. Percent moisture was determined by drying 3 gram samples of ground sunflower kernels 48 hours at 70°C in the Stabil-Therm forced draft oven according to the A.O.A.C. method. The

color values of the roasted kernels were determined using a Gardner Automatic Color Difference Meter with a red-brown standard calibration plate. Flavor, Color, Texture, Odor, Appearance, and Product Acceptance were determined by an informal group of experienced taste panelists.

The correlation coefficients indicate that percent moisture and texture were the most highly related characteristics and as % moisture decreased desirable texture increased. Shear value and texture were also highly related and negatively correlated. Color was the most important physical characteristic related to flavor, appearance and product acceptance. This would, of course, seem natural since color is a good indication of amount of roast.

Dehulled and roasted sunflower kernels were used as a nut substitute in many confectionary and bakery formulas and were found to be very acceptable. When used in cakes, cookies, and pies the sunflower kernels had a definitely nutty flavor and maintained a crisp texture even after cooking. In some products, the kernels were too crisp and the sunflower flavor was too concentrated but this problem was alleviated by chopping or grinding the kernels.

Both the raw and roasted kernels have a tendency to develop a rancid taste unless held under cold storage. Workers at the Northern Regional Research Laboratory in Peoria, Illinois isolated and identified four oxygenated fatty acids in sunflower seed oil that could affect its flavor stability and nutritional value. These are cis-9, 10-epoxystearic acid, cis-9, 10-epoxy-cis 12 octadecenoic acid, 13-hydroxy-cis-9, trans-11-octadecadienoic acid, and 9-hydroxy-trans-10, cis 12 octadecadienoic acid.

The hexane extracted sunflower meal has a slightly nutty, but relatively bland flavor and exhibits excellent stability even under poor storage conditions. This hexane extracted meal is an attractive creamy white color unless it is exposed to alkaline conditions when the oxidation of chlorogenic acid, a phenolic compound, will cause an undesirable color development.

At various pH levels the meal will turn from white to beige to green to brown. The white color on the acid side of the range is due to some protein precipitation while the darkening and green on the alkaline side are due to oxidation of the chlorogenic acid. These color reactions present few problems as most foods are slightly acid. However, since the chlorogenic acid is both highly water and alcohol soluble, in processes with a high percentage of water or alcohol and in highly alkaline processes, an undesirable color reaction does occur in both the meal and the alkaline water or alcohol solutions. This can create problems in areas such as tortilla or textured vegetable protein manufacture.

High protein tortilla chips were made from different types of sunflower meals and were evaluated. The non-defatted meal produced a chip that had a pleasant golden brown color but quickly developed a rancid flavor. Chips made from the defatted meal also had a pleasant color and a slightly nutty flavor. Chips made from the sunflower masa had the characteristic masa flavor and odor, but had a very unpleasant green color.

Textured vegetable protein fibers were made utilizing a modified low alkaline process described by Anson and Pader for peanut meal. The fibers were quite bland in flavor, but did darken as they dried due to the oxidation

Correlation Coeffecients for Organoleptic and Physical Attributes

of Roasted Sunflower Kernels

	Shear Value	% Moisture	Rd	a	b	Flavor	Color	Texture	Odor	Appearance	Product Appearance
Shear Value	1.000	0.928*	0.527*	-0.494*	0.199	0.165	0.178	-0.790*	0.297	0.291	0.153
% Moisture		1.000	0.681*	-0.639*	0.303	0.267	0.238	-0.929*	0.405*	0.391	0.276
Rd			1.000	-0.732*	0.792*	0.575*	0.633*	0.140	0.641*	0.759*	0.673*
a				1.000	-0.191	0.483*	-0.361	-0.166	-0.445*	-0.547*	-0.554*
b					1.000	0.417*	0.617*	0.905*	0.529*	0.631*	0.513*
Flavor						1.000	0.554*	0.520*	0.687*	0.714*	0.942*
Color							1.000	0.440*	0.551*	0.828*	0.624*
Texture								1.000	0.294	0.507*	0.590*
Odor									1.000	0.694*	0.696*
Appearance										1.000	0.772*
Product Acceptance											1.000

* Significant at 1% level

of chlorogenic acid.

Bread was baked substituting 10 - 20% of the wheat flour with sunflower meal. This high protein product had a distinctive slightly nutty flavor and exhibited no adverse color reaction at all.

In conclusion, the physical, and organoleptic properties indicate that dehulled sunflower kernels can be used in human food formulations. Physical and organoleptic analysis of the color, flavor, texture, and acceptance indicate a 10 - 15 minute roast at 350°F is the most desirable and that sunflower seeds are extremely acceptable as a nut substitute in bakery and confectionary products.

Chemical and physical analysis of defatted sunflower meal indicates that the major problem was discoloration due to oxidation of chlorogenic acid. An attractive cream color, relatively bland flavor, and excellent stability was demonstrated even under poor storage conditions. High protein tortilla chips and textured vegetable protein fibers made from the meal were acceptable when processing conditions did not induce oxidation of chlorogenic acid. The defatted meal was quite acceptable in products with a normal pH range.

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