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(54) Title: FOOD COMPOSITIONS INCORPORATING STEARIDONIC ACID.

(57) Abstract: The present invention relates to the improvement of food items through the increased utilization of plant-derived stearidonic acid. Many long chain fatty acids have been classified as being Omega 3 and have been shown to provide several health benefits, including heart health. According to the current invention plant-derived stearidonic acid (18:4ω3) has been incorporated into a wide range of food products by using either oil or flour processed from soybeans with enhanced levels of stearidonic acid. These foods range from oil-based products (salad dressing, mayonnaise) to dairy products (milk, cheese) to prepared foods (entrees, side dishes). In addition to improved health benefits the current invention provides food rich in Omega-3 fatty acids that have enhanced storage and/or shelf life characteristics.

FOOD COMPOSITIONS INCORPORATING STEARIDONIC ACID

FIELD OF THE INVENTION

[001] The present invention relates to the utilization of transgenically derived stearidonic acid in the development of functional food products. More specifically it relates to an improvement in both the nutritional quality and shelf-life of food products through the use of transgenic plant-derived stearidonic acid.

BACKGROUND OF THE INVENTION

[002] The present invention is directed to a method for improving foodstuffs through the utilization of plant-derived stearidonic acid ("SDA"). Specifically, the inventor provides techniques and methods for the utilization of plant-derived SDA in foodstuffs that improves nutritional quality. In the past dietary fats have been thought of as valueless or even harmful dietary components. Many studies have made a physiological link between dietary fats and obesity and other pathologies such as atherosclerosis. Given this perception of low nutritional value, consumption of fats has been discouraged by many in the medical establishment.

[003] However, recent studies have determined that despite their relatively simple biological structures there are some types of fats that appear to improve body function in some ways and that may, in fact, be essential to certain physiological processes. The wider class of fat molecules includes fatty acids, isoprenols, steroids, other lipids and oil-soluble vitamins. Among these are the fatty acids. The fatty acids are carboxylic acids, which have from 2 to 26 carbons in their "backbone," with none, or various numbers of unsaturations in their carbohydrate structure. They generally have dissociation constants (pKa) of about 4.5 indicating that in normal body conditions (physiological pH of 7.4) the vast majority will be in a dissociated form.

[004] With the improvement in nutritional stature for fats and in particular fatty acids, many in the food industry have begun to focus on fatty acids and lipid technology as a new focus for food production. This focus has been particularly intense for the production and incorporation of Omega-3 fatty acids into the diet. Omega-3 fatty acids are long-chain

polyunsaturated fatty acids (18-22 carbon atoms in chain length) with the first of the double bonds ("unsaturations") beginning with the third carbon atom. They are called "polyunsaturated" because their molecules have two or more double bonds "unsaturations" in their carbohydrate chain. They are termed "long-chain" fatty acids since their carbon backbone has at least 18 carbon atoms. In addition to stearidonic acid "SDA" the omega-3 family of fatty acids includes alpha-linolenic acid ("ALA"), eicosapentaenoic acid ("EPA"), and docosahexaenoic acid ("DHA"). ALA is the "base" omega-3 fatty acid, from which EPA and DHA are made in the body through a series of enzymatic reactions, including the production of SDA. Most nutritionists point to DHA and EPA as the most physiologically important of the Omega-3 fatty acids. This synthesis processes from ALA are called "elongation" (the molecule becomes longer by incorporating new carbon atoms) and "desaturation" (new double bonds are created), respectively. In nature, ALA is primarily found in certain plant seeds (e.g., flax) while EPA and DHA mostly occur in the tissues of cold-water predatory fish (e.g., tuna, trout, sardines and salmon), and in some marine algae or microbes that they feed upon.

[005] It is also not widely known that the cold-water marine fish harvested for omega-3's and their use as food do not actually produce the essential omega-3 PUFA's, EPA and DHA. Rather, the long chain PUFA's are biosynthesized by microbes or alga and are passed up the food-chain and collect in the tissues of predatory species. Currently there are two commercially available marine single-cell oils rich in DHA produced by a United States Company - Martek, one from a heterotrophic dinoflagellate (*Crypthecodinium cohnii*) and the other from a marine thraustochytrid (*Schizochytrium sp.*). Unfortunately, the cost of production is simply too substantial to commercially justify large scale production and the available supply remains small.

[006] In addition to difficulties with simply securing a supply of Omega-3 fatty acids, are the costs to process omega-3 fatty acids into food products. Even after harvest these costs are also prohibitive to food companies. The reason for additional processing costs is the relative chemical instability of EPA and DHA. These Omega-3 fatty acids can be quickly oxidized leading to undesirable odors and flavors. To reduce the rate of oxidation food processors must therefore either distribute the oil in a frozen condition or encapsulate the desirable fatty acids, each greatly increasing the cost of processing and consequent cost to the consumer. Despite this increased expense - food companies are interested in supplying Omega-3 fatty acids because

they believe that health conscious consumers may be willing to pay a small premium for an improved diet if a reliable supply can be developed.

[007] Along with the movement of food companies to develop essential fats and oils as an important component in a healthy diet, governments have begun developing regulations pushing for the adoption of PUFA's in the diet. The difficulty in supplying these needs has been the inability to develop a large enough supply of Omega-3 oil to align with growing marketplace demand. As already mentioned, the Omega-3 fatty acids deemed to be of highest value, EPA and DHA, also chemically degrade very quickly over time limiting commercial access. Importantly, during the rapid process of EPA and DHA oxidation these long chain fatty acids develop rancid or simply unsatisfactory sensory properties that make their inclusion in many foodstuffs difficult or impossible from a commercial acceptance perspective. In addition, with increased demand for Omega-3 fatty acids has come the realization that already depleted global fish stocks cannot meet any significant growth in future human nutritional needs for Omega-3's. These limitations on supply, stability and sourcing greatly increase cost and correspondingly limit the availability of dietary Omega-3's.

[008] Accordingly, a need exists to provide a large-scale stable supply of Omega-3 fatty acids or critical precursors thereto that can be included in food and feed formulations in a commercially acceptable way. The current invention provides this alternative to fish or microbe supplied Omega-3 fatty acids and does so utilizing a comparatively chemically stable Omega-3 fatty acid, SDA as a source that offers neutral taste, cost-effective production and abundant supply as derived from transgenic plants. SDA is the immediate metabolic product of α-linoleic acid ("ALA"), and once in the body is readily metabolized to EPA. The plant species that are specifically included within the group of those that could supply demand are: soybeans, corn, and canola, but also may include other plants as needed. Once produced the SDA of the invention can be used to improve the health characteristics of a great variety of food products. This production can also be scaled-up as needed to both reduce the need to harvest wild fish stocks and to provide essential fatty acid components for aquaculture operations, each easing pressure on global fisheries.

[009] Importantly, the current art suggests that food compositions comprising alpha-linolenic acid are not converted to EPA to any physiologically significant extent when formulated into foods and/or beverages for commercial sale and consumer consumption. The

difficulty here is the needed volume of ALA relative to the reasonable volume of consumer foodstuffs. Traditional means of obtaining physiologically relevant amounts of EPA or DHA include the addition of fish oils or algal oils which possess negative attributes of off-flavors and poor stability. In order to contain a concentration of ALA that will lead to a physiologically significant concentration of EPA and DHA in the body, an excessive amount of ALA is required, leading to difficulties in formulating food products and portion sizes that are simply not practicable..

[0010] Surprisingly, the inventor has found that the concentration of SDA from the transgenic plant sources of the invention require a far lower concentration in a given food or beverage product to be physiologically significant, these ranges are well within acceptable volume parameters for typical food products. A further benefit is found in the enhanced flavor and stability in comparison with other means of obtaining similar benefits such as direct addition of DHA containing oils like fish oil. As such, the SDA compositions of the invention are uniquely suited fatty acid for both healthy and stable food compositions.

SUMMARY OF THE INVENTION

[0011] The present invention encompasses production of oil from transgenic soybeans engineered to contain significant quantities of stearidonic acid (18:4ω3) for use in food products to improve the health of an end consumer. Sufficient quantities of SDA enriched soybeans have been grown to allow the delivery of soybean oil with a substantial SDA component. This "SDA oil" provides an initial clean flavor, longer shelf-life stability and enhanced nutritional quality relative to either source of Omega-3 oils. The means to maintain oil quality during storage have also been developed. Several food products made from the SDA oil have been produced and found to have similar taste and sensory properties compared to products made from conventional oils, such as soybean oil.

[0012] Also according to the current invention, shelf-life testing of food products has also been conducted and the plant-derived SDA oil has substantially improved shelf-life characteristics relative to other Omega-3 containing products. Therefore, a preferred

embodiment of the current invention is the usage of the SDA oil produced by transgenic plants in the production of food products for human consumption.

[0013] Nutritional studies have shown that, compared to alpha-linolenic acid, SDA is about 5 times more efficiently converted *in vivo* to EPA. Accordingly, in another embodiment of the current invention plant-derived SDA can be utilized as a neutraceutical supplement or dietary additive for certain pathological conditions.

[0014] Specifically, the current invention demonstrates that acceptable food products can be made with stearidonic acid, increasing their shelf-life beyond that of competitive PUFA oils.

[0015] Moreover, the method of the current invention also provides for optimizing food formulations to optimize health improvements in end consumers, in the form of an edible oil, processing oil or oil composition, a whole bean extraction for use in a soymilk formulation or as a partial extraction flour-type composition.

[0016] In an additional embodiment of the current invention the SDA oils produced by transgenic plants can form the basis for the diet of aquaculture raised fish and/or products from those fish.

[0017] In an additional embodiment of the current invention the SDA oils produced by transgenic plants can form the basis for the diet of beef cattle to improve the nutritional characteristics of beef and/or beef products. Additional embodiments of the current invention may also improve reproductive function.

[0018] In an additional embodiment of the current invention the SDA oils produced by transgenic plants can form the basis for the diet of pigs to improve the nutritional characteristics of pork and/or pork products. Additional embodiments of the current invention may also improve reproductive function.

[0019] In an additional embodiment of the current invention the SDA oils produced by transgenic plants can form the basis for the diet of chickens to improve the nutritional characteristics of chicken and/or chicken products. Additional embodiments of the current invention may also improve reproductive function.

[0020] Other features and advantages of this invention will become apparent in the following detailed description of preferred embodiments of this invention, taken with reference to the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Fig. 1 Shows The Biosynthetic Pathway Of PUFA Metabolism.

[0022] Fig. 2 Shows Time Point Testing For Sensory Information For Italian Dressing A-E.

[0023] Fig. 3 Shows Time Point Testing For Sensory Information For Ranch Dressing A-E.

[0024] Fig. 4 Shows Time Point Testing For Sensory Information For Mayonnaise A-D.

[0025] Fig. 5 Shows Time Point Testing For Sensory Information For Soymilk A-B.

[0026] Fig. 6 Shows Time Point Testing For Sensory Information For Fruit Smoothies A-C.

[0027] Fig. 7 Shows A Graphic Representing The Relative Bioactivity Of Omega-3 Fatty Acids.

[0028] Fig. 8 Shows A Process Flow Diagram For The Production Of Soymilk.

[0029] Fig. 9 Shows A Process Flow Diagram For The Production Of Vanilla Soymilk.

[0030] Fig. 10 Shows A Process Flow Diagram For The Production Of Margarine.

[0031] Fig. 11 Shows A Model of Stearidonic Acid.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0032] The following abbreviations have designated meanings in the specification:

Abbreviation Key:

AA	**Arachidonic Acid**
ALA	**α – Linolenic Acid**
DHA	**Docosahexanoic Acid**
DNA	**Deoxyribonucleic Acid**
EPA	**Eicosapentanoic Acid**
GLA	**γ- Linolenic Acid**
LA	**Linoleic Acid**
mRNA	**messenger Ribonucleic Acid**
PUFA	**Poly-Unsaturated Fatty Acids**
SDA	**Stearidonic Acid**

Explanation of Terms:

Expression – The process of the transcription of a gene to produce the corresponding mRNA and translation of this mRNA to produce the corresponding gene product (i.e., a peptide, polypeptide, or protein).

Feed - Materials available for feeding animals which includes without limitation forage, fodder and concentrates.

Food – Substances which are ingested by humans and contain nutrients which can be metabolized to produce energy.

Gene – Chromosomal DNA, plasmid DNA, cDNA, synthetic DNA, or other DNA that encodes a peptide, polypeptide, protein, or RNA molecule.

Host or Host Organism – Bacteria cells, fungi, animals and animal cells, plants and plant cells, or any plant parts or tissues including protoplasts, calli, roots, tubers, seeds, stems, leaves, seedlings, embryos, and pollen.

Mouthfeel - Means how the substance feels in a human mouth. With regard to taste test profiles this refers to the viscosity, texture and smoothness of the substance being tested.

Nutritional Food Bar – As used herein, the term "Nutritional Food Bar" means a food bar designed to promote health.

Transformation – refers to the introduction of nucleic acid into a recipient host.

Transgene – Any piece of a nucleic acid molecule that is inserted by artifice into a cell, or an ancestor thereof, and becomes part of the genome of the plant or animal which develops from that cell. Such a transgene may include a gene which is partly or entirely exogenous (i.e., foreign) to the transgenic plant or animal, or may represent a gene having identity to an endogenous gene of the plant or animal.

Transgenic – Any cell that includes a nucleic acid molecule that has been inserted by artifice into a cell, or an ancestor thereof, and becomes part of the genome of the plant or animal which develops from that cell.

DETAILED DESCRIPTION

[0033] The present invention relates to a system for an improved method of production of stearidonic acid and its incorporation into the diets of humans and livestock in an effort to improve human health. This production is through the utilization of transgenic plants engineered to produce SDA in high yield to allow commercial incorporation into food products. For the purposes of the current invention the acid and salt forms of fatty acids, for instance, butyric acid and butyrate, arachidonic acid and arachidonate, will be considered interchangeable chemical forms.

[0034] Turning to FIG. 1, all higher plants have the ability to synthesize the main 18 carbon PUFA's, LA and ALA, and in some cases SDA (C18:4n3, SDA), but few are able to further elongate and desaturate these to produce AA, EPA or DHA. Synthesis of EPA and/or DHA in higher plants therefore requires the introduction of several genes encoding all of the biosynthetic enzymes required to convert LA into AA, or ALA into EPA and DHA. Taking into account the importance of PUFAs in human health, the successful production of PUFAs (especially the n-3 class) in transgenic oilseeds, according to the current invention can then provide a sustainable source of these essential fatty acids for dietary use. The "conventional" aerobic pathway which operates in most PUFA-synthesising eukaryotic organisms, starts with Δ6desaturation of both LA and ALA to yield γ-linolenic (GLA, 18:3n6) and SDA.

Establishing the Composition of Oils

[0035] Turning to Table 1a, it is important to provide a basis of what constitutes 'normal' ranges of oil composition vis-à-vis the oil compositions of the current invention. A significant source of data used to establish basic composition criteria for edible oils and fats of major importance has been the Ministry of Agriculture, Fisheries and Food (MAFF) and the Federation of Oils, Seeds and Fats Associations (FOSFA) at the Leatherhead Food Research Association facility in the United Kingdom.

[0036] To establish meaningful standards data, it is essential that sufficient samples be collected from representative geographical origins and that the oils be pure. In the MAFF/FOSFA work, over 600 authentic commercial samples of vegetable oilseeds of known

origin and history, generally of ten different geographical origins, were studied for each of 11 vegetable oils. The extracted oils were analyzed to determine their overall fatty acid composition ("FAC"). The FAC at the 2-position of the triglyceride, sterol and tocopherol composition, triglyceride carbon number and iodine value, protein values in the oil, melting point and solid fat content as appropriate are determined.

[0037] Prior to 1981, FAC data were not included in published standards because data of sufficient quality was not available. In 1981, standards were adopted that included FAC ranges as mandatory compositional criteria. The MAFF/FOSFA work provided the basis for later revisions to these ranges.

[0038] In general, as more data became available, it was possible to propose fatty acid ranges much narrower and consequently more specific than those adopted in 1981. Table 1a gives examples of FAC of oils that were adopted by the Codex Alimentarius Commission (CAC) in 1981 and ranges for the same oils proposed at the Codex Committee on Fats and Oils (CCFO) meeting held in 1993.

TABLE 1a - STANDARDS FOR FATTY ACID COMPOSITION OF OILS

Fatty acid	Soybean oil		Groundnut oil		Cottonseed oil		Sunflower-seed oil	
	1981	1993	1981	1993	1981	1993	1981	1993
C14:0	< 0.5	< 0.2	< 0.6	< 0.1	0.4-2	0.6-1	< 0.5	< 0.2
C16:0	7-14	8-13.3	6-16	8.3-14	17-31	21.4-26.4	3-10	5.6-7.6
C16:1	< 0.5	< 0.2	< 1	< 0.2	0.5-2	0-1.2	< 1	< 0.3
C18:0	1.4-5.5	2.4-5.4	1.3-6.5	1.9-4.4	1-4	2.1-3.3	1-10	2.7-6.5
C18:1	19-30	17.7-26.1	35-72	36.4-67.1	13-44	14.7-21.7	14-65	14-39.4
C18:2	44-62	49.8-57.1	13-45	14-43	33-59	46.7-58.2	20-75	48.3-74
C18:3	4-11	5.5-9.5	< 1	< 0.1	0.1-2.1	0-0.4	0-0.7	0-0.2
C20:0	<1	0.1-0.6	1-3	1.1-1.7	0-0.7	0.2-0.5	0-1.5	0.2-0.4
C20:1	<1	<0.3	0.5-2.1	0.7-1.7	0-0.5	0-0.1	0-0.5	0-0.2

C22:0	< 0.5	0.3-0.7	1-5	2.1-4.4	0-0.5	0-0.6	0-1	0.5-1.3
C22:1	-	< 0.3	< 2	< 0.3	0-0.5	0-0.3	0-0.5	0-0.2
C22:2	-	-	-	-	-	-	-	0-0.3
024:0	-	< 0.4	0.5-3	1.1-2.2	0-0.5	0-0.1	0-0.5	0.2-0.3
C24:1	-	-	-	< 0.3	-	-	< 0.5	-

Sources: CODEX ALIMENTARIUS COMMISSION, 1983 and 1993.

[0039] Given the above and according to the current invention, the SDA rich oil produced in an recombinant oilseed plant, provides an oil composition not previously available for food manufacturers. It provides for the incorporation of an Omega-3 oil in food products that was not present in appreciable amounts in typical vegetable oils prior to the current invention. In addition the use of this Omega-3 oil is made possible without the traditional concerns with food sensory qualities, or shelf-life when such oils are delivered from a fish or algal source. After delivery of the oil it can be taken and utilized for the production of baked goods, dairy products, spreads, margarines, sports products, nutrition bars and infant formulas, feed, aquaculture, neutraceutical and medicinal uses. Each having enhanced nutritional content.

[0040] Turning to Table 1b, to illustrate the utility of the current invention a variety of food products have been/are being chosen representing a broad range of food categories, to determine the impact of SDA and other Omega-3 oils on product taste and shelf life.

[0041] Oxidative stability, as measured by accepted shelf-life sensory tests, is an important PUFA characteristic that determines the useful lifetime and flavor characteristics of fat and oils. Oxidative deterioration in fats and oils can be assessed by wet chemical methods such as peroxide value (PV, which measures peroxides resulting from primary oxidation), and p-anisidine value (AV, which principally measures 2-alkenals resulting from secondary oxidation), or in foods, can be assessed by sensory tasting tests. Selected food categories and products are as follows:

TABLE 1b

BEVERAGES	DAIRY PRODUCTS	BAKING	PREPARED FOODS	OIL BASED PRODUCTS	SNACK FOODS
Soy milks Smoothies Fruit Juices Dairy Drinks	Cheeses Cream Cheeses Sour Cream Yogurt Yogurt Drinks Non Dairy Creamers Dips	Breads Rolls Cakes Pastries Cookies Crackers Muffins	Entrees Side Dishes Soups Sauces Processed Meats Processed Fish Pet Foods	Salad Dressing Mayonnaise Margarine/ Spreads Shortening	Granola Cereals Snack/Nutritional Bars Confectionary

[0042] According to the current studies the development of food products incorporating transgenic SDA provided several formulations and processes. Additional development and research has been conducted for flavor optimization and the enhancement of shelf-life characteristics. For example, food or beverages that can contain the SDA compositions of the current invention, include baked goods and baked good mixes (e.g., cakes, brownies, muffins, cookies, pastries, pies, and pie crusts), shortening and oil products (e.g., shortenings, margarines, frying oils, cooking and salad oils, popcorn oils, salad dressings, and mayonnaise), foods that are fried in oil (e.g., potato chips, corn chips, tortilla chips, other fried farinaceous snack foods, french fries, doughnuts, and fried chicken), dairy products and artificial dairy products (e.g., butter, ice cream and other fat-containing frozen desserts, yogurt, and cheeses, including natural cheeses, processed cheeses, cream cheese, cottage cheese, cheese foods and cheese spread, milk, cream, sour cream, buttermilk, and coffee creamer), meat products (e.g., hamburgers, hot dogs, wieners, sausages, bologna and other luncheon meats, canned meats, including pasta/meat products, stews, sandwich spreads, and canned fish), meat analogs, tofu, and various kinds of protein spreads, sweet goods and confections (e.g., candies, chocolates, chocolate confections, frostings, and icings, syrups, cream fillings, and fruit fillings), nut butters and various kinds of soups, dips, sauces and gravies. Each of the above examples comprise different embodiments of the current invention.

[0043] The current invention bases its formulations on target levels of Omega-3 oils for each food product. These levels were identified based on bio-equivalence of the SDA product. The following information in Table 2a, identifies the targeted Omega 3 levels on a per serving basis:

TABLE 2a

Omega-3 Source	mg Omega-3 per serving
Stearidonic Acid (SDA)	375
EPA/DHA (fish/algal oil)	130
ALA (flax oil)	320

[0044] Based on this information, preferred formulations of the SDA of the current invention were developed with the appropriate level of stearidonic acid to deliver the targeted levels on a per serving basis. The amount added varied between different applications due to the differences in serving size.

[0045] Below are Tables 2b-d reflecting the ranges of the SDA oil compositions of the current invention.

TABLE 2b. SDA Oil Variant-1 (Produced by the Transgenic Plants of the Invention)

ANALYTICAL DATA OF SOYBEAN SEEDS AND OILS – CRUSH, (250 kilograms)									
	SEED			CRUDE OIL			RBD OIL		
Moisture (w/w %)	9.13	8.8	11.51	N/A	N/A	N/A	N/A	N/A	N/A
Oil content (%)	19.2	18.56	19.72	N/A	N/A	N/A	N/A	N/A	N/A
Peroxide value (PV, meq/kg)	N/A	N/A	N/A	0.46	0.00	0.06	0.0	0.0	0.0
Free fatty acids (FFA, %)	N/A	N/A	N/A	0.24	0.24	0.42	0.05	0.13	0.05
p-Anisidine value (AV)	N/A	N/A	N/A	0.43	0.31	0.22	0.3	0.63	0.83
Conjugated dienes (CD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rancimat @110 C, hrs	N/A	N/A	N/A	N/A	N/A	N/A	4.6	1.89	1.85
Trans fatty acids (mg/g)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fatty acid composition (FAC, w/w%)									
C14:0 (Myristic)	0.11	0.1	0.1	0.09	0.09	0.08	0.09	0.08	0.08
C16:0 (Palmitic)	11.43	11.82	12.15	11.68	12.2	12	11.57	11.3	12.23
C16:1n7 (Palmitoleic)	0.1	0.09	0.09	0.1	0.12	0.14	0.1	0.09	0.14
C18:0 (Stearic)	4.26	4.28	4.31	4.26	4.41	4.24	4.24	4.4	4.26
C18:1n9 (Oleic)	21.09	19.44	18.54	20.88	19.28	18.6	21.16	19.3	18.74
C18:1 (Octadecenoic)	1.47	1.52	1.50	1.46	1.48	1.46	1.46	1.52	1.44
C18:2n6 (Linoleic)	51.75	24.82	24.56	52.14	25.48	24.06	51.88	25.38	24.1
C18:3n6 (Gamma linolenic)		5.28	6.17		5.23	6.15		5.27	6.21
C18:3n3 (Alpha linolenic)	8.47	10.00	10.14	8.22	10.6	10.03	8.23	10.72	10.15
C18:4n3 (Stearidonic)		***20.40***	***20.90***		***19.40***	***21.16***		***20.16***	***21.10***
C20:0 (Arachidic)	0.33	0.35	0.36	0.32	0.37	0.36	0.32	0.37	0.37
C20:1n9 (Eicosenoic)	0.16	0.17	0.18	0.15	0.24	0.24	0.15	0.18	0.22
C20:2n6 (Eicosadienoic)	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.03
C22:0 (Behenic)	0.31	0.30	0.31	0.32	0.31	0.31	0.32	0.32	0.3
C24:0 (Lignoceric)	0.1	0.06	0.06	0.1	0.08	0.07	0.1	0.06	0.07
Others	0.39	0.69	0.6	0.25	0.68	1.07	0.35	0.83	0.56

Total*	100.0	99.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Color (5.25")	N/A	N/A	N/A	70Y 3.2R (1")	70Y 3.6R (1")	70Y 3.8R (1")	2.8Y 0.1R	9Y 0.2R	3.3Y 0.0R
Chlorophyll (ppm)	N/A	N/A	N/A	0.007	0.004	0.011	0.02	0.028	0.013
Tocopherols (ppm)									
Alpha	N/A	N/A	N/A	98.5	106	101	99.4	103	95.3
Gamma	N/A	N/A	N/A	940	869	834	914	815	765
Delta	N/A	N/A	N/A	305	285	286	293	249	235
Total	N/A	N/A	N/A	1343.5	1260.0	1221.0	1306.4	1167.0	1095.3
Sterols (ppm)									
Campesterol	N/A	N/A	N/A	761	799	677	318	227	588
Stigmasterol	N/A	N/A	N/A	722	684	556	240	130	444
Beta-Sitosterol	N/A	N/A	N/A	1849	2196	1920	1071	1021	1747
Total	N/A	N/A	N/A	3332	3679	3153	1629	1378	2779
Metals (ppm)									
Phosphorus	N/A	N/A	N/A	473.6	451	58.5	N/A	N/A	N/A
Ca	N/A	N/A	N/A	18.45	10.7	10.6	N/A	N/A	N/A
Mg	N/A	N/A	N/A	30.98	28.2	6.98	N/A	N/A	N/A
Fe	N/A	N/A	N/A	1.41	1.48	0.09	N/A	N/A	N/A
Cu	N/A	N/A	N/A	<0.05	<0.05	<0.05	N/A	N/A	N/A
Na	N/A	N/A	N/A	1.75	1.39	<0.20	N/A	N/A	N/A

TABLE 2c. SDA Oil Variant-1 (Produced by the Transgenic Plants of the Invention)

ANALYTICAL DATA OF SOYBEAN SEEDS AND OILS – CRUSH,
(5 Metric Tonnes Control Soybeans, 6.8 Tonnes SDA soybeans)

	Control (NK43 B1)	SDA	Control (NK43 B1)	SDA with N2	SDA no N2	Batch 1 &2 Combo	Batch 2a	Batch 2b	SDA w N2 Batch 1	SDA w N2 Batch 2	SDA w/o N2
Moisture, %* or ppm	12.7*	12.1*	N/A	N/A	N/A	45.3	22.9	16.7	99.2	107.4	115.7
Oil content, %	19.9	20.0									
Crude fiber, %	4.43	4.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ash, %	4.68	4.63	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Urease	2.16	2.14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Protein, (N*6.25)%	36.0	36.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trypsin inhibitor	43,300	39,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Free fatty acids (FFA, %)	N/A	N/A	0.235	0.14	0.28	0.04	0.04	0.04	0.02	0.03	0.03
Peroxide value (PV, meq/kg)	N/A	N/A	0.17	0.31	0.39	0.1	0.1	0.1	0.0	0.0	0.1
p-Anisidine value (AV)	N/A	N/A	0.31	0.47	0.71	2.64	0.98	0.8	0.4	1.05	1.1
Conjugated dienes (CD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trans fatty acids, %	0.00	0.00	0.19	0.46	0.48	0.31	0.29	0.30	0.89	0.92	0.86
Fatty acid composition (FAC, w/w %)											
C14:0 (Myristic)	0.09	0.11	0.08	0.10	0.10	0.07	0.07	0.07	0.10	0.10	0.11

C16:0 (Palmitic)	11.14	12.14	10.65	12.07	12.54	10.49	10.48	10.49	12.07	12.06	12.03
C16:1 (*trans*-Hexadecanoic)**			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C16:1n7 (Palmitoleic)	0.15	0.15	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11
C17:0 (Margaric)	0.10	0.10	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A
C18:0 (Stearic)	4.38	4.19	4.65	4.19	4.26	4.66	4.64	4.64	4.19	4.19	4.19
C18:1 (*trans* Octadecenoic)			0.08	0.08	0.08	0.09	0.09	0.09	0.07	0.06	0.08
C18:1n9 (Oleic)	20.40	18.35	20.64	17.92	17.91	20.70	20.66	20.68	17.92	17.92	17.96
C18:1 (Octadecenoic)	1.29	1.27	1.47	1.47	1.49	1.49	1.50	1.48	1.46	1.47	1.46
C18:2 (*trans*-Octadecadienoic)			0.05	0.09	0.09	0.09	0.10	0.10	0.13	0.12	0.14
C18:2n6 (Linoleic)	53.51	35.07	53.10	35.22	35.34	53.07	53.07	53.07	35.21	35.26	35.47
C18:3 (*trans*-Octadecatrienoic)			0.04	0.18	0.20	0.13	0.10	0.11	0.40	0.42	0.36
C18:3n6 (Gamma linolenic)	0.00	4.92	0.00	4.95	4.82	N/A	N/A	N/A	4.91	4.90	4.83
C18:3n3 (Alpha linolenic)	7.34	10.31	7.63	10.27	10.18	7.58	7.63	7.62	10.13	10.11	10.09
C18:4 (*trans*-Octadecatetraenoic)			0.00	0.11	0.10	N/A	N/A	N/A	0.28	0.31	0.27
C18:4n3 (Stearidonic)	***0.00***	***11.70***	***0.00***	***11.78***	***11.31***	N/A	N/A	N/A	***11.43***	***11.37***	***11.25***
C20:0 (Arachidic)	0.38	0.39	0.39	0.42	0.41	0.38	0.39	0.39	0.41	0.41	0.41
C20:1n9 (Eicosenoic)	0.27	0.28	0.21	0.25	0.23	0.21	0.21	0.21	0.36	0.36	0.36
C20:2n6 (Eicosadienoic)	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C22:0 (Behenic)	0.38	0.33	0.40	0.33	0.34	0.41	0.40	0.40	0.35	0.35	0.36
C24:0 (Lignoceric)	0.16	0.14	0.14	0.13	0.13	0.14	0.14	0.14	0.13	0.13	0.13
Others	0.39	0.53	0.35	0.32	0.34	0.38	0.39	0.38	0.35	0.35	0.37
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Color (5.25")**	N/A	N/A	N/A	N/A	N/A	2.6Y 0.2R	1.2Y 0.0R	0.9Y 0.0R	1.4Y 0.0R	6.5Y 0.3R	3Y 0.4R
Chlorophyll, ppm	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
Citric acid, ppm	N/A	N/A	N/A	N/A	N/A	<10	<10	<10	<10	<10	<10
Tocopherols (ppm)											
Alpha	N/A	N/A	N/A	N/A	N/A	90.7	84.6	87.4	151	157	139
Gamma	N/A	N/A	N/A	N/A	N/A	727	725	689	683	721	650
Delta	N/A	N/A	N/A	N/A	N/A	159	171	162	102	104	105
Total	N/A	N/A	N/A	N/A	N/A	976.7	980.6	938.4	936	982	894
Sterols (ppm)											
campesterol	N/A	N/A	N/A	N/A	N/A	533	459	451	460	495	383
stigmasterol	N/A	N/A	N/A	N/A	N/A	569	453	448	465	519	364
B-sitosterol	N/A	N/A	N/A	N/A	N/A	1550	1410	1380	1620	1680	1480
Other	N/A	N/A	N/A	N/A	N/A	465	398	403	536	581	472
Total	N/A	N/A	N/A	N/A	N/A	3117	2720	2682	3081	3275	2699
Metals (ppm)											
Phosphorus	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ca	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Na	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 2d. SDA Oil Variant-1 (Produced by the Transgenic Plants of the Invention)

ANALYTICAL DATA OF SOYBEAN SEEDS AND OILS – CRUSH,
(3 Metric Tonnes Control Soybeans, 5 Tonnes SDA soybeans)

	Control Seed			SDA Seed	Crude Oil		RBD Oil		
	RR1	A3525	MO591	SDA Comp	Control	Avg. SDA Values	Avg. Control Values	Lt Bleach SDA	Hvy Bleach-SDA
Moisture (w/w % or ppm*)	11.54	10.2	10.24				33.4*	38.6*	55.45*
Oil content (%)	18.90	19.59	19.28	19.08					
Peroxide value (PV, meq/kg)	0.3	0.46	0.5	0.5	0.21	0.26	0.0	0.0	0.0
Free fatty acids (FFA, %)	0.44	0.11	0.15	0.27	0.3	0.4	0.03	0.04	0.03
p-Anisidine value (AV)	N/A	N/A	N/A	N/A	0.34	1.63	1.07	2.35	2.05
Conjugated dienes (CD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trans fatty acids (w/w %)	N/A	N/A	N/A	N/A	0.19	0.48	0.32	0.63	0.67
Fatty acid composition (FAC, w/w%)									
C14:0 (Myristic)	0.09	0.10	0.10	0.10	0.08	0.09	0.07	0.08	0.08
C16:0 (Palmitic)	10.94	11.41	11.71	12.68	11.11	12.59	10.99	12.42	12.42
C16:1 (*Trans*-Hexadecanoic)	N/A	N/A	N/A	0	0.01	0.01	0.01	0.01	0.01
C16:1n7 (Palmitoleic)	0.15	0.15	0.15	0.16	0.11	0.13	0.12	0.11	0.13
C17:0 (Margaric)	0.10	0.11	0.11	0.11	N/A	N/A	0	0	0
C18:0 (Stearic)	4.55	4.48	4.47	4.35	4.51	4.29	4.48	4.28	4.28
C18:1 (*Trans*-Octadecenoic)	N/A	N/A	N/A	0	0.08	0.08	0.08	0.07	0.06
C18:1n9 (Oleic)	21.70	20.90	20.51	18.47	20.77	17.76	20.82	17.83	17.85
C18:1 (Octadecenoic)	0.96	1.14	1.09	1.11	1.51	1.58	1.49	1.56	1.57
C18:2 (*Trans*-Octadecadienoic)	N/A	N/A	N/A	0	0.06	0.08	0.10	0.08	0.10
C18:2n6 (Linoleic)	51.76	52.25	52.52	31.25	52.00	31.39	52.08	31.31	31.32
C18:3 (*Trans*-Octadecatrienoic)	N/A	N/A	N/A	0	0.07	0.25	0.16	0.29	0.30
C18:3n6 (Gamma linolenic)	0	0.06	0	5.04	N/A	5.10	0	5.12	5.13
C18:3n3 (Alpha linolenic)	8.29	7.91	8.03	10.50	8.15	10.48	8.09	10.41	10.38
C18:4 (*Trans* Octadecatetraenoic)	N/A	N/A	N/A	0	N/A	0.13	0	0.21	0.24
C18:4n3 (Stearidonic)	N/A	0.16	N/A	14.59	N/A	14.64	0	14.77	14.68
C20:0 (Arachidic)	0.39	0.36	0.37	0.40	0.38	0.38	0.37	0.38	0.38
C20:1n9 (Eicosenoic)	0.26	0.25	0.24	0.29	0.24	0.26	0.22	0.27	0.28
C20:2n6 (Eicosadienoic)	0.04	0.04	0.04	0.03	0.04	0.03	0.04	0.04	0.05
C22:0 (Behenic)	0.41	0.34	0.34	0.33	0.38	0.32	0.37	0.34	0.34
C24:0 (Lignoceric)	0.14	0.13	0.12	0.11	0.13	0.09	0.13	0.10	0.10
Others	0.21	0.22	0.20	0.49	0.39	0.33	0.39	0.31	0.31
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Color (5.25")	N/A	N/A	N/A	N/A	70Y 2.9R (1")	70Y 3.7R (1")	5.2Y 0.4R	5.5Y 0.3R	4.3Y 0.3R
Chlorophyll (ppm)	N/A	N/A	N/A	N/A	0.156	0.033	0.0	0.0	0.0

Citric acid (ppm)	N/A	N/A	N/A	N/A	N/A	N/A	<10	<10	<10
Tocopherols (ppm)									
Alpha	N/A	N/A	N/A	N/A	96.1	111	87.6	106	94.9
Gamma	N/A	N/A	N/A	N/A	830	860	723	777	738
Delta	N/A	N/A	N/A	N/A	238	221	183	176	163
Total	N/A	N/A	N/A	N/A	1164.1	1192	993.6	1059	995.9
Sterols (ppm)									
Campesterol	N/A	N/A	N/A	N/A	778	668	674	532	498
Stigmasterol	N/A	N/A	N/A	N/A	773	673	656	512	476
Beta-Sitosterol	N/A	N/A	N/A	N/A	1860	1880	1700	1640	1570
Others	N/A	N/A	N/A	N/A	577	732	498	623	599
Total	N/A	N/A	N/A	N/A	3988	3953	3528	3307	3143
Metals (ppm)									
Phosphorus	N/A	N/A	N/A	N/A	330	756	N/A	N/A	N/A
Ca	N/A	N/A	N/A	N/A	18.6	52.8	N/A	N/A	N/A
Mg	N/A	N/A	N/A	N/A	23.6	47	N/A	N/A	N/A
Fe	N/A	N/A	N/A	N/A	0.67	0.59	N/A	N/A	N/A
Cu	N/A	N/A	N/A	N/A	<0.05	<0.05	N/A	N/A	N/A
Na	N/A	N/A	N/A	N/A	<0.20	<0.20	N/A	N/A	N/A

[0046] For the instant invention the primary source of stearidonic acid was oil extracted from transgenic soybeans which have been engineered to produce high levels of stearidonic acid. The soybeans were processed at an oil processing facility and oil was extracted consistent with the methods described in US Patent Applications 2006/0111578, and 2006/0111254. In addition to oil, flour was made from the transgenic and control soybeans typical of industry practices in processing full-fatted soy flour. One example of a food formulation utilizing the SDA of the invention is found in Table 3a-3c, and Figures 2a-2e below. General attributes of Italian style dressings according to preferred embodiments of the current invention are provided in Tables 4a-4c.

Table 3a Italian Salad Dressing – Shelf Life Attributes -

	Soybean Oil (reference)							
		95°F	95°F	95°F	95°F	73°F	73°F	73°F
	Initial	1 mo	2 mo	3 mo	4 mo	2 mo	4 mo	6 mo
APPEARANCE								
Opacity	5	5	5	5	5	5	5	5
Color	5	5	6	6	6	5	5	5
AROMA		55						

Total Aroma	7.5	7.5	7.5	8	8.5	7.5	7.5	7.5
Vinegar	6	6	5.5	6	5.5	6	6	5.5
Pungent	5	5	5	5.5	5.5	5	4.5	5
Total Onion/ Garlic/Herb	4	4.5	3.5	3.5	3	4.5	4	4
Total Oil	2	2.5	3	3.5	3.5	2.5	2.5	2.5
Total Off	0	0	2	2.5	3	0.5	1	1.5
Oxidized Oil	0	0	1.5	2	2.5	0.5	0.5	1.5
FLAVOR								
Total Flavor	8.5	8	8.5	9	9	8.5	8.5	8
Vinegar	6	6	6	6.5	6	6	6	5.5
Pungent	6	6	6	6.5	6	6	6	5.5
Total Onion/ Garlic/Herb	5	5	4.5	4	3.5	5.5	4.5	4.5
Sour	6	6	6	6.5	7	6.5	6.5	6
Salty	6.5	7	6.5	6.5	7	6.5	7	7
Total Oil	3	3	4	4	4	3.5	3.5	3
Total Off	0	0	2	2.5	3.5	0.5	1	2
Oxidized Oil	0	0	2	2	2.5	0.5	0.5	2
TEXTURE								
Viscosity by Mouth	4	4	4.5	4.5	4	4	4	4
Oily Mouthfeel (after 5 seconds)	7	7	7.5	7.5	7.5	7	7.5	7
Comments:		very similar to control	slight cardboard, slight pondy, slight painty	oxidized oil, old herb, slightly waxy	oxidized oil, cardboard cooked oil	very slight oxidized oil	slightly oxidized oil, slightly cardboard	
Scale range = 0 to 15								

Table 3a cont'd Italian Salad Dressing – Shelf Life Attributes -

	SDA Oil							
		95°F	95°F	95°F	95°F	73°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	4 mo	2 mo	4 mo	6 mo
APPEARANCE								
Opacity	6	5.5	5.5	5	6	5.5	6	7
Color	5	5	7	6	6.5	5	5	6
AROMA								
Total Aroma	7	8	8.5	8	8	7	7.5	7.5
Vinegar	5.5	6	5.5	6	5.5	5.5	6	5.5
Pungent	5	5	5	5	5	4.5	5	4.5
Total Onion/ Garlic/Herb	4	4	3.5	3.5	3	3.5	3.5	4
Total Oil	2.5	2.5	3.5	3	3.5	2.5	2.5	2.5
Total Off	0.5	0.5	2.5	2.5	3	1	2	2

Oxidized Oil	0.5	0.5	2.5	2.5	2.5	0.5	1.5	2
FLAVOR								
Total Flavor	7.5	8	9	9	9	8.5	8.5	8.5
Vinegar	5.5	5.5	6	6.5	6	6	6	6
Pungent	5.5	5.5	6	6.5	6	5.5	6	6
Total Onion/ Garlic/Herb	5	4.5	4	4	3.5	4.5	4.5	4.5
Sour	6	6	5.5	6.5	7	5.5	6	6.5
Salty	6.5	6.5	6.5	7	7	6.5	7	6.5
Total Oil	3.5	3.5	4	3.5	4	3.5	3.5	3.5
Total Off	0.5	0.5	2.5	2.5	3.5	2	2.5	3
Oxidized Oil	0.5	0.5	2.5	2.5	3	1	2	3
TEXTURE								
Viscosity by Mouth	4.5	4	4	4	4	4.5	4	4
Oily Mouthfeel (after 5 seconds)	7	7	7	7.5	7.5	7	7	7
Comments:	very slight oxidized oil and very slight beany/ pondy	very slight card-board	pondy, slight beany, very slight fishy	slightly pondy, slightly fishy, oxidized oil	pondy, painty, slightly fishy	slight pondy, slight beany	slightly pondy, old oil	

Table 3b Italian Salad Dressing – Shelf Life Attributes

	Fish Oil							
		95°F	95°F	95°F	95°F	73°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	4 mo	2 mo	4 mo	6 mo
APPEARANCE								
Opacity	6.5	5	5	5	5	6	6	6
Color	5	5	5.5	6	7.5	5	5	5
AROMA								
Total Aroma	6.5	7.5	8.5	9	9	7	7	7
Vinegar	5.5	6	5.5	5.5	5	5.5	5.5	5.5
Pungent	4.5	4.5	5	4.5	5	4.5	4.5	5
Onion/ Garlic/Herb	3.5	3	3.5	3	3	3.5	3.5	3.5
Total Oil	3	3	3.5	5	6	2.5	2.5	3
Total Off	0.5	1	3.5	5	6	1	2	3
Oxidized Oil	0.5	1	3	4.5	5.5	0.5	1.5	3
FLAVOR								
Total Flavor	7.5	7.5	9	9.5	10	8	8.5	8.5
Vinegar	5.5	6	6	5.5	5	6	6.5	6
Pungent	5	6	6	6	5	6	6.5	5.5
Total Onion/ Garlic/Herb	4.5	4.5	4	3.5	3.5	5.5	4	4
Sour	5.5	6	6	6	7	6	6.5	6

Salty	6.5	6.5	7	6.5	7	7	6.5	7
Total Oil	4	3.5	4	5	6.5	3.5	4	3.5
Total Off	0.5	1.5	3	4.5	6.5	1	2.5	3.5
Oxidized Oil	0.5	1	3	4	6	0.5	2	3.5
TEXTURE								
Viscosity by Mouth	5	4.5	4.5	4.5	4	4.5	4	4
Oily Mouthfeel (after 5 seconds)	8	8	7.5	7.5	7.5	8	7	7
Comments:	very slight oxidized oil aroma and flavor	slight oxidized oil, sight beany	pondy, cardboard, heavy oil, slight painty	distinctly fishy	strong fishy	very slight oxidized oil	slightly fishy, slightly pondy, slightly motor oil	waxy, cardboard

Table 3b cont'd Italian Salad Dressing – Shelf Life Attributes -

	Algal Oil							
		95°F	95°F	95°F	95°F	73°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	4 mo	2 mo	4 mo	6 mo
APPEARANCE								
Opacity	5.5	5	5	5	5.5	5.5	5.5	6
Color	5	5	5.5	6	7	5	5	4.5
AROMA								
Total Aroma	7	7.5	7.5	8	8	7	7.5	7
Vinegar	5.5	6	5.5	6	5	5.5	5.5	5.5
Pungent	5	5.5	4.5	5	4.5	5	5	4.5
Onion/ Garlic/Herb	3.5	3.5	3.5	3	3	3.5	3.5	3.5
Total Oil	3	2.5	3	3	3.5	2.5	3	2.5
Total Off	1	1	2	2	3	1	2	2
Oxidized Oil	1	1	1.5	1.5	2.5	1	1.5	2
FLAVOR								
Total Flavor	7.5	7.5	8.5	8.5	9	8	8.5	8
Vinegar	5.5	6	6	6	6	6	6.5	5.5
Pungent	5.5	6	6	6	6	6	6	5.5
Onion/ Garlic/Herb	4.5	4.5	4.5	4	3	4.5	4.5	4.5
Sour	6	6	6	6.5	7	6	6.5	5.5
Salty	6.5	6.5	6.5	6.5	7	6.5	7	6.5
Total Oil	4	3.5	3.5	4	4	3.5	3.5	3.5
Total Off	1	1	2	2.5	3	1	2	2.5
Oxidized Oil	1	1	1.5	2	2.5	0.5	2	2.5
TEXTURE								

Viscosity by Mouth	5	4	4	4	4	4.5	4	4.5
Oily Mouthfeel (after 5 seconds)	7.5	7	7	7	7	7.5	7	7
Comments:	slight oxidized oil aroma and flavor, very slight pondy	slight oxidized oil, slight card-board	slight cardboard, slight oxidized oil	pondy, heavy oil, reheated oil	pondy, slightly rubbery, oxidized heavy oil	slight oxidized oil, slight cardboard, slight heated oil	slightly oxidized oil, slightly reheated heavy oil	slightly cardboard slightly painty

Table 3c Italian Salad Dressing – Shelf Life Attributes

	Flax Oil							
		95°F	95°F	95°F	95°F	73°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	4 mo	2 mo	4 mo	6 mo
APPEARANCE								
Opacity	5.5	5	5	6	5.5	5.5	5	5.5
Color	5	5	5.5	6	7	5	5	5
AROMA								
Total Aroma	7	7	7.5	8	8	7	7	7
Vinegar	5.5	6	6	6	6	6	5.5	5.5
Pungent	5	5	5	5.5	5.5	4.5	4	5
Total Onion/ Garlic/Herb	3.5	4	3.5	3	3	3.5	4	3.5
Total Oil	3.5	3	3	3	3.5	3	3	3
Total Off	2	1.5	2.5	2.5	3	1.5	2.5	2.5
Oxidized Oil	1.5	1	2.5	2	2.5	1	1.5	2
FLAVOR								
Total Flavor	8	8	8.5	9	9	8	9	8.5
Vinegar	6	5.5	6	6.5	6	6	6	5.5
Pungent	5.5	5.5	6	6	6	6	6	5.5
Total Onion/ Garlic/Herb	4	5	4.5	4	3.5	5	5	4.5
Sour	6	5.5	6	6.5	6.5	5.5	6.5	5.5
Salty	6.5	6.5	6.5	6.5	7	6.5	7	6.5
Total Oil	4	4	4	3.5	4	4	4	3.5
Total Off	3	1.5	2.5	2	3.5	1.5	3	2.5
Oxidized Oil	2	0.5	2	2	2.5	1.5	2	2.5
TEXTURE								
Viscosity by Mouth	5	4.5	4.5	4	4	5	4.5	4
Oily Mouthfeel (after 5 seconds)	8	7.5	7.5	7.5	7	7.5	7.5	7

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Table 4a: ITALIAN SALAD DRESSING

SDA SALAD DRESSING FORMULATIONS - ITALIAN					
Variant	Control	SDA	Fish Oil	Algal Oil	Flax Oil
Formula Number	50-RA-325-000	50-RA-326-000	50-RA-328-000	50-RA-330-000	50-RA-327-000
INGREDIENT	%				
Liquid Soybean Oil	44.5000	33.1700	43.0700	43.2700	42.9700
Omega 3 Oil		11.33	1.43	1.23	1.53
Water	39.3530	39.3530	39.3530	39.3530	39.3530
Egg Yolk, Liquid, 10% Salt	2.9000	2.9000	2.9000	2.9000	2.9000
Viegar, White Distilled, 120 gr	2.8500	2.8500	2.8500	2.8500	2.8500
Sugar, White, Fine Granulated	2.5000	2.5000	2.5000	2.5000	2.5000
Buttermilk Powder, Cultured LOL#20631	2.1000	2.1000	2.1000	2.1000	2.1000
Salt, Regular, Non Iodized	1.7000	1.7000	1.7000	1.7000	1.7000
Flavor, Cultured Buttermilk, Cargill#24521	1.5000	1.5000	1.5000	1.5000	1.5000
Garlic, Dehydrated, Granular	0.4500	0.4500	0.4500	0.4500	0.4500
Onion, Dehydrated, Granular	0.4400	0.4400	0.4400	0.4400	0.4400
Mustard Flour, Wisconsin Spice SP448	0.4000	0.4000	0.4000	0.4000	0.4000
Acid, Phosphoric, 75%	0.4000	0.4000	0.4000	0.4000	0.4000
Gum, Xanthan, 60 mesh, Regular	0.2750	0.2750	0.2750	0.2750	0.2750
Preservative, Potassium Sorbate	0.2000	0.2000	0.2000	0.2000	0.2000
Monosodium Glutamate (MSG)	0.2000	0.2000	0.2000	0.2000	0.2000
Preservative, Sodium Benzoate, Granular	0.1000	0.1000	0.1000	0.1000	0.1000
Pepper, Black, 30-60 mesh	0.1000	0.1000	0.1000	0.1000	0.1000
Parsley, Dehydrated, Granular -10 +30	0.0250	0.0250	0.0250	0.0250	0.0250
Preservative, EDTA, Calcium Disodium	0.0070	0.0070	0.0070	0.0070	0.0070
TOTAL	100.0000	100.0000	100.0000	100.0000	100.0000

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Table 4b: ITALIAN SALAD DRESSING

Italian Salad Dressing Production Process:
1. Check that the mixer is in good working condition, free and clear of dust & dirt, sealed tight, mill set correctly.
2. Set mix tank speed to 25 hz.
3. Meter in water to mix tank.
4. Add preservatives (Benzoate, Sorbate, EDTA) into mix tank.
5. Make gum slurry (Xanthan Gum + 400g soybean oil)
6. Add to Dixie tank, mix for 3 minutes
7. Add the rest of the dry ingredients to the Dixie mill.
8. Adjust mix tank speed to 45 hz.
9. Add HFCS, caramel color, and Yellow No. 6 to the Dixie tank
10. Slowly add remainder of soybean oil and if appropriate, Omega 3 oil
11. Add distilled vinegar, mix for 30 seconds
12. Open mix tank valve, and set pump speed to 30 hz.
13. Turn on pum to pack; colloid mill is off.
14. Pack into bulk or individual containers, cap.

Table 4c: ITALIAN SALAD DRESSING
SHELF LIFE PRODUCTION
ANALTYICAL/MICRO RESULTS

ITALIAN DRESSING

	Control	SDA	Fish Oil	Algal Oil	Flax Oil
	50-RA-252-000	50-RA-248-000	50-RA-264-000	50-RA-266-000	50-RA-265-000
pH	3.51	3.52	3.53	3.52	3.51
Total Acidity	1.01	1.02	1.00	1.01	1.02
Total Solids	2.56	2.51	2.50	2.52	2.53
Bostwick (viscosity)	18.9 cm	19.1 cm	19.25 cm	19.0 cm	18.9 cm
Total Plate Count	<10	<10	<10	<10	<10
Lactics	<10	<10	<10	<10	<10
Yeast	<10	<10	<10	<10	<10
Mold	<10	<10	<10	<10	<10

[0047] According to the methods of the current invention samples of various salad dressings were submitted to a contracting food laboratory for confirmatory studies and analysis of various embodiments of the invention.. The general approach to the shelf-life testing is for 5 attribute panelists to taste the dressings and come to consensus regarding the attributes and intensity (on a 15 pt scale – 0 being absent, 15 being extreme) for each dressing. The lists of attributes identified by the panelists are in the attached documents. Additional attributes are identified as warranted. The characteristics of attribute testing are provided below, Table 5, along with the data from sensory testing at various time points, Table 6.

TABLE 5. SDA DRESSING DEFINITIONS OF SENSORY ATTRIBUTES

APPEARANCE

Yellow Color	The intensity of the yellow color in the sample, from light to dark yellow.

AROMA/FLAVOR

Total Aroma	The total aroma intensity of the sample.
Total Flavor	The total flavor intensity of the sample, including the basic tastes.
Total Oil	The intensity of aroma/flavor of any type of oil, including oxidized oil.

Oxidized Oil	The intensity of aroma/flavor of oxidized oil, described as old oil that has undergone oxidation, characterized as cardboard, beany, painty, or fishy.
Total Off Aroma/Flavor	The intensity of aroma/flavor of believed to not intended in the product, includes oxidized oil and other off notes. The nature of the off note is to be described.
Mayonnaise/Dairy	The intensity of the aroma/flavor associated with mayonnaise or dairy product.
Vinegar	The intensity of the aroma/flavor of white vinegar or acetic acid.
Onion/Garlic/Herb	The intensity of aroma/flavor associated with onion, garlic, and all dried and fresh green herbs.
Sour	One of the four basic tastes, perceived primarily on the sides of the tongue; common to acids.
Salty	One of the four basic tastes, perceived primarily on the sides of the tongue; common to sodium chloride (table salt).

FEELING FACTORS

Pungent	The amount of burning or irritation of the nasal cavity produced by smelling the sample, such as with horseradish.

TEXTURE

Viscosity by Mouth	The degree of thickness of the sample as perceived when manipulated in the mouth.
Oily Mouthcoating	The amount of coating perceived on the soft tissues of the mouth

AFTERTASTE

Total Aftertaste	The total aftertaste intensity of the sample.

EXAMPLE 1
Salad Dressing

[0048] The tables above represent the data developed for a preferred embodiment of the current invention. Please also see Figures 2a-2e for graphical representation of the data out to four months. According to the data provided herein, the samples containing SDA are significantly less off-flavored than corresponding fish and algal Omega-3 oil formulations, providing the benefit of the presence of an omega-3 formulation without the substantially shortened shelf-life and limited stability. Due to pungent flavors and extremely unpleasant odors the fish and algal derived oils simply could not be tested and were removed from the 3 months accelerated evaluation period whereas the SDA composition of the invention was not. Overall the SDA compositions of the invention demonstrate improved stability, reduced degradation and consequent enhanced shelf-life for commercial utilization in conjunction with the delivery of beneficial Omega-3's into the diet.

[0049] With regard to specific salad dressing embodiments the SDA compositions of the invention developed utilized for enhanced Ranch Dressings maintained their flavor profile longer that the fish and algal oils after 6 months room temperature storage. For Italian dressings, the more complex flavor system does do some masking, but the SDA containing dressings of the current invention are again less off flavored than comparable based fish/algal dressings.

Italian Salad Dressings:

[0050] According to the current invention the shelf-life studies, at room temperature and accelerated studies, were completed through 4 months. Each sample has been evaluated by the trained attribute panel in a food laboratory at 0, 2 and 4 months at room temperature and at 1, 2 and 3 months accelerated temperature (95°F). For Ranch Dressings, the fish and algal oil samples were only smelled at 3 months due to high off flavor and character at the two month point. All other samples, including those containing the SDA oil of the invention, were evaluated at 3 months. This is typical for accelerated shelf life evaluations.

[0051] According to the methods of the current invention the Italian dressings have demonstrated significant stability in terms of flavor relative to other omega-3 containing test subjects. Accelerated testing has been completed through four months testing at 95°F. At this

point, all of the products exhibited off flavors, with the fish oils demonstrating the highest in off notes. Significantly, the SDA formulations of the invention were similar to the soybean oil reference.

[0052] According to the methods of the current invention the Ranch-style dressings demonstrated significant improvements according to sensory parameters relative to Fish Oil and Algal Oil formulations containing other Omega-3's. Also according to the invention, accelerated testing has been completed. High intensity off flavors developed in the fish and algal samples at two months whereas the SDA oil of the invention and the reference soybean oil could be evaluated according to sensory parameters at 3 months. The reference and flax samples exhibited more characteristic flavors and less off flavor than the SDA oil of the invention. The SDA oil of the invention exhibited more characteristic flavors and less off flavors than the fish and algal samples. This demonstrates that SDA has improved shelf life vs. fish and algal oils. In addition, room temperature testing was completed for the formulations according to the current invention through 4 months. Results indicate that the SDA samples of the invention indicate that the SDA product of the invention has a significantly lower profile for off flavors and unpleasant odors relative to other omega-3 sources, including fish and algal oils.

[0053] The data for both Italian and Ranch type dressings and charts that demonstrate the characteristics for the evaluation are attached in Tables 1-11 and figures 2 and 3.

EXAMPLE 2
RANCH SALAD DRESSING

Table 6a - Ranch Salad Dressing Shelf Life Attributes

	Soybean Oil (reference)						SDA Oil					
		95°F	95°F	95°F	73°F	73°F		95°F	95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	2 mo	4 mo	Ini	1 mo	2 mo	3 mo	2 mo	4 mo
APPEARANCE												
Yellow Color	4	5	5	6	4	4	4	4.5	5	6	4	4
AROMA												
Total Aroma	6.5	6.5	6.5	7.5	6.5	7	6.5	7	8	8.5	6.5	7
Mayonnaise	4	4	3.5	3	4	3.5	4	4	2.5	1.5	4	3
Dairy/Cultured Dairy	2.5	2.5	2	1.5	2	2	2.5	2	1.5	1	2.5	1.5
Vinegar	4	4	3.5	3	3.5	3.5	3.5	3.5	2.5	2.5	3.5	3
Pungent	4	4	4	3.5	3.5	4	3.5	3.5	5	4.5	4	4
Total Onion/Garlic/Herb	3	3	2	2	2.5	2.5	2.5	2.5	1.5	1	2.5	2
Total Oil	2.5	2.5	4	4.5	3	3	3	3	5.5	6	3	3.5
Total Off	1	1	4	4.5	2	2	1.5	3	5.5	6.5	1.5	3
Oxidized Oil	1	1	3.5	4	1.5	1.5	1	3	5.5	6	1	3
FLAVOR												
Total Flavor	7	7.5	8	8.5	7.5	7.5	7	7.5	8.5	9	7.5	8
Mayonnaise	5	5.5	3.5	3.5	5	4	5	5	3	2.5	4.5	3.5
Dairy/Cultured Dairy	3	3	2	2	2.5	2.5	3	2	1.5	1.5	2.5	2
Vinegar	4	4	3.5	3.5	3.5	4	3.5	4	2.5	3.5	4	3.5
Pungent	4	4	4.5	4	4	4	3.5	4	5	5	4	4.5
Total Onion/ Garlic/Herb	4	4	2.5	2	3	3.5	3.5	3	2	2	3.5	3
Sour	4.5	4.5	5	5	4.5	4.5	4	4	5	5.5	4.5	5
Total Oil	3.5	3.5	5	4.5	4.5	3.5	4	4	7	6.5	4	4.5
Total Off	1.5	2	5	5	2	2.5	2	3.5	7	7	2	4
Oxidized Oil	1.5	2	5	4.5	1.5	2	1.5	3	7	6.5	1.5	4
TEXTURE												
Viscosity by Mouth	6	6	6	6	6	6	6	6.5	6	6	6	6
Oily Mouthfeel (after 5 sec	5	5.5	5	5	5	5	5.5	6	5	5	5	5
Comments:		very slight oxidized oil	cardboard, slight oxidized oil	oxidized oil, musty (sweat socks)	slight oxidized oil, slight cardboard	slightly oxidized oil	slight oxidized, slight beany	pondy, fishy	primarily pondy, fishy, linseed oil	fishy, pondy, oxidized oil-painty	slight oxidized oil	fishy, painty, SO2

Scale = 0 1o 15

Note: color indicates variance from reference soy oil at initial timepoint; yellow=+/-1.0, orange=+/-1.5 to 2.0, red=/<2.5

Table 6a - Ranch Salad
Dressing Shelf Life Attributes

	Fish Oil						Algal Oil					
		95°F	95°F	95°F	73°F	73°F		95°F	95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	2 mo	4 mo	Ini	1 mo	2 mo	3 mo	2 mo	4 mo
APPEARANCE												
Yellow Color	4	4.5	5	6.5	4	4	5	5.5	5.5	6	5	4.5
AROMA												
Total Aroma	6.5	8.5	9	10.5	8	8.5	6.5	7.5	8.5	10	6	8
Mayonnaise	4	2	2	0.5	3.5	2	4	3	2.5	0.5	3.5	2
Dairy/Cultured Dairy	2.5	1	1	0.5	2	1.5	2	2	1	0.5	2	1.5
Vinegar	4	2	2	2	3	2.5	3.5	3	2	2	3	2.5
Pungent	4	2.5	5.5	5.5	4	4.5	3.5	3	5	5	3.5	4.5
Total Onion/Garlic/Herb	3	1.5	1	0.5	2	1.5	3	2	1	1	2	1.5
Total Oil	2.5	6	6.5	8.5	4	5.5	2.5	5	6	7.5	3.5	4.5
Total Off	1	6.5	7	9.5	4	5	1	4	6	8.5	2	4.5
Oxidized Oil	1	6.5	6.5	8.5	3.5	5	1	4	6	7.5	1.5	4.5
FLAVOR												
Total Flavor	7	9	9.5		8.5	9.5	7	8	9		7.5	9
Mayonnaise	5	2	2.5		4.5	2	5	3.5	2.5		4.5	2
Dairy/Cultured Dairy	3	1.5	1		2	1	3	2	1.5		2	1.5
Vinegar	4	2	2		3.5	2.5	3.5	3.5	2		3.5	3
Pungent	4	2.5	6		4	5	4	3.5	6		3.5	4.5
Total Onion/ Garlic/Herb	4	1	1.5		2.5	1.5	3.5	3	1.5		2.5	1.5
Sour	4.5	3.5	5.5		5	5	4	3.5	5.5		4	5
Total Oil	4	7	7.5		5	7.5	3.5	5.5	7.5		4.5	6.5
Total Off	2	7	8		4.5	7	1.5	5	7.5		2	6.5
Oxidized Oil	2	7	8		4	7	1.5	5	7.5		1.5	6.5
TEXTURE												
Viscosity by Mouth	6	6	6		6	6	6.5	6.5	6.5		6	6
Oily Mouthfeel (after 5 sec	5.5	5	5		5	5	5	6	5		5.5	5
Comments:	slight beany, slight oxidized *oil*	strong fishy, slight pondy	strong fishy	fishy	fishy, pondy, *old* vegetabl *es*	strong fish	very slight *oxidized* oil	fishy	strong fishy, *pondy*	fishy, pondy	oxidized oil, slight pondy, slight *cardboard*	fishy, pondy

Scale = 0 1o 15
Note: color indicates variance from reference soy oil at initial timepoint; yellow=+/-1.0, orange=+/-1.5 to 2.0, red=/<2.5

Table 6b - Ranch Salad Dressing Shelf Life Attributes

	Flax Oil					
		95°F	95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	3 mo	2 mo	4 mo
APPEARANCE						
Yellow Color	4.5	5	5.5	6	5	4.5
AROMA						
Total Aroma	6	7	6.5	8	6.5	6
Mayonnaise	3.5	4.5	3.5	3	4	3
Dairy/Cultured Dairy	3	2.5	1.5	1.5	2	2
Vinegar	3.5	4	3	3	3	3.5
Pungent	3.5	4	4	3.5	3.5	3.5
Total Onion/Garlic/Herb	3	3	1.5	2	2.5	2
Total Oil	3	3	4	4	3	3
Total Off	2	2	3.5	4.5	2	2
Oxidized Oil	1.5	1.5	3.5	4	1.5	2
FLAVOR						
Total Flavor	7	7	7.5	8.5	8	7
Mayonnaise	4.5	5	3.5	3.5	5	4
Dairy/Cultured Dairy	3	3	2	2	2.5	2.5
Vinegar	3.5	4	3	3.5	3.5	4
Pungent	4	3.5	4.5	4	4	4.5
Total Onion/ Garlic/Herb	3.5	3.5	2.5	2.5	3	2.5
Sour	4.5	4	5	5	5	5
Total Oil	4	4	4.5	5	4.5	4
Total Off	3	2.5	4	5	3.5	3
Oxidized Oil	2	2.5	3.5	4.5	2.5	2.5
TEXTURE						
Viscosity by Mouth	6.5	6.5	6	6	6	6
Oily Mouthfeel (after 5 sec	6	5.5	5	5	5.5	5
Comments:	slight fishy	slight oxidized oil, slight fishy	pondy, beany, oxidized oil	musty (sweat socks), oxidized oil, slightly fishy, pondy	pondy, slightly sour milk	cardboard, slightly old parmesean, slightly pondy

Scale = 0 1o 15

Note: color indicates variance from reference soy oil at initial timepoint; yellow=+/-1.0, or

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Table 7a

SDA SALAD DRESSING FORMULATIONS - RANCH

Variant	Control	SDA	Fish Oil	Algal Oil	Flax Oil
Formula Number	50-RA-325-000	50-RA-326-000	50-RA-328-000	50-RA-330-000	50-RA-327-000
INGREDIENT	%				
Liquid Soybean Oil	44.5000	33.1700	43.0700	43.2700	42.9700

Omega 3 Oil		11.33	1.43	1.23	1.53
Water	39.3530	39.3530	39.3530	39.3530	39.3530
Egg Yolk, Liquid, 10% Salt	2.9000	2.9000	2.9000	2.9000	2.9000
Vinegar, White Distilled, 120 gr	2.8500	2.8500	2.8500	2.8500	2.8500
Sugar, White, Fine Granulated	2.5000	2.5000	2.5000	2.5000	2.5000
Buttermilk Powder, Cultured LOL#20631	2.1000	2.1000	2.1000	2.1000	2.1000
Salt, Regular, Non Iodized	1.7000	1.7000	1.7000	1.7000	1.7000
Flavor, Cultured Buttermilk, Cargill#24521	1.5000	1.5000	1.5000	1.5000	1.5000
Garlic, Dehydrated, Granular	0.4500	0.4500	0.4500	0.4500	0.4500
Oniion, Dehydrated, Granular	0.4400	0.4400	0.4400	0.4400	0.4400
Mustard Flour, Wisconsin Spice SP448	0.4000	0.4000	0.4000	0.4000	0.4000
Acid, Phosphoric, 75%	0.4000	0.4000	0.4000	0.4000	0.4000
Gum, Xanthan, 60 mesh, Regular	0.2750	0.2750	0.2750	0.2750	0.2750
Preservative, Potassium Sorbate	0.2000	0.2000	0.2000	0.2000	0.2000
Monosodium Glutamate (MSG)	0.2000	0.2000	0.2000	0.2000	0.2000
Preservative, Sodium Benzoate, Granular	0.1000	0.1000	0.1000	0.1000	0.1000
Pepper, Black, 30-60 mesh	0.1000	0.1000	0.1000	0.1000	0.1000
Parsley, Dehydrated, Granular -10 +30	0.0250	0.0250	0.0250	0.0250	0.0250
Preservative, EDTA, Calcium Disodium	0.0070	0.0070	0.0070	0.0070	0.0070
TOTAL	100.0000	100.0000	100.0000	100.0000	100.0000

Table 7b

Ranch Dressing Production Process

1. Check that the Mixer is in good working condition, free and clear of any dirt or dust, sealed tight.
2. Set colloid mill at 0.45"
3. Set mix tank speed at 45 hz.
4. Meter water into the mix tank.
5. Add in preservatives (Benzoate, Sorbate, EDTA) into the mix tank.
6. Make gum slurry (Xanthan gum + 700g soybean oil)
7. Add slurry to dixie tank, allow to mix for 3 minutes
8. Increast tank speed to 35 hz.
9. Add remaining dry ingredients slowly to the mix tank.
10. Add Egg Yolk and Cultured Milk Powder
11. Increase tank speed to 45 hz.
12. Slowly add the remaining soybean oil, and if appropriate, the Omega 3 oil.
13. Add slowly, the vinegar and phosphoric acid.
14. Alll to mix until all ingredients are incorporated and mixed (approx 30 sec)
15. Open mix tank valve, and set pump speed to 30 hz.

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Table 7c

SHELF LIFE PRODUCTION
ANALTYICAL/MICRO RESULTS

RANCH DRESSING

	Control	SDA	Fish Oil	Algal Oil	Flax Oil
	50-RA-325-000	50-RA-326-000	50-RA-328-000	50-RA-330-000	50-RA-327-000

pH	3.80	3.79	3.79	3.79	3.80
Total Acidity	0.82	0.83	0.82	0.84	0.84
Total Solids	2.17	2.15	2.15	2.14	2.17
Bostwick (viscosity)	8.3 CM	8.5 cm	8.8 cm	8.5 cm	8.8 cm
Total Plate Count	30	50	110	30	20
Lactics	<10	<10	<10	<10	<10
Yeast	<10	<10	<10	<10	<10
Mold	<10	<10	<10	<10	<10

[0054] The general approach to the shelf life testing is for 5 trained attribute panelists to taste the dressings and come to consensus regarding the attributes and intensity (on a 15 pt scale – 0 being absent, 15 being extreme) for each dressing. The lists of attributes identified by the panelists are in the attached documents. Additional attributes would be identified as warranted.

[0055] For the current example the tables above provide significant data on flavor and consistency. In the case of Ranch Dressing, because of its more sensitive flavor, the differences between the dressings made with SDA and the competitive counterparts are more obvious. The tables above represent the data developed for a preferred embodiment of the current invention. Please also see Figures 3a-3h for graphical representation of the data with Ranch Dressing. According to the data provided herein the samples containing SDA are significantly less off-flavored than those containing the fish and algal oils. Due to pungent flavors and extremely unpleasant odor the fish and algal derived oils were simply removed from the 3 months accelerated evaluation period whereas SDA was not. Demonstrating improved stability, reduced degradation and consequent enhanced shelf-life.

EXAMPLE 3
MAYONNAISE

[0056] According to the current invention, a mayonnaise was prepared and tested with the omega-3 containing oil of the invention, the data provided applies for all mayonnaise and spoonable salad dressing variants, produced in a variety of ways (colloid mill, frying mill, etc).

Table 8a SDA – Mayonnaise, Formulation

MAYONNAISE SHELF LIFE ATTRIBUTES										
n=5										
	Soybean Oil (reference)					**SDA Oil**				
		95°F	95°F	73°F	73°F		95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	2 mo	4 mo	Ini	1 mo	2 mo	2 mo	4 mo
APPEARANCE										
Color	4	4.5	5	4	4	4	4.5	5	4	4
AROMA										
Total Aroma	6	6.5	7	6	6	6	7	8.5	6.5	6.5
Eggy Aroma	3.5	3.5	3	3.5	3	3.5	3.5	2	3.5	2.5
Vinegar Aroma	3	3.5	2.5	3	3	3	2.5	2.5	3	2.5
Pungent	4	4.5	4	4	4.5	3.5	4	4.5	3.5	4.5
Total Oil	1.5	2.5	3.5	2	2.5	1.5	2.5	5	2	3.5
Total Off	0.5	2	3.5	1.5	2.5	0.5	3	6.5	2	4.5
Oxidized Oil	0.5	2	3.5	1.5	2	0.5	2.5	5	2	3.5
FLAVOR										
Total Flavor	6.5	7	7	7	7	6.5	8.5	9	7	8
Eggy Flavor	4	4	3	4	3.5	4	4.5	2.5	4	3
Vinegar Flavor	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5
Sweet	3.5	3.5	3.5	3.5	3	3.5	5	3.5	3	3
Sour	2.5	2.5	3	3	3	2.5	3.5	3	2.5	3
Salty	3	3	3	3.5	3.5	3.5	3.5	3	3.5	4
Total Oil	3	3.5	4	3.5	3.5	3.5	4	5.5	3.5	4.5
Total Off	1.5	3	4.5	2	3.5	1	5	6.5	2.5	5.5
Oxidized Oil	1.5	2.5	4	2	3	0.5	4	5.5	2	4.5
TEXTURE										
Viscosity by Mouth	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9
Oily Mouthfeel (after 5 seconds)	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9
Comments:		old oil, beany, slightly waxy	painty, cardboard	slightly oxidized, cardboard	reheated oil, slightly beany				slight sulfur, oxidized oil, slightly beany	Slight sulfur, pondy, slightly melted plastic

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Table 8b Composition of the Invention – Comparison with Fish Oil-based Mayonnaise

n=5					
	Fish Oil				
		95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	2 mo	4 mo
APPEARANCE					
Color	4	4.5	5	4	4
AROMA					
Total Aroma	6	6.5	7.5	6.5	6.5
Eggy Aroma	3.5	3.5	3	3.5	3
Vinegar Aroma	3	3	3	3	3
Pungent	3.5	4	4.5	4	4.5
Total Oil	1.5	2	4	2.5	3
Total Off	0.5	2	4.5	2	3.5
Oxidized Oil	0.5	1.5	4	2	3
FLAVOR					
Total Flavor	6.5	7.5	8	7.5	8
Eggy Flavor	4	4	2.5	4	3
Vinegar Flavor	2.5	2.5	2.5	2.5	2.5
Sweet	3.5	3.5	3.5	3.5	3
Sour	2.5	3.5	3.5	3	3
Salty	3	3.5	4	3.5	4
Total Oil	3	3.5	5	4	5
Total Off	1	3	6	3.5	5.5
Oxidized Oil	0.5	2.5	5	3.5	5
TEXTURE					
Viscosity by Mouth	8.5	9	8.5	8.5	9
Oily Mouthfeel (after 5 seconds)	8.5	9	8.5	8.5	9.5
Comments:		fishy, musty, painty	strong fishy	oxidized oil, painty, old mayo, fish	fishy

Table 8c Composition of the Invention – Comparison with Algal Oil-based Mayonnaise

n=5					
	Algal Oil				
		95°F	95°F	73°F	73°F
	Ini	1 mo	2 mo	2 mo	4 mo
APPEARANCE					
Color	5.5	7	6.5	6	5.5
AROMA					
Total Aroma	6	8	9	7	8
Eggy Aroma	4	2.5	2	3	2
Vinegar Aroma	3	3	2.5	3	2
Pungent	3.5	4.5	5	4	5.5
Total Oil	1.5	4	6	2.5	5
Total Off	0.5	4.5	6.5	2	5.5
Oxidized Oil	0.5	4.5	6	2	5
FLAVOR					
Total Flavor	6.5	9	9.5	8	9
Eggy Flavor	5	2.5	2	3	2
Vinegar Flavor	2.5	2.5	2	2.5	1.5
Sweet	4	2.5	3.5	3	3
Sour	2.5	3.5	3.5	3	3.5
Salty	3.5	3.5	3.5	3.5	4
Total Oil	3	6	7	5	6.5
Total Off	1.5	6.5	7.5	4.5	7.5
Oxidized Oil	1	6	7	4.5	6.5
TEXTURE					
Viscosity by Mouth	8.5	8.5	8.5	8.5	9
Oily Mouthfeel (after 5 seconds)	8.5	9	8.5	8.5	8.5
Comments:		fishy, pondy	Strong fishy	Oxidized oil, painty old mayo, fishy	Fishy, pondy, beany, cardboard

8d Composition of the Invention – Comparison with Flax Oil-based Mayonnaise

n=5					
	Flax Oil				
		95°F	95°F	73°F	73°F
	Initial	1 mo	2 mo	2 mo	4 mo
APPEARANCE					
Color	4.5	5.5	5.5	5	5
AROMA					
Total Aroma	6	6.5	7.5	6.5	6.5
Eggy Aroma	3.5	4	2	3.5	2.5
Vinegar Aroma	3	3	2.5	3.5	2.5
Pungent	3.5	4	5	4.5	4
Total Oil	1.5	2.5	4.5	2	3
Total Off	1.5	2	5	1.5	3.5
Oxidized Oil	1	2	4.5	1.5	3
FLAVOR					
Total Flavor	7	7	8	7.5	7.5
Eggy Flavor	3.5	4	2.5	3.5	3
Vinegar Flavor	2.5	2.5	2	3	2.5
Sweet	3	3.5	3.5	3.5	3.5
Sour	2.5	3	3	3	3
Salty	3.5	3.5	3.5	3.5	4
Total Oil	3	3.5	5	4	4.5
Total Off	3.5	2.5	5.5	3	4.5
Oxidized Oil	3	2.5	5	3	4.5
TEXTURE					
Viscosity by Mouth	8.5	9	8.5	8	8.5
Oily Mouthfeel (after 5 seconds)	8.5	9	8.5	8.5	8.5
Comments:		Old oil, reheated oil, beany, waxy	Fishy, cardboard, reheated oil	Fishy, pondy	Strong fishy

Table 9a.

SDA MAYONNAISE FORMULATIONS AND PROCESS

Variant	Control	SDA	Fish	Algal	Flax
Code Number	050-RA787-000	050-RA788-000	050-RA790-000	050-RA791-000	050-RA792-000
Ingredient	%	%	%	%	%
Soy Salad Oil	80.0000	55.6500	76.9000	77.3500	76.7300
Omega 3 Oil		24.3500	3.1000	2.6500	3.2700
Water	7.7930	7.7930	7.7930	7.7930	7.7930
Egg Yolk (10% salted)	6.0000	6.0000	6.0000	6.0000	6.0000
White Distilled Vinegar, 120gr	3.0000	3.0000	3.0000	3.0000	3.0000
High Fructose Corn Syrup - 42 solids	2.0000	2.0000	2.0000	2.0000	2.0000
Salt	0.8000	0.8000	0.8000	0.8000	0.8000
Mustard Flour	0.4000	0.4000	0.4000	0.4000	0.4000
EDTA, Calcium Disodium	0.0070	0.0070	0.0070	0.0070	0.0070
Total	**100.0000**	**100.0000**	**100.0000**	**100.0000**	**100.0000**

Table 9b

Mayonnaise Process - Pilot Plant

2. Set the colloid mill at 30.
3. Add the water first, then mix in the EDTA.
4. Add the egg yolk, mix for 3 min.
5. Pre-mix the mustard flour, sugar, and salt. Add the premix slowly until dissolved and evenly dispersed.
6. Add in the oils mix for 3 minutes, set Dixie mix tank speed at 35hz.
7. Slowly add in the vinegar
8. Mix until all ingredients are dispersed. Shut off Dixie Mixer agitation, allow air to escape.
9. Start up the Collid Mill. Open mix tank, valve, set pump speed to 30hz.
10. Pack into individual packages.

[0057] According to the current invention. The general approach to the shelf life testing is for 5 trained attribute panelists to taste the dressings and come to consensus regarding the attributes and intensity (on a 15 pt scale – 0 being absent, 15 being extreme) for each dressing. The lists of attributes identified by the panelists are in the attached documents. Additional attributes would be identified as warranted.

Table 9c.

	VALUE	SCALE REFERENCE
APPEARANCE		
Color	0.0	White (paper)
	7.5	Manila Folder
AROMA\FLAVOR		
Eggy	8.0/6.0	Chopped Hard Boiled Eggs
Vinegar Aroma	6.5	100% Heinz Distilled Vinegar solution
Vinegar Flavor	4.0	2% Heinz Distilled Vinegar solution
Total Off	3.5	Edamame, raw soybeans
Oxidized Dairy/Oil	4.0	Canola Oil (opened 9/05)
(aroma and flavor)	5.0	Wesson Vegetable Oil (opened 11/22/04)
	8.0	Kraft Parmesan Cheese (2001 expiration date)
Sweet	2.0	2.0% Sucrose in Water
	5.0	5.0% Sucrose in Water
Sour	2.0	0.025% Citric Acid in Water
	5.0	0.04% Citric Acid in Water
Salty	2.0	0.2% Sodium Chloride in Water
	5.0	0.5% Sodium Chloride in Water
MOUTHFEEL FACTORS		
Pungent (aroma)	8.0	100% Heinz Distilled Vinegar solution
TEXTURE		
Viscosity by Mouth	8.0	50:50 mix of Lucerne Heavy Cream and Kraft Mayonnaise
	11.0	Kraft Mayonnaise
Oily Mouthfeel	8.0	Kraft Mayonnaise

[0058] According to the current invention the following data was developed after initial evaluations. Similar to the Salad Dressings example, the initial flavor of SDA containing

mayonnaise was similar to the control. The flax sample was most different from the others compared

[0059] According to the methods of the current invention, the shelf-life studies two month studies at both room temperature and accelerated storage conditions were completed. All samples in the accelerated temperature study had noticeable off flavor with the algal oil sample containing the highest off notes. SDA performed better than the other omega-3 containing oil sources. For the room temperature study, Algal oil exhibited much higher levels of off flavors than the SDA oil of the invention. See the above data in tables 12-14 and Figures 4a-4e.

EXAMPLE 4
SOY MILK

[0060] According to the current invention, Soymilk can be prepared in two different ways. In the first, SDA enriched soybeans are de-hulled, flaked and then made into full fatted soy flour. The soymilk is formulated by first dissolving the soy flour into water, mixing, and processing to inactivate the enzymes. The soy base is filtered to remove additional solids and degassed. The remaining ingredients are added, mixed, the product is then homogenized in a two stage homogenizer, then processed through a Ultra High Temperature (UHT) thermal processing unit. The resulting product is packed and refrigerated with a typical shelf life of 12 weeks. Following is a formulation as provided in Table 10, see also FIG. 6 for a process flow diagram.

Table 10.

Vanilla Soymilk	%
Water	88.122
SDA Enriched Soy Flour	6.786
Full Fat Soymilk.	0.600
Sucrose	3.400
Carageenen	0.022
Cellulose Gum	0.350
Salt	0.040
Calcium Carbonate	0.350
Natural and Artificial Flavors	0.330
TOTAL	100.000

[0061] The example used can also be applied to different types of homogenization and thermal processing units (direct steam, indirect steam, etc.). Different soymilk flavors, including plain, chocolate, apple, orange, berry, etc. can be prepared in the same manner.

[0062] The resulting product was found to have acceptable flavor and mouth "feel" properties in comparison to soymilk made from flour processed the same way but without the SDA enhancement of the current invention. According to the data developed in pursuit of the current invention after 9 months shelf life, only slight differences in taste exist between the embodiments of the current invention enhanced with a transgenic SDA composition versus a control composition with non-transgenic soybean oil containing no Omega-3 fatty acids. This was done for both the soymilk and fruit smoothies. Note these are kept refrigerated and only have a 3 month shelf life in most commercial settings.

[0063] The second approach to this example is to use isolated soy protein, and to add SDA enriched soy oil to achieve a new product composition. Following is a formulation as provided in Table 11 with a corresponding flow diagram in FIG 7.

Table 11.

Vanilla Soymilk	%
Water	88.058
Sucrose	3.500
Isolated Soy Protein	2.700
Maltodextrin	3.500
11% SDA Soybean Oil	1.500
Caraeenan	0.022
Cellulose gum	0.350
Salt	0.040
Natural & Artificial Flavors	0.330
TOTAL	100.000

[0064] According to the current invention the example provided above used can also be applied to different types of homogenization and thermal processing units (direct steam, indirect steam, etc.). Different soymilk flavors, including plain, chocolate, apple, orange, berry, etc. can be prepared in the same manner. The resulting product was found to have acceptable flavor and mouthfeel properties in comparison to soymilk made with refined, bleached and deodorized soybean oil.

TABLE 12

SOYMILK ATTRIBUTE REMARKS AND EVALUATION

9 WEEK PROFILES

(n=5 panelists)

	Soybean Oil (reference) Initial	40°F 3 wks	40°F 6 wks	40°F 9 wks	SDA Oil Initial	40°F 3 wks	40°F 6 wks	40°F 9 wks
APPEARANCE								
Color	4	4	4	4	4	4	4	4
AROMA								
Total Aroma	8.5	8.5	8.5	8.5	7.5	6.5	6.5	7.5
Sweet Aromatic/Vanilla	7.5	7.5	7.5	7.5	6	6	6	6
Cereal/Soy/Grain	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Total Off	0	0	0	0	2.5	2	2	1
Oxidized Oil	0	0	0	0	2	1	1	1
FLAVOR								
Total Flavor	7.5	7.5	6.5	7	8.5	6	6	6.5
Sweet Aromatic/Vanilla	5.5	5.5	5	4.5	5.5	4.5	4	4
Cereal/Soy/Grain	6.5	6.5	6	6.5	7	5.5	5.5	5.5
Sweet	5	5	4.5	4.5	5	4.5	4	4
Bitter	0.5	1.5	1.5	1.5	1.5	3	2	2
Total Off	0.5	1.5	1.5	1.5	2.5	2.5	2.5	2
Oxidized Oil	0	0	1	1	1.5	1	1.5	1.5
TEXTURE								
Viscosity by Mouth	2	2	2	2	2	2	2	2
Chalky/Gritty	3	3	2.5	3.5	3	3	2.5	3
Astringent	4	4	4	4	4	4	4	4
Comments:	slight green, slight beany	cardboard packaging	slight soft plastic, slight waxy	slight cardboard	slightly chemical, slightly oxidized oil, slightly pondy	cardboard, playdough, slight chemical/solvent	beany, cardboard	beany, cardboard

Scale range = 0 to 15

Note: color indicates variance from Soybean reference; yellow=+/-1.0, orange=+/-1.5 to 2.0, red=/<2.5

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EXAMPLE 5
FRUIT SMOOTHIES

[0065] According to a preferred embodiment of the current invention, fruit smoothies, developed from soymilk. Other sources of SDA oil could be used for the development of fruit smoothies as well, in alternative embodiments. Also according to the current invention the processes developed for the production of the fruit smoothies takes into account the unique properties of the SDA oil for enhancing health and nutrition. Two smoothie type products have been developed, and both products have been determine to have extended shelf life properties. During a process that involves the utilization of ultra high pasteurization, stored refrigerated, with a 12 week shelf life typical of other refrigerated drinks. Although a mixed berry prototype is described herein, other flavors can be developed including strawberry, grape, cranberry, orange, lemon, apple, pineapple, mango, strawberry- banana and any other fruit flavor combination.

[0066] In the first approach, soymilk is prepared as described in the first part of Example 4, utilizing SDA enriched soy flour. Additional ingredients including stabilizers, flavorings and fruit are added prior to homogenization. The following is a formulation used for the product:

Table 13.
MIXED BERRY FRUIT SMOOTHIE - SOY BASED

	%
Water	77.774
SDA Enriched Soy Flour	6.773
Pectin	0.300
Cellulose gel/pectin mix	0.400
Sucrose	9.300
Citric Acid, anhydrous	0.450
Potassium Citrate, granular	0.060
Soy lecithin	0.060
Salt	0.070
Frozen Strawbery Puree	4.000
Frozen Blackberry Puree	0.500
Red Grape Juice Concentrate	0.123
Natural Flavor	0.020
Natural Flavor	0.060
Natural Berry Flavor	0.050
Natural and Artificial Mixed Berry Flavor	0.040
Natural and Artificial Blueberry Flavor	0.020
Total	100.000

[0067] The soybase portion was prepared according to the process described in Example 4. The processing for the remainder of the product is described below:

Table 14

Preparation Procedures:

1. Pre-weigh all dry ingredients
2. **Stabilizer portion:** Add prescribed water for stabilizer portion into mixing vessel and begin agitation.
3. Heat water to 110 to 120°F.
4. Mix the pectin and Avicel with a portion of the dry sugar and add slowly to the water with high shear mixing. Allow 5 minutes for hydration.
5. Add the citric acid.
6. **Soy milk portion:**
7. Add the potassium citrate, soy lecithin and salt.
8. **Combine the stablilzer portion and soymilk portion into larger, steam jacketed mixing vessel.**
9. Add the purees, color, and flavorings and mix until uniform.
10. Check pH. Expected pH 4.2 ± 0.2.
11. Heat to 160°F and homogenize d/s 2500+500 psi. (3000 psi total)
12. UHT process in the Microthermics unit. Target process is 224°F for 19 seconds.
13. Cool in Microthermics cooling sections and fill directly into containers.
14. Apply closure and place bottles into chilled water bath. Cool to ≤50°F.
15. Take count of bottles, apply labels, and refrigerate (PD Warehouse walk-in refrigerator).

[0068] A second approach developed by the current invention is where an SDA enriched oil is added to a formulation containing Isolated Soy Protein. In this embodiment, a mixed berry product was developed, but can be extended to additional flavors as described above. Following is the basic formulation used in an embodiment of the current invention:

Table 15

MIXED BERRY FRUIT SMOOTHIE - SOY BASED

	%
Water	81.077
Pectin	0.300
Cellulose gel/pectin mix	0.400
Sucrose	8.700
Citric Acid, anhydrous	0.310
11% SDA Soybean Oil	1.500
Isolated Soy Protein	2.700
Potassium Citrate, granular	0.060
Soy lecithin	0.080
Salt	0.060
Frozen Strawbery Puree	4.000

Frozen Blackberry Puree	0.500
Red Grape Juice Concentrate	0.123
Natural Flavor	0.020
Natural Flavor	0.060
Natural Berry Flavor	0.050
Natural and Artificial Mixed Berry Flavor	0.040
Natural and Artificial Blueberry Flavor	0.020
Total	100.000

The product was developed according to the methods of the invention and has the following formulation:

Table 16

Preparation Procedures:

1. Pre-weigh all dry ingredients
2. **Stabilizer portion:** *Add prescribed water for stabilizer portion into mixing vessel and begin agitation.*
3. Heat water to 110 to 120°F.
4. Mix the pectin and Avicel with a portion of the dry sugar and add slowly to the water with high shear mixing. Allow 5 minutes for hydration.
5. Add the citric acid.
6. ***Soy milk portion:*** *Add the prescribed water for the soymilk portion into a separate mixing vessel and begin agitation.*
7. Heat the water to 100 to 110°F
8. Add the soy protein isolate. Mix well to disperse.
9. *Add the potassium citrate, soy lecithin, salt and oil.*
10. **Combine the stabilizer portion and soymilk portion into larger, steam jacketed mixing vessel.**
11. Add the frozen strawberry puree, color, and flavorings and mix until uniform.
10. Check pH. Expected pH 4.2 ± 0.2.

[0069] The resulting products from both approaches in this example were typical of a fruit flavored smoothie embodiment of the invention with a refrigerated shelf life of 12 months as developed for the current invention.

[0070] The data and techniques above demonstrate the production of a mixed berry smoothie from soymilk according to the methods of the invention. According to an embodiment of the invention the SDA oil of the invention provides substantial differences relative to other omega-3 containing samples. The data is presented in Table 17 – 21 and graphs demonstrating the results are in Figures 6a-6b.

TABLE 17

MIXED BERRY SMOOTHIE – ATTRIBUTE RESULTS

9 WEEK PROFILES

(n=5 panelists)

	Soybean Oil				SDA Oil			
	(reference)	40°F	40°F	40°F		40°F	40°F	40°F
	Initial	3 wks	6 wks	9 wks	Ini	3 wks	6 wks	9 wks
APPEARANCE								
Color	4	4	4	4	4	4	4	4
AROMA								
Total Aroma	7	7	7.5	7	6.5	6.5	6.5	6.5
Sweet Aromatic	5.5	5.5	6	5.5	4.5	5	4.5	4.5
Berry*	6.5	6.5	7	6.5	5.5	5	5	5.5
Total Dairy/Cultured Dairy	2.5	2.5	2.5	2.5	2	2	2.5	2.5
Cereal/Soy/Grain	1.5	1.5	1.5	1.5	1	2	1.5	1.5
Total Off	0	0	0	0	0.5	1	0.5	0.5
Oxidized Oil	0	0	0	0	0	0.5	0	0.5
FLAVOR								
Total Flavor	8.5	8.5	9	8.5	8	7.5	8	8
Sweet Aromatic	6.5	6.5	6	6.5	6	5.5	5	5.5
Berry*	7.5	7.5	7.5	7.5	7	6.5	6.5	6.5
Total Dairy/Cultured Dairy	4	4	4.5	4	3.5	4	4	4
Cereal/Soy/Grain	2.5	2.5	2.5	2.5	2	2.5	3	2
Sweet	8	8	7.5	8	7	7	6.5	7
Sour	5	5	5.5	5.5	6	5	5.5	6
Bitter	1	1	1	1.5	1.5	1.5	2	2
Total Off	0	0	0	1.5	1.5	1.5	2	2.5
Oxidized Oil	0	0	0	0.5	0	0.5	1	1
TEXTURE								
Viscosity by Mouth	4	4	4.5	4.5	4	4	4.5	4
Chalky/Gritty	3.5	3.5	3.5	3.5	3.5	3.5	4	4
Astringent	4	4	4	4	4	4	4.5	4
Comments:				slight beany	slightly oxidized milk	slight cooked berry, cardboard	beany, green beany, oxidized milk	sllight bean, oxidized milk

EXAMPLE 6
MARGARINE TYPE SPREADS

Table 18

70% Fat Margarine Type Spread

	Control	SDA	Fish	Algal	Flax
Ingredient	%	%	%	%	%
Soy Salad Oil	35.00	10.65	31.90	32.35	31.73
Partially Hydrogenated Soy Bean Oil *	35.00	35.00	35.00	35.00	35.00
Omega 3 Oil		24.35	3.10	2.65	3.27
Water	27.60	27.60	27.60	27.60	27.60
Salt	2.00	2.00	2.00	2.00	2.00
Lecithin, Soy Based **	0.14	0.14	0.14	0.14	0.14
Sodium Benzoate	0.09	0.09	0.09	0.09	0.09
52% Plastic Mono & Diglyceride ***	0.15	0.15	0.15	0.15	0.15
Vitamin A / Beta Carotene Blend ****	0.01	0.01	0.01	0.01	0.01
Natural & Artificial Butter Flavor	0.01	0.01	0.01	0.01	0.01
Total	100.00	100.00	100.00	100.00	100.00

[0071] According to a preferred embodiment of the current invention, a typical margarine process, is, the water, salt, sodium benzoate, and butter flavor are mixed as an aqueous phase. Turning to FIG. 9 a milk ingredient, such as whey powder, sodium caseinate or milk powder may be added to the aqueous phase. The oils, lecithin, mono and diglycerides, vitamins, and flavorings are mixed, and combined with the aqueous phase and mixed. The mixed emulsion is passed through a series of scraped surface heat exchangers, pin mixers and resting tubes (A, B and C units respectively) to achieve a desired fill temperature and consistency.

EXAMPLE 7
COOKIE DOUGH

[0072] According to the invention the SDA oil of the invention can also be developed into food products including cookies. Below is provided one recipe for such utilization.

Table 19

Ingredient	%
Flour	49.20
Baker's Sugar	16.00
Hardened soybean oil (Mpt 36-38°)	17.40
20% SDA Oil	7.5
Liquid soya oil	4.1
Salt	0.80
Water	5.00
Total	100.00

Recombinant Plant Production

[0073] One method to recombinantly produce a protein of interest a nucleic acid encoding a transgenic protein can be introduced into a host cell. The recombinant host cells can be used to produce the transgenic protein, including a desirable fatty acid such as SDA that can be secreted or held in the seed, seed pod or other portion of a target plant. A nucleic acid encoding a transgenic protein can be introduced into a host cell, e.g., by homologous recombination. In most cases, a nucleic acid encoding the transgenic protein of interest is incorporated into a recombinant expression vector.

[0074] In particular the current invention is also directed to transgenic plants and transformed host cells which comprise, in a 5' to 3' orientation, a promoter operably linked to a heterologous structural nucleic acid sequence. Additional nucleic acid sequences may also be introduced into the plant or host cell along with the promoter and structural nucleic acid sequence. These additional sequences may include 3' transcriptional terminators, 3' polyadenylation signals, other untranslated nucleic acid sequences, transit or targeting sequences, selectable markers, enhancers, and operators.

[0075] Preferred nucleic acid sequences of the present invention, including recombinant vectors, structural nucleic acid sequences, promoters, and other regulatory elements, are described above. The means for preparing such recombinant vectors are well known in the art. For example, methods for making recombinant vectors particularly suited to plant transformation are described in U.S. Pat. Nos. 4,940,835 and 4,757,011.

[0076] Typical vectors useful for expression of nucleic acids in cells and higher plants are well known in the art and include vectors derived from the tumor-inducing (Ti) plasmid of *Agrobacterium tumefaciens*. Other recombinant vectors useful for plant transformation, have also been described in the literature.

[0077] The transformed host cell may generally be any cell which is compatible with the present invention. The transformed host cell may be prokaryotic, more preferably a bacterial cell, even more preferably an *Agrobacterium*, *Bacillus, Escherichia, Pseudomonas* cell, and most preferably is an *Escherichia coli* cell. Alternatively, the transformed host cell is preferably eukaryotic, and more preferably a plant, yeast, or fungal cell. The yeast cell preferably is a *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*, or *Pichia pastoris*. The plant cell preferably is an alfalfa, apple, banana, barley, bean, broccoli, cabbage, canola, carrot, cassava, celery, citrus, clover, coconut, coffee, corn, cotton, cucumber, garlic, grape, linseed, melon, oat, olive, onion, palm, pea, peanut, pepper, potato, radish, rapeseed (non-canola), rice, rye, sorghum, soybean, spinach, strawberry, sugarbeet, sugarcane, sunflower, tobacco, tomato, or wheat cell. The transformed host cell is more preferably a canola, maize, or soybean cell; and most preferably a soybean cell. The soybean cell is preferably an elite soybean cell line. An "elite line" is any line that has resulted from breeding and selection for superior agronomic performance.

[0078] The transgenic plant of the invention is preferably an alfalfa, apple, banana, barley, bean, broccoli, cabbage, canola, carrot, cassava, celery, citrus, clover, coconut, coffee, corn, cotton, cucumber, garlic, grape, linseed, melon, oat, olive, onion, palm, pea, peanut, pepper, potato, radish, rapeseed (non-canola), rice, rye, safflower, sorghum, soybean, spinach, strawberry, sugarbeet, sugarcane, sunflower, tobacco, tomato, or wheat plant. The transformed host plant is most preferably a canola, maize, or soybean cell; and of these most preferably a soybean plant.

Method for Preparing Transgenic Plants

[0079] The invention is further directed to a method for preparing transgenic plants capable of producing a substantial amount of SDA comprising, in a 5' to 3' direction, a promoter operably linked to a heterologous structural nucleic acid sequence. The nucleic acid sequence comprising the sequence of SDA when translated and transcribed into amino acid form. Other structural nucleic acid sequences may also be introduced into the plant along with the promoter and structural nucleic acid sequence. These other structural nucleic acid sequences may include 3' transcriptional terminators, 3' polyadenylation signals, other untranslated nucleic acid sequences, transit or targeting sequences, selectable markers, enhancers, and operators.

[0080] The method generally comprises selecting a suitable plant cell, transforming the plant cell with a recombinant vector, obtaining the transformed host cell, and culturing the transformed host cell under conditions effective to produce a plant.

[0081] The transgenic plant of the invention may generally be any type of plant, preferably is one with agronomic, horticultural, ornamental, economic, or commercial value, and more preferably is an alfalfa, apple, banana, barley, bean, broccoli, cabbage, canola, carrot, castorbean, celery, citrus, clover, coconut, coffee, corn, cotton, cucumber, Douglas fir, Eucalyptus, garlic, grape, Loblolly pine, linseed, melon, oat, olive, onion, palm, parsnip, pea, peanut, pepper, poplar, potato, radish, *Radiata* pine, rapeseed (non-canola), rice, rye, safflower, sorghum, Southern pine, soybean, spinach, strawberry, sugarbeet, sugarcane, sunflower, Sweetgum, tea, tobacco, tomato, turf, or wheat plant. The transformed plant is more preferably a canola, maize, or soybean cell; and most preferably a soybean plant. The soybean plant is preferably an elite soybean plant. An elite plant is any plant from an elite line. Elite lines are described above.

[0082] The regeneration, development, and cultivation of plants from transformed plant protoplast or explants is well taught in the art (Gelvin et al., **PLANT MOLECULAR BIOLOGY MANUAL**, (1990); and, Weissbach and Weissbach, **METHODS FOR PLANT MOLECULAR BIOLOGY** (1989)). In this method, transformants are generally cultured in the presence of a selective media which selects for the successfully transformed cells and induces the regeneration of the desired plant shoots. These shoots are typically obtained within two to four months.

[0083] The shoots are then transferred to an appropriate root-inducing medium containing the selective agent and an antibiotic to prevent bacterial growth. Many of the shoots

will develop roots. These are then transplanted to soil or other media to allow the continued development of roots. The method, as outlined, will generally vary depending on the particular plant strain employed.

[0084] Preferably, the regenerated transgenic plants are self-pollinated to provide homozygous transgenic plants. Alternatively, pollen obtained from the regenerated transgenic plants may be crossed with non-transgenic plants, preferably inbred lines of economically important species. Conversely, pollen from non-transgenic plants may be used to pollinate the regenerated transgenic plants.

[0085] The transgenic plant may pass along the nucleic acid sequence encoding the protein of interest to its progeny. The transgenic plant is preferably homozygous for the nucleic acid encoding the protein of interest protein and transmits that sequence to all its offspring upon as a result of sexual reproduction. Progeny may be grown from seeds produced by the transgenic plant. These additional plants may then be self-pollinated to generate a true breeding line of plants.

[0086] The progeny from these plants are evaluated, among other things, for gene expression. The gene expression may be detected by several common methods (e.g., western blotting, immunoprecipitation, and ELISA).

[0087] Regulatory sequences include those that direct constitutive expression of a nucleotide sequence in many types of host cells, those that direct expression of the nucleotide sequence only in certain host cells (e.g., tissue-specific regulatory sequences) and those that direct expression in a regulatable manner (e.g., only in the presence of an inducing agent). It will be appreciated by those skilled in the art that the design of the expression vector may depend on such factors as the choice of the host cell to be transformed, the level of expression of transgenic protein desired, and the like. The transgenic protein expression vectors can be introduced into host cells to thereby produce transgenic proteins encoded by nucleic acids.

[0088] As used herein, the terms "transformation" and "transfection" refer to a variety of art-recognized techniques for introducing foreign nucleic acid (e.g., DNA) into a host cell, including calcium phosphate or calcium chloride co-precipitation, DEAE-dextran-mediated transfection, lipofection, electroporation, microinjection and viral-mediated transfection. Suitable methods for transforming or transfecting host cells can be found in Sambrook et al. (**Molecular**

Cloning: A Laboratory Manual, 2nd Edition, Cold Spring Harbor Laboratory press (1989)), and other laboratory manuals.

[0089] One skilled in the art can refer to general reference texts for detailed descriptions of known techniques discussed herein or equivalent techniques. These texts include: Ausubel, et al., CURRENT PROTOCOLS IN MOLECULAR BIOLOGY (eds., John Wiley & Sons, N.Y. (1989)); Birren et al., GENOME ANALYSIS: A LABORATORY MANUAL 1: ANALYZING DNA, (Cold Spring Harbor Press, Cold Spring Harbor, N.Y. (1997)); Clark, PLANT MOLECULAR BIOLOGY: A LABORATORY MANUAL, (Clark, Springer-Verlag, Berlin, (1997)); and, Maliga et al., METHODS IN PLANT MOLECULAR BIOLOGY, (Cold Spring Harbor Press, Cold Spring Harbor, N.Y. (1995)). These texts can, of course, also be referred to in making or using an aspect of the invention. It is understood that any of the agents of the invention can be substantially purified and/or be biologically active and/or recombinant.

[0090]

Reduction of Linoleic Acid

[0091] It is known that Omega-3 and Omega-6 fatty acids are fatty acids that are required in human nutrition. Omega-6 fatty acids include linoleic acid and its derivatives. These oils are considered essential to human nutrition because these fatty acids must be consumed in the diet because humans cannot manufacture them from other dietary fats or nutrients, and they cannot be stored in the body. Fatty Acids of this sort provide energy and are also components of nerve cells, cellular membranes, and are converted to hormone-like substances known as prostaglandins.

[0092] Looking at Fig. 1, linoleic acid is an 18-carbon long polyunsaturated fatty acid containing two double bonds. Its first double bond occurs at the sixth carbon from the omega end, classifying it as an omega-6 oil. As linoleic acid is absorbed and metabolized in the human body, it is converted into a derivative fatty acid, gamma linoleic acid (GLA), which is converted into di-homo-gamma linoleic acid (DGLA) and arachidonic acid (AA). The DGLA and AA are then converted into two types of prostaglandins by adding two carbon molecules and removing hydrogen molecules. There are three families of prostaglandins, PGE1, PGE2, and PGE3. DGLA is converted to PGE1, while AA is converted into PGE2. PGE3 is made by the conversion of omega-3 fatty acids.

[0093] In humans the over consumption of omega-6 oils in relation to consumption of omega-3 oils can lead to an overproduction of inflammation-producing prostagladins (PGE2) and a scarcity of anti-inflammatory prostaglandins (PGE1 and PGE2). This in turn can lead to a variety of other health problems. Going further, the daily consumption of omega-6 fatty acids by consumers may be excessive, due to the presence of omega-6 fatty acids in common cooking vegetable oils and processed foods currently on the market. The ratio of omega-6 to omega-3 fatty acid consumption can often reach 20:1 in western diets. To achieve a more desirable ratio, an embodiment of the current invention provides for the increased production of SDA while reducing the production of LA in a transgenic oilseed plant. The resulting oil contains lower levels of LA while providing for the production of significant quantities of SDA and can be used in a variety of roles in the food industry from cooking oil to food ingredient.

Raising Tocopherol Levels

[0094] Tocopherols are natural antioxidants and essential nutrients in the diet found in plant oils. These antioxidants protect cell membranes and other fat-soluble parts of the body, such as low-density lipoprotein (LDL) cholesterol from damage. It also appears to protect the body against cardiovascular disease and certain forms of cancer and has demonstrated immuno-enhancing effects. According to the current invention enhancements in the presence of tocopherols in the oil of transgenic seed oil plants will be beneficial to consumers of the oil. Relative to the purposes of the current invention enhanced concentrations of tocopherols present in various embodiments of the current will be beneficial as a part of an oil product and may also reduce the oxidation of SDA

[0095] Although the foregoing invention has been described in some detail by way of illustration and example for purposes of understanding, it will be apparent to those skilled in the art that certain changes and modifications may be practiced. Therefore, the description and examples should not be construed as limiting the scope of the invention, which is delineated by the appended claims.

[0096] Accordingly, it is to be understood that the embodiments of the invention herein providing for an improved source of SDA for utilization in food products should not be limited to the specific examples. These examples are illustrative of the general applicability of the

current invention to a vast range of food items. With the inclusion of SDA these items can be made with the same or better sensory qualities while significantly enhancing the nutritionally quality of the food produced for human consumption.

[0097] Moreover, the examples provided herein are merely illustrative of the application of the principles of the invention. It will be evident from the foregoing description that changes in the form, methods of use, and applications of the elements of the disclosed plant-derived could be used for applications not directly related to human consumption. Included in this field is the use of plant-derived SDA for the development of nutritionally enhanced feed for use in animal production industries generally including but not limited to: beef production; poultry production; pork production; and or, aquaculture. These variant uses may be resorted to without departing from the spirit of the invention, or the scope of the appended claims.

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CLAIMS

What is claimed is:

1. A food product comprising stearidonic acid exhibiting extended shelf-life against flavor degradation wherein said stearidonic acid is derived from a transgenic plant.

2. The product of claim 1 wherein said extended shelf-life comprises at least 5% longer shelf life than a corresponding concentration of EPA.

3. The product of claim 1 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

4. The product of claim 1 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

5. The product of claim 1 further exhibiting enhanced stability.

6. The product of claim 1 further comprising tocopherols.

7. The product of claim 6 further comprising at least about 5 ppm tocopherols.

8. The product of claim 1 wherein said stearidonic acid comprises from 0.1% to 80% of said food product.

9. The product of claim 2 further comprising soy protein.

10. The product of claim 2 wherein said feed product comprises less than about 40% LA.

11. The product of claim 1 further comprising wherein said stearidonic acid is part of an oil fraction from an oilseed plant.

12. The product of claim 3 wherein said oilseed plant fraction is comprised of from 2% to 50% of said oilseed plant oil after plant produced seed and/or fragment is crushed to release said oil fraction.

13. The product of claim 3 wherein said oilseed plant is comprised of at least 20% of said oilseed plant oil after plant produced seed and/or fragment is crushed to release said oil fraction.

14. The product of claim 1, further comprising: a) a moisture containing ingredient; and, b) sufficient stabilizer to form an emulsion, such that said food product is a stable emulsion.

15. The product of claim 6 additionally comprising a chelating agent.

16. The product of claim 7 additionally comprising a dairy component.

17. The product of claim 6, 7 or 8 wherein said food product is a mayonnaise.

18. The product of claim 6, wherein said moisture containing ingredient is a dairy component.

19. The product of claim 10, wherein said dairy component comprises between 25% - 80% of the weight of said product.

20. The product of claim 11, wherein said food product is a yogurt.

21. The product of claim 11, wherein said food product is frozen

22. The product of claim 13, wherein said food product is an ice cream.

23. The product of claim 11, wherein said food product is a margarine.

24. The product of claim 6, wherein said emulsion is of the oil-in-water type and wherein said aqueous phase comprises 10% to 80% by weight of said food product.

25. The product of claim 16, wherein said aqueous phase comprises water.

26. The food product of claim 17, wherein said food product is a salad dressing.

27. The food product of claims 12, 14, 15 or 18 wherein said food product is stable when refrigerated.

28. The product of claim 1 without any heat treatment for the preparation of the food product.

29. The product of claim 1 wherein said transgenic plant is a crop plant.

30. The product of claim 1 wherein said transgenic plant is an oilseed plant.

31. The product of claim 1 wherein said transgenic plant is selected from the group consisting of: canola, corn, flax, and soybean.

32. The food product of claim 1 wherein said food product is selected from the group consisting of: baked goods, dairy products, spreads, margarines, sports products, nutrition bars and infant formulas.

33. An animal feed product containing stearidonic acid exhibiting extended product life wherein the stearidonic acid is derived from a transgenic plant and wherein said feed product can be utilized as animal feed for livestock and/or aquaculture.

26. The feed product of 33 wherein said livestock is cattle.

27. The feed product of 33 wherein said livestock is swine.

28. The feed product of 33 wherein said livestock is poultry.

29. The feed product of 33 wherein said livestock is a chicken.

30. The feed product of 33 wherein said aquaculture animal is salmon.

31. The feed product of 33 wherein said aquaculture animal is trout.

32. The feed product of 33 wherein said aquaculture animal is catfish.

33. The feed product of 33 wherein said aquaculture animal is tilapia.

34. The feed product of 33 wherein said aquaculture animal is a crustacean.

35. The feed product of 33 wherein said aquaculture animal is mackerel.

36. The product of claim 33 wherein said extended shelf-life comprises at least 5% longer shelf life than a corresponding concentration of EPA.

37. The product of claim 33 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

38. The product of claim 33 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

39. The product of claim 33 further exhibiting enhanced stability.

40. The product of claim 33 further comprising tocopherols.

41. The product of claim 40 further comprising at least about 5 ppm tocopherols.

42. The product of claim 33 further comprising wherein said stearidonic acid comprises from 0.1% to 80% of said feed product.

43. The product of claim 42 further comprising soy protein.

44. The product of claim 42 wherein said feed product comprises less than about 40% LA.

45. A product containing stearidonic acid exhibiting enhanced stability and extended shelf-life against flavor degradation wherein the stearidonic acid is derived from a transgenic plant and is utilized as a neutraceutical.

46. A neutraceutical containing stearidonic acid exhibiting extended shelf-life against flavor degradation wherein the stearidonic acid is derived from a transgenic plant.

47. The neutraceutical of claim 46 wherein said extended shelf-life comprises at least 5% longer shelf life than a corresponding concentration of EPA.

48. The neutraceutical of claim 46 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

49 The neutraceutical of claim 46 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

50. The neutraceutical of claim 46 further exhibiting enhanced stability.

51. The neutraceutical of claim 46 further comprising tocopherols.

52. The neutraceutical of claim 51 further comprising at least about 5 ppm tocopherols.

53. The neutraceutical of claim 46 further comprising wherein said stearidonic acid comprises from 0.1% to 80% of said feed product.

54. The neutraceutical of claim 53 further comprising soy protein.

55. The neutraceutical of claim 53 wherein said feed product comprises less than about 40% LA.

56. A method of making a product selected from the group consisting of a food product, a medical food product, a dietary supplement, an infant formula and a pharmaceutical wherein the product is supplemented with stearidonic acid.

57. The method of claim 56 further comprising decreasing the level of fatty acids other than stearidonic acid.

58. The method of claim 56 further comprising supplementing with tocopherols

59. The method of claim 56 wherein said stearidonic acid comprises from 0.1% to 80% of said food product.

60. The method of claim 59 further comprising soy protein.

61. The method of claim 56 wherein said product exhibits extended shelf life.

62. The method of claim 56 wherein said stearidonic acid is derived from a transgenic soybean.

63. The method of claim 59 wherein further comprising supplementing with fatty acids selected from the group of ALA, DHA, EPA, or oleic acid.

64. A method of supplementing an animal feed comprising combining stearidonic acid derived from a transgenic plant with feed nutrients.

65. A method according to claim 64 wherein the feed nutrients are selected from the group consisting of proteins, lipids, carbohydrates, vitamins, minerals, and nucleic acids.

66. The method of claim 64 further comprising supplementing with tocopherols.

67. The method of claim 64 wherein said stearidonic acid comprises from 0.1% to 80% of said food product.

68. The method of claim 67 further comprising soy protein.

69. The method of claim 64 wherein said product exhibits extended shelf life.

70. The method of claim 64 wherein said stearidonic acid is derived from a transgenic soybean.

71. A method for providing a human or animal a diet supplement enriched with stearidonic acid comprising a transgenic plant derived stearidonic acid in a form consumable or usable by humans or animals.

72. The product of claim 71 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

73. The product of claim 71 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

74. The product of claim 71 further exhibiting enhanced stability.

75. The product of claim 71 further comprising tocopherols.

76. The product of claim 75 further comprising at least about 5 ppm tocopherols.

77. The product of claim 71 wherein said stearidonic acid comprises from 0.1% to 80% of said diet supplement.

78. The product of claim 72 further comprising soy protein.

79. A food ingredient comprising a transgenic soybean oil, wherein said transgenic soybean oil comprises at least about 0.2 % SDA and at most about 40% LA based on the total weight of fatty acids or derivatives thereof in the composition, and wherein said soybean oil comprises at least about 400 ppm tocopherols.

80. The product of claim 79 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

81. The product of claim 79 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

82. The product of claim 79 further exhibiting enhanced stability.

83. The product of claim 79 further comprising tocopherols.

84. The product of claim 83 further comprising at least about 5 ppm tocopherols.

85. The product of claim 79 wherein said stearidonic acid comprises from 0.1% to 80% of said food product.

86. The product of claim 80 further comprising soy protein.

87. The food ingredient of claim 86 wherein the transgenic soybean oil comprises at least one stabilizing agent selected from the group consisting of citric acid, t-butyl hydroquinone, ascorbyl palmitate, propyl gallate, and combinations thereof.

88. The food ingredient of claim 86 wherein the transgenic soybean oil exhibits enhanced stability in comparison with a second transgenic soybean oil comprising a similar level of SDA, wherein the second transgenic soybean oil comprises no added stabilizers and comprises less than about 400 ppm tocopherols.

89. The food ingredient of claim 86 wherein said transgenic soybean oil further comprises of at least 10 % SDA and at most about 35% LA based on the total weight of fatty acids or derivatives thereof in the composition, and wherein said soybean oil comprises at least about 400 ppm tocopherols.

90. The food ingredient of claim 86 wherein said transgenic soybean oil exhibits extended shelf life in comparison with a corresponding concentration of DHA.

91. A transgenic plant oil wherein said transgenic plant oil comprises at least about 0.2 % SDA and less than about 10% LA based on the total weight of fatty acids or derivatives thereof in the composition, and wherein said oil comprises at least about 400 ppm tocopherols.

92. The product of claim 91 wherein said extended shelf-life comprises at least about 10% longer shelf life than a corresponding concentration of EPA.

93. The product of claim 91 wherein said extended shelf-life comprises at least about 15% longer shelf life than a corresponding concentration of EPA.

94. The product of claim 91 further exhibiting enhanced stability.

95. The product of claim 91 further comprising tocopherols.

96. The product of claim 95 further comprising at least about 5 ppm tocopherols.

97. The product of claim 92 wherein said stearidonic acid comprises from 0.1% to 80% of said food product.

98. The product of claim 92 further comprising soy protein.

99. The food ingredient of claim 91 wherein said transgenic soybean oil exhibits extended shelf life in comparison with a corresponding concentration of DHA.

100. The composition of claim 1, wherein the composition is selected from the food product is selected from the group consisting of:

a) soybean meal;

b) soyflour;

c) defatted soyflour;

d) soymilk;

e) spray-dried soymilk;

f) soy protein concentrate;

g) texturized soy protein concentrate;

h) hydrolyzed soy protein;

i) soy protein isolate; and,

j) spray-dried tofu.

101. The food product of claim 1, wherein the food product is a liquid beverage or dry beverage mix further comprising sucrose, calcium carbonate, flavor, salt, gum and vitamin.

Pathways of PUFA Metabolism

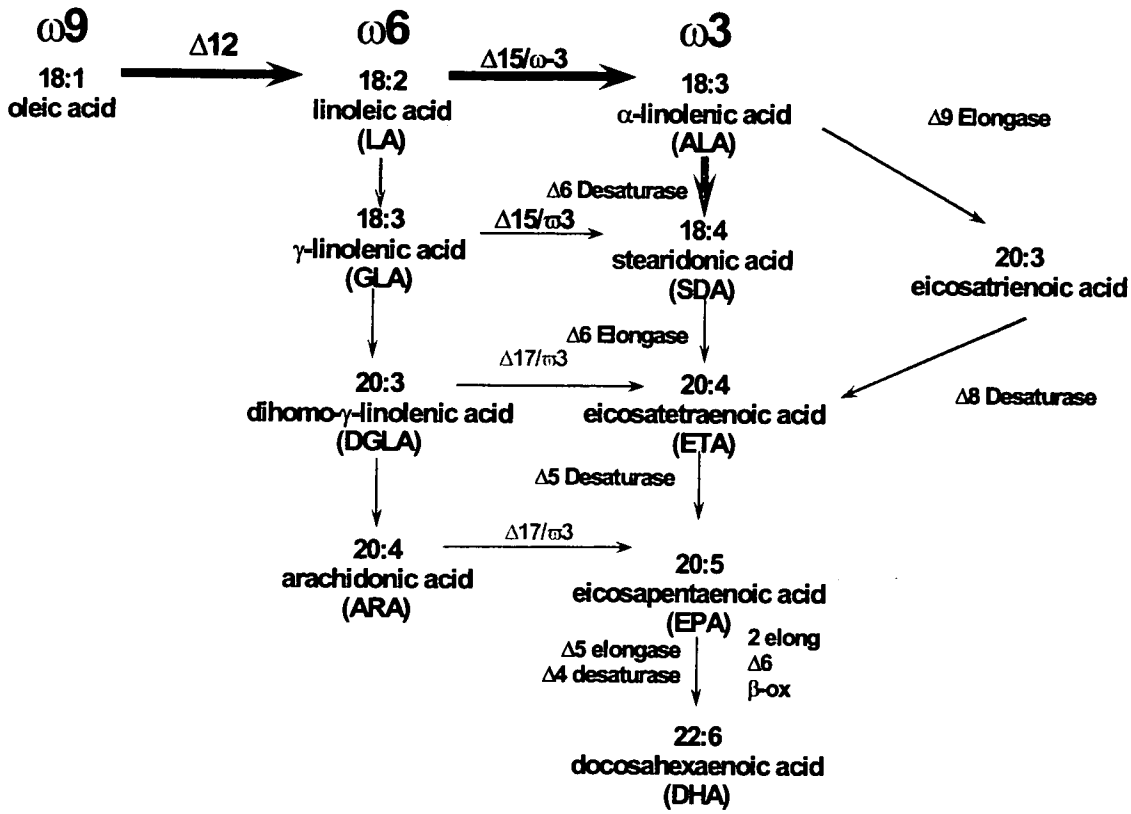


FIG. 1

FIG. 2a

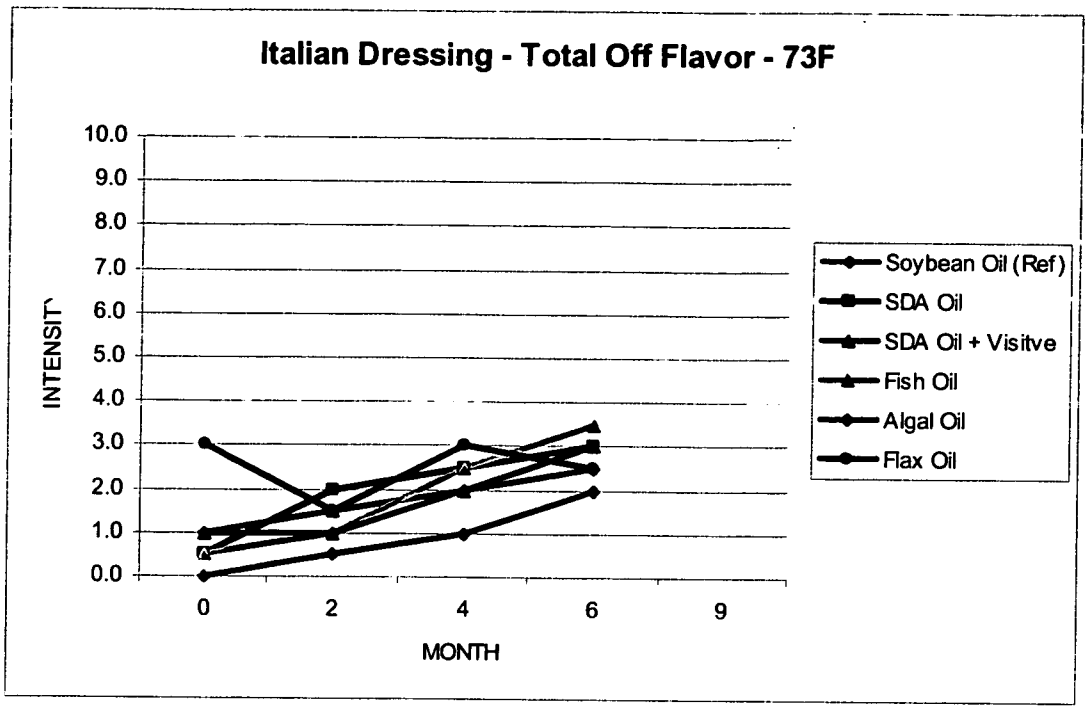

Italian Dressing - Total Off Flavor - 73F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 2b

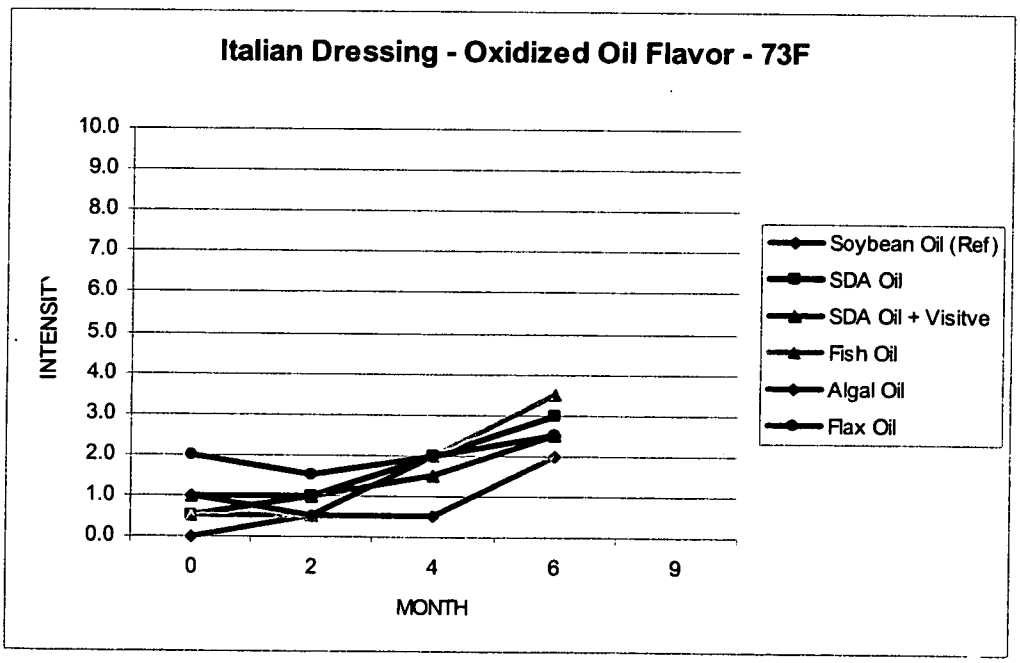

Italian Dressing - Oxidized Oil Flavor - 73F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG 2c

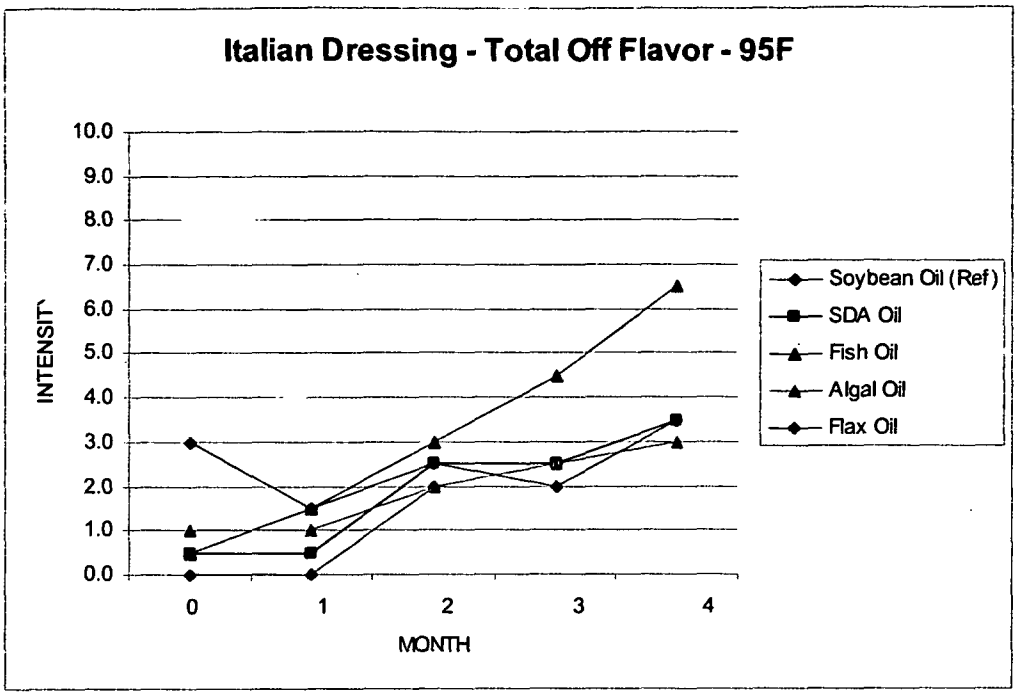

Italian Dressing - Total Off Flavor - 95F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
1
2
3
4
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 2d

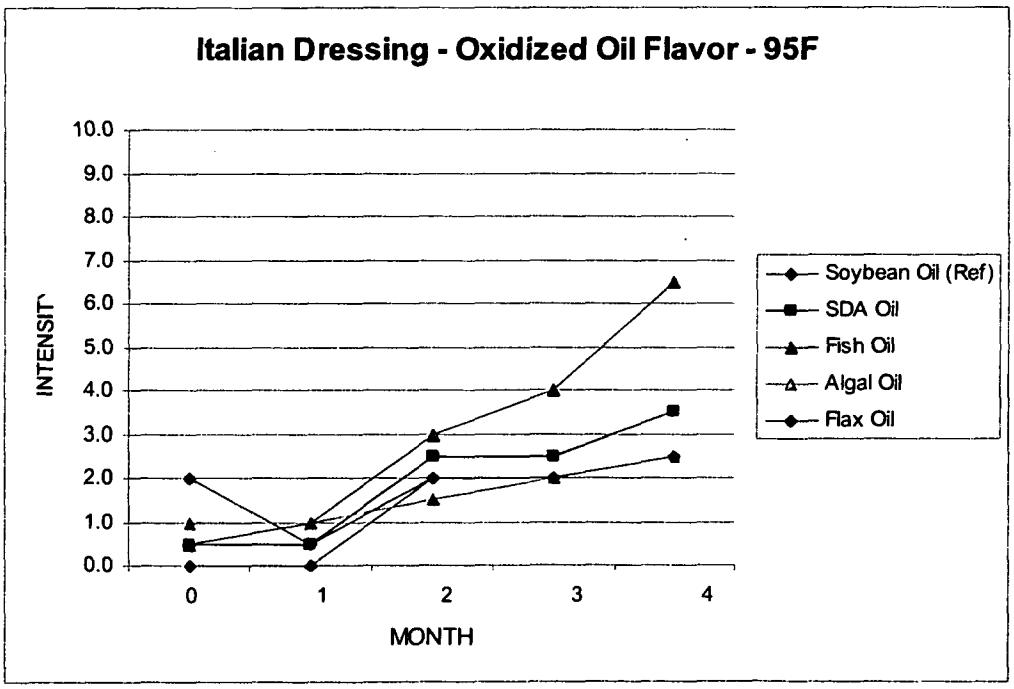

Italian Dressing - Oxidized Oil Flavor - 95F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
1
2
3
4
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG 2e

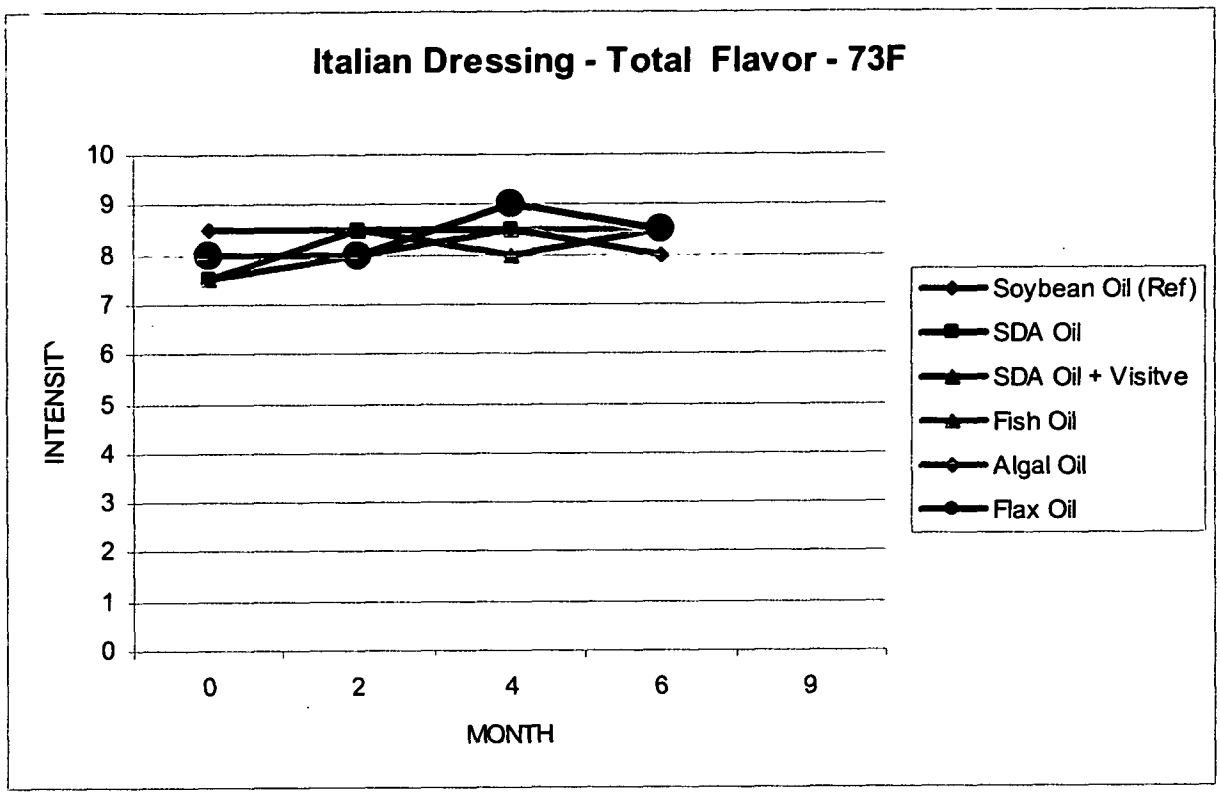

Italian Dressing - Total Flavor - 73F
INTENSITY
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 3a

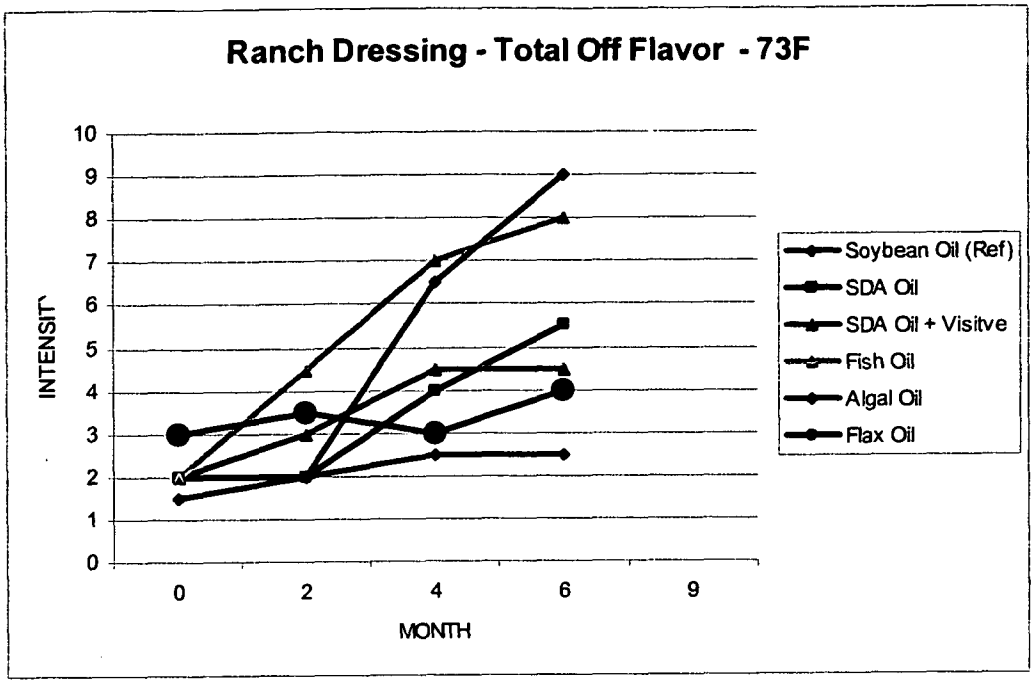

Ranch Dressing - Total Off Flavor - 73F
INTENSIT`
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 3b

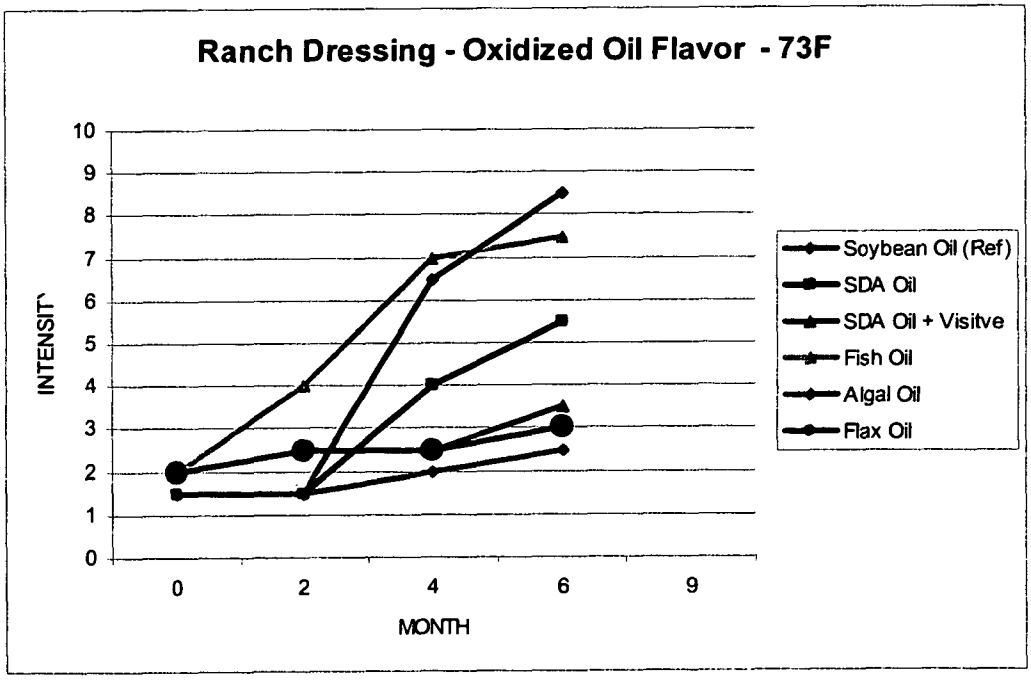

Ranch Dressing - Oxidized Oil Flavor - 73F
INTENSIT`
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 3c

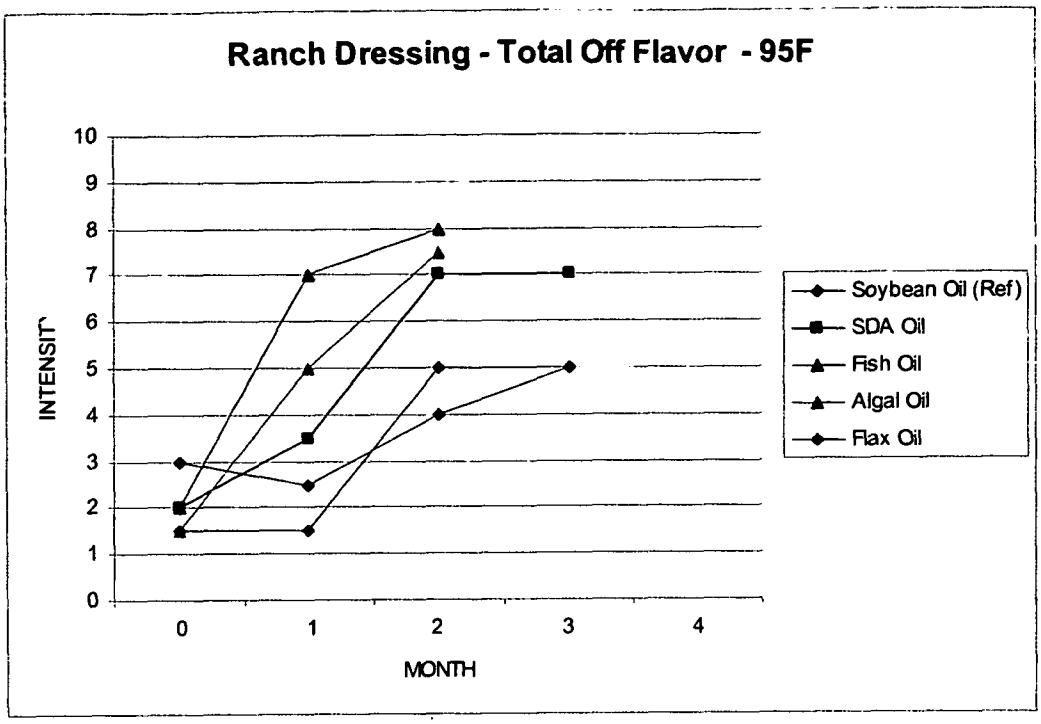

Ranch Dressing - Total Off Flavor - 95F
INTENSITY
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 3d

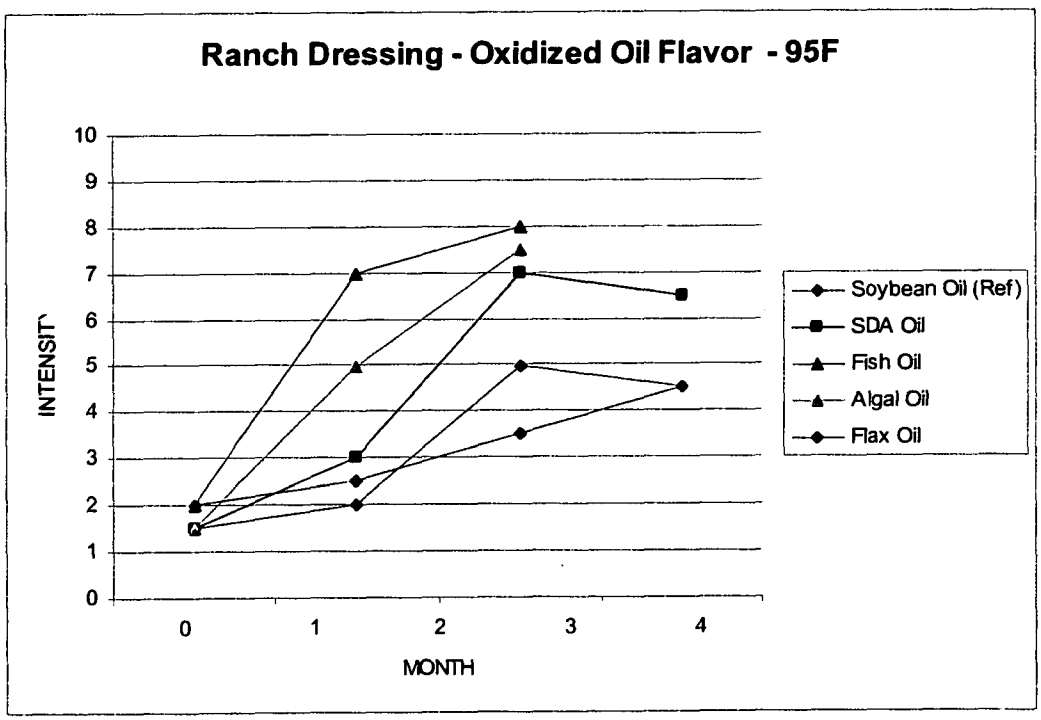

Ranch Dressing - Oxidized Oil Flavor - 95F
INTENSITY
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 3e

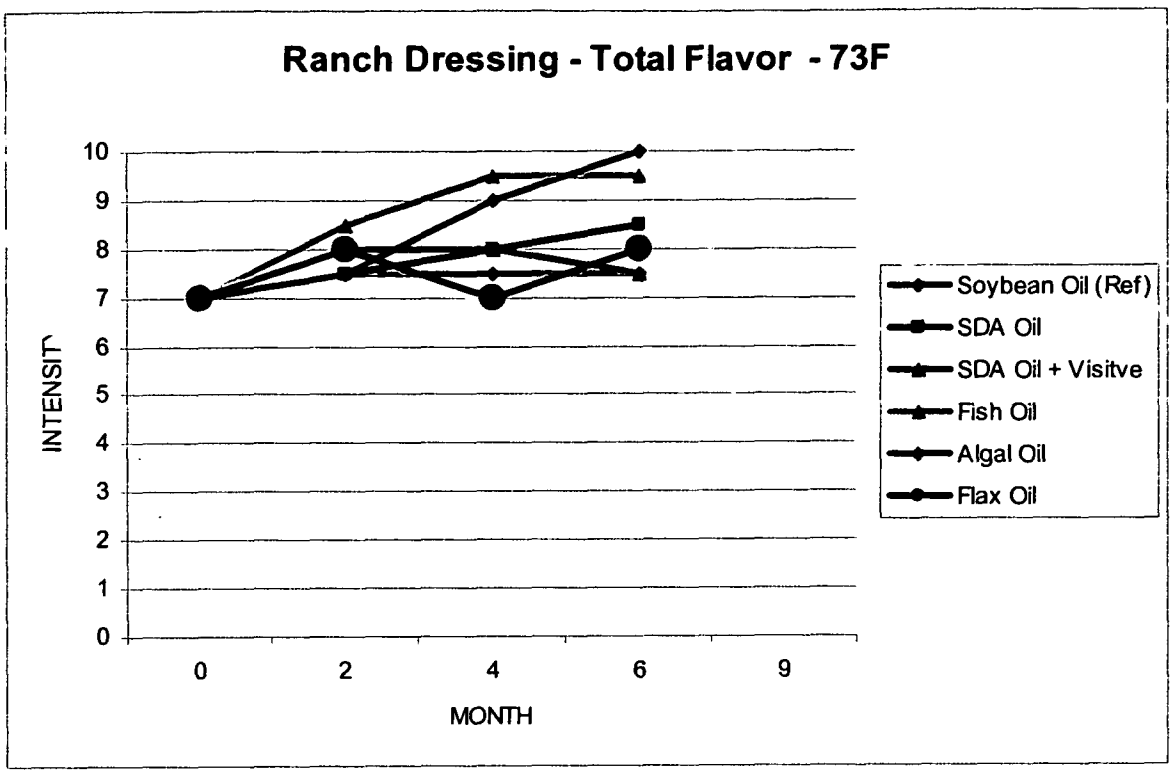

Ranch Dressing - Total Flavor - 73F
INTENSITY
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
9
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 4a

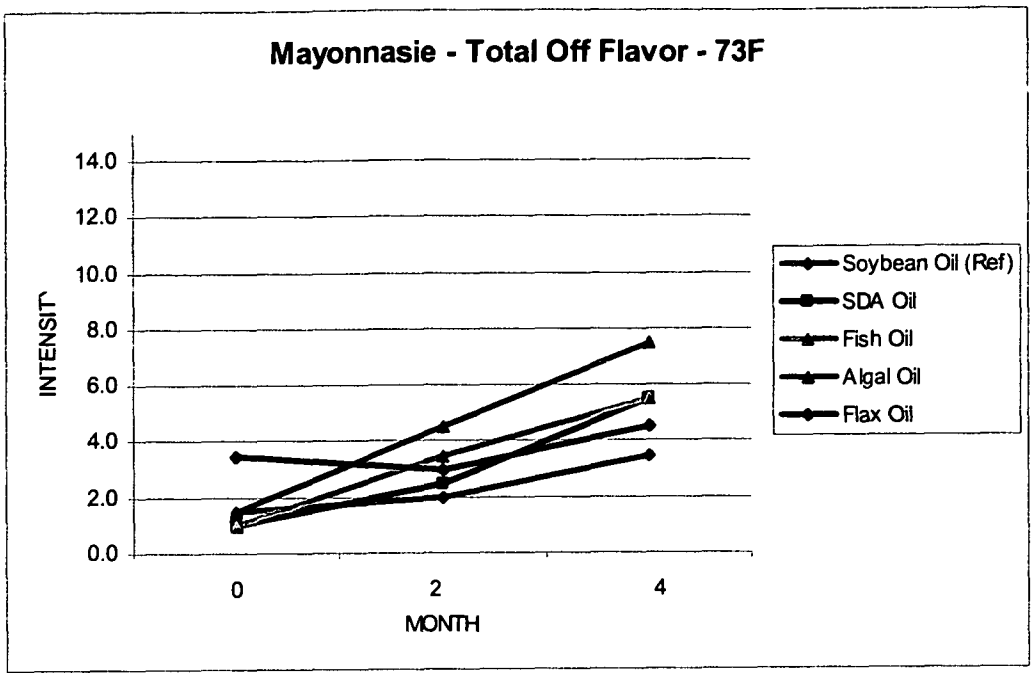

Mayonnasie - Total Off Flavor - 73F
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
INTENSIT
0
2
4
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 4b

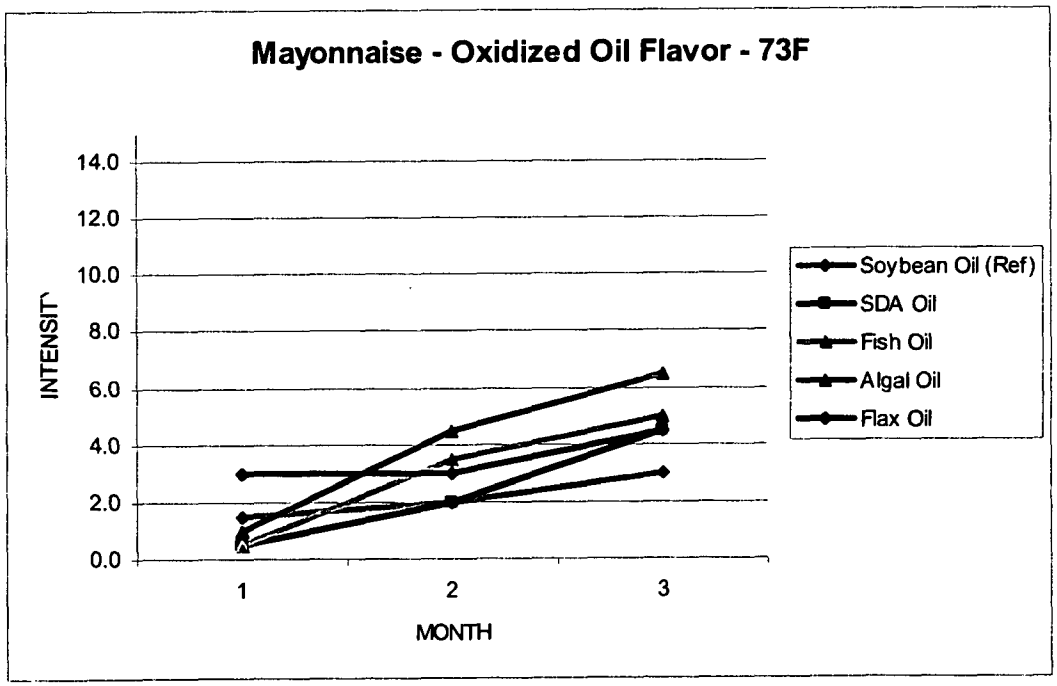

Mayonnaise - Oxidized Oil Flavor - 73F
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
INTENSIT
1
2
3
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 4c

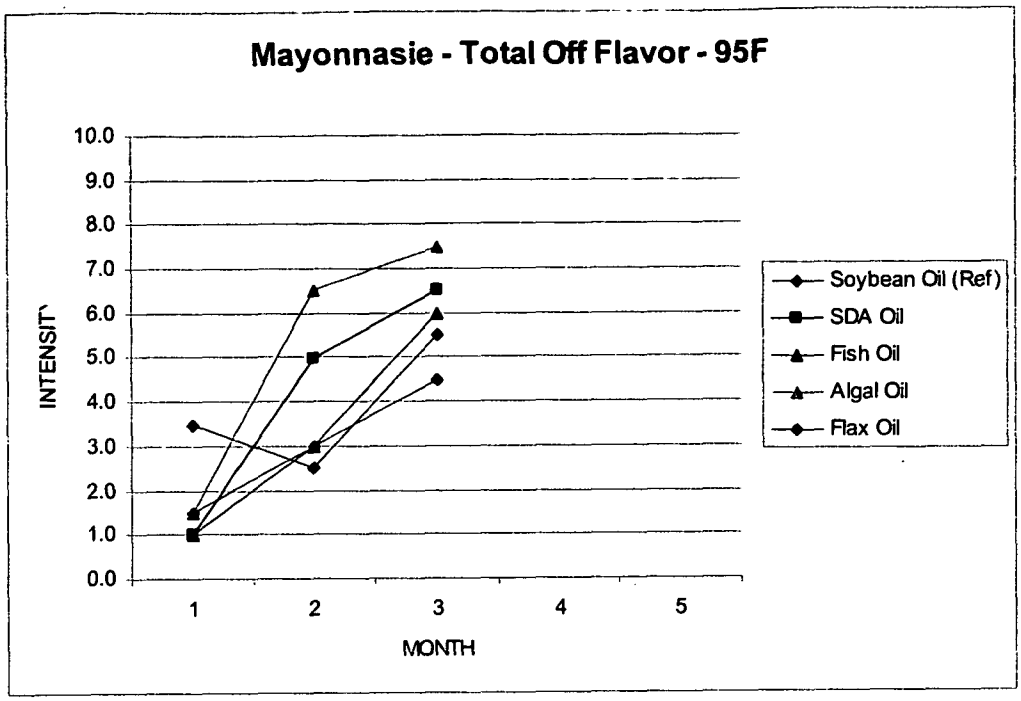

Mayonnasie - Total Off Flavor - 95F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1
2
3
4
5
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

FIG. 4d

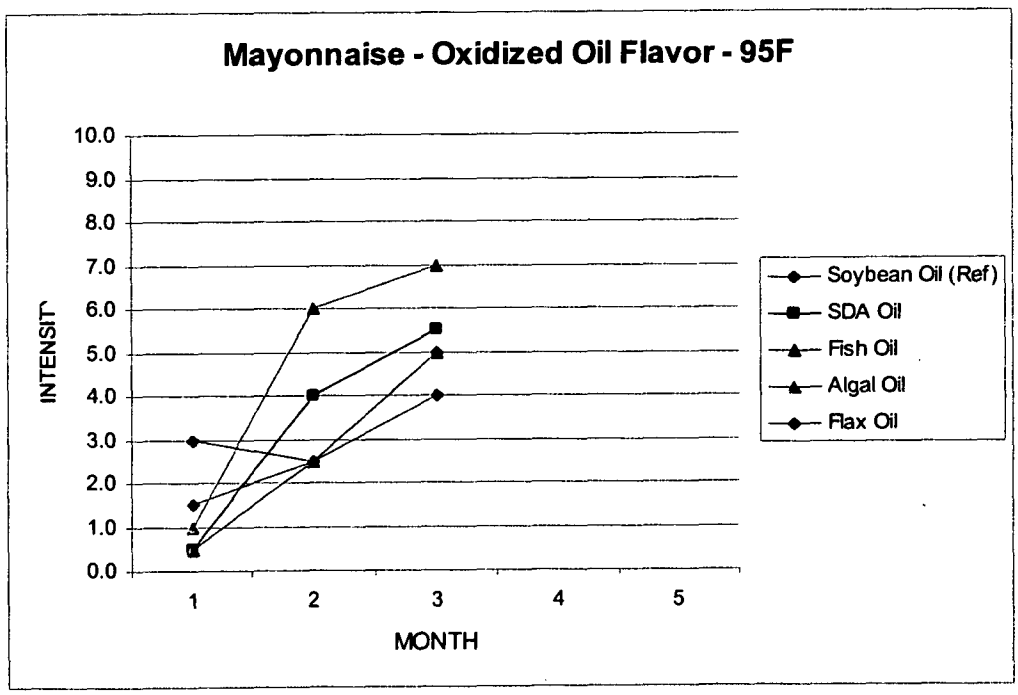

Mayonnaise - Oxidized Oil Flavor - 95F
INTENSITY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1
2
3
4
5
MONTH
Soybean Oil (Ref)
SDA Oil
Fish Oil
Algal Oil
Flax Oil

Fig. 4e

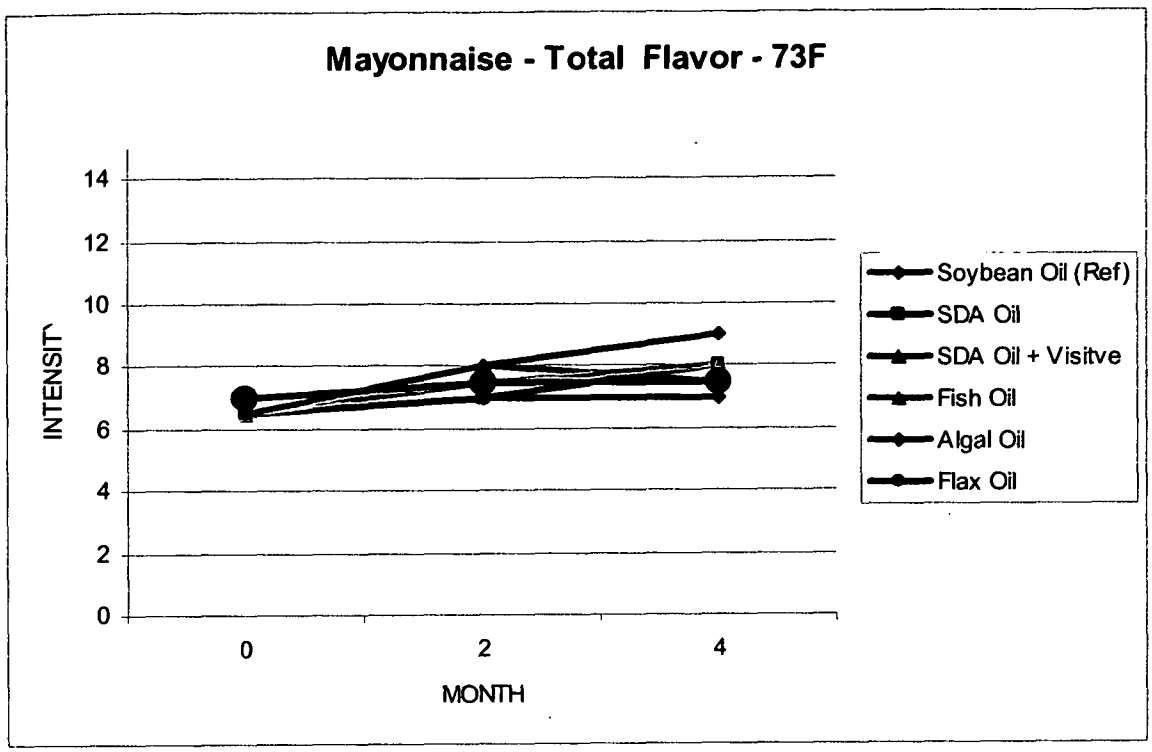

Mayonnaise - Total Flavor - 73F
INTENSITY
14
12
10
8
6
4
2
0
0
2
4
MONTH
Soybean Oil (Ref)
SDA Oil
SDA Oil + Visitve
Fish Oil
Algal Oil
Flax Oil

FIG. 5a

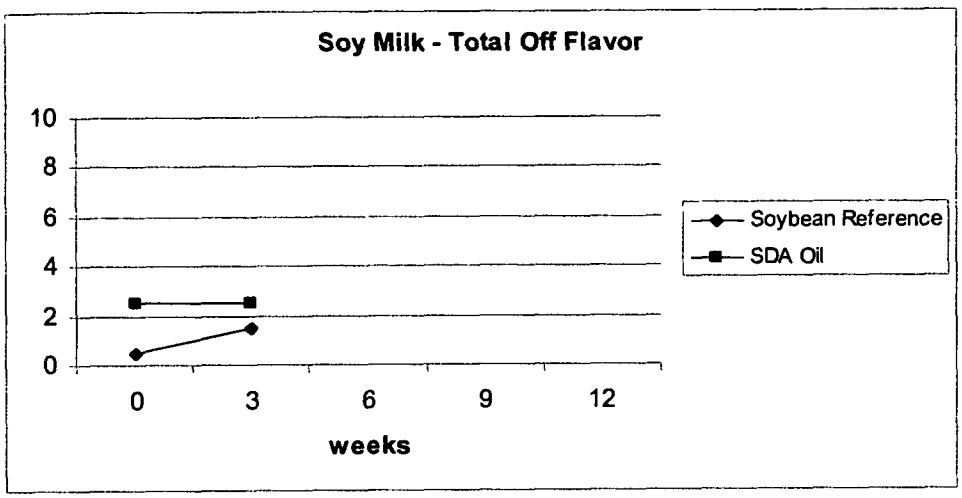

Soy Milk - Total Off Flavor
10
8
6
4
2
0
0
3
6
9
12
weeks
Soybean Reference
SDA Oil

FIG. 5b

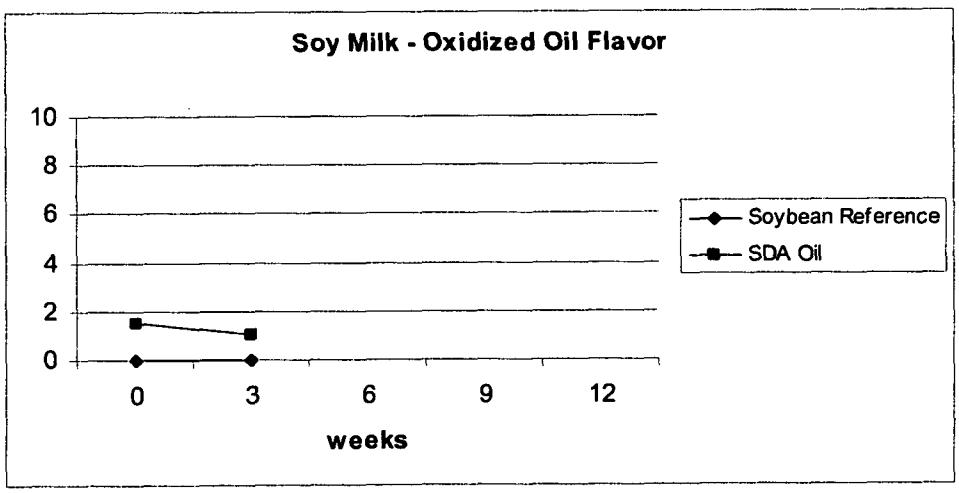

Soy Milk - Oxidized Oil Flavor
10
8
6
4
2
0
0
3
6
9
12
weeks
Soybean Reference
SDA Oil

FIG. 6a

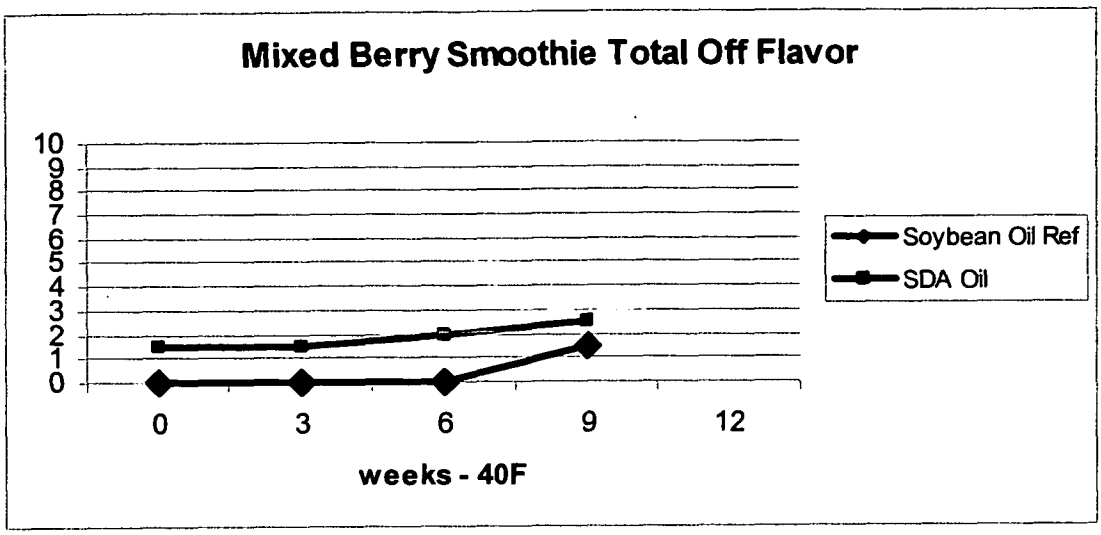

Mixed Berry Smoothie Total Off Flavor
10
9
8
7
6
5
4
3
2
1
0
0
3
6
9
12
weeks - 40F
Soybean Oil Ref
SDA Oil

FIG. 6b

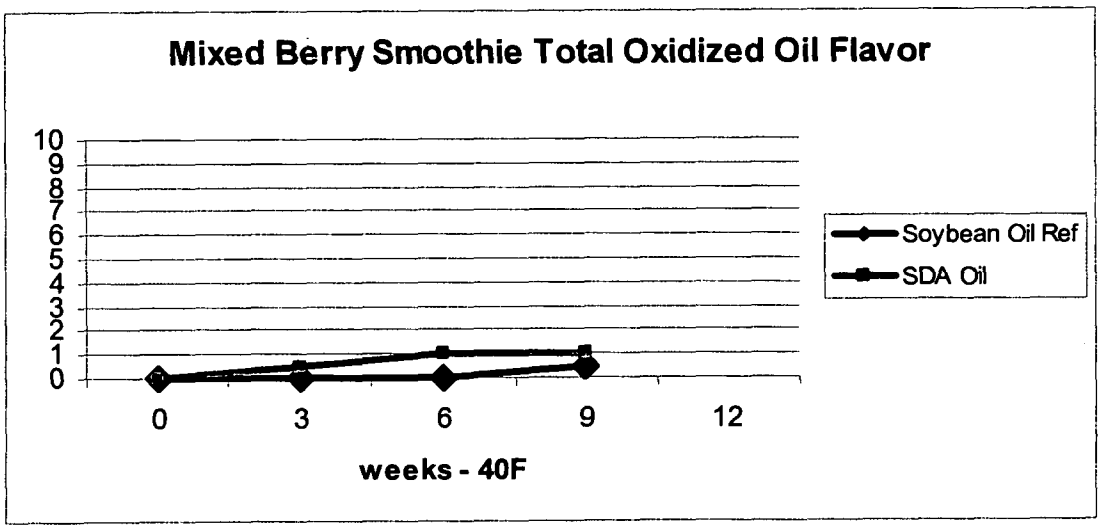
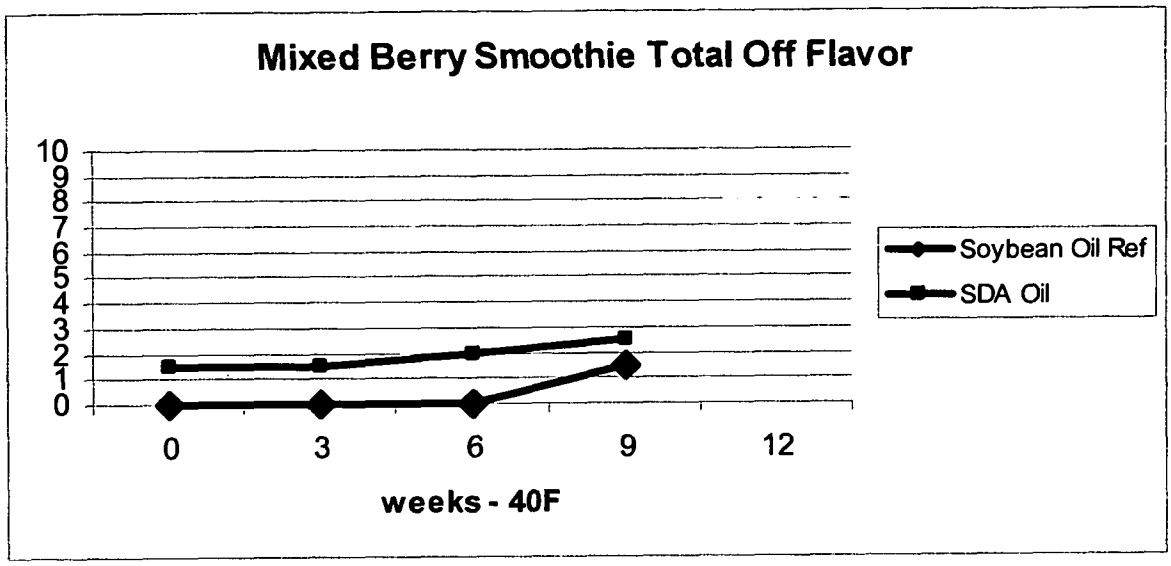

Mixed Berry Smoothie Total Oxidized Oil Flavor
10
9
8
7
6
5
4
3
2
1
0
0
3
6
9
12
weeks - 40F
Soybean Oil Ref
SDA Oil

FIG. 6c


Mixed Berry Smoothie Total Off Flavor
10
9
8
7
6
5
4
3
2
1
0
0
3
6
9
12
weeks - 40F
Soybean Oil Ref
SDA Oil

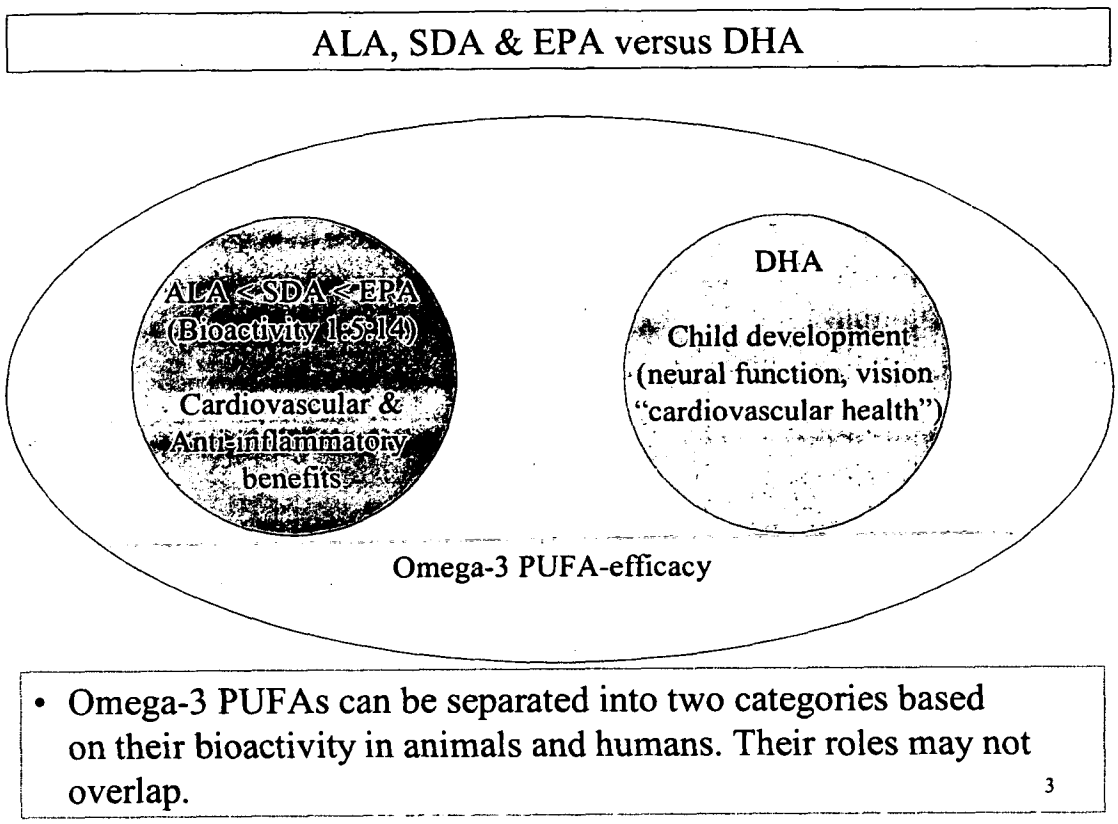

ALA, SDA & EPA versus DHA
ALA < SDA < EPA
(Bioactivity 1:5:14)
Cardiovascular &
Anti-inflammatory
benefits
DHA
Child development
(neural function, vision
"cardiovascular health")
Omega-3 PUFA-efficacy
• Omega-3 PUFAs can be separated into two categories based on their bioactivity in animals and humans. Their roles may not overlap.
3

FIG. 7

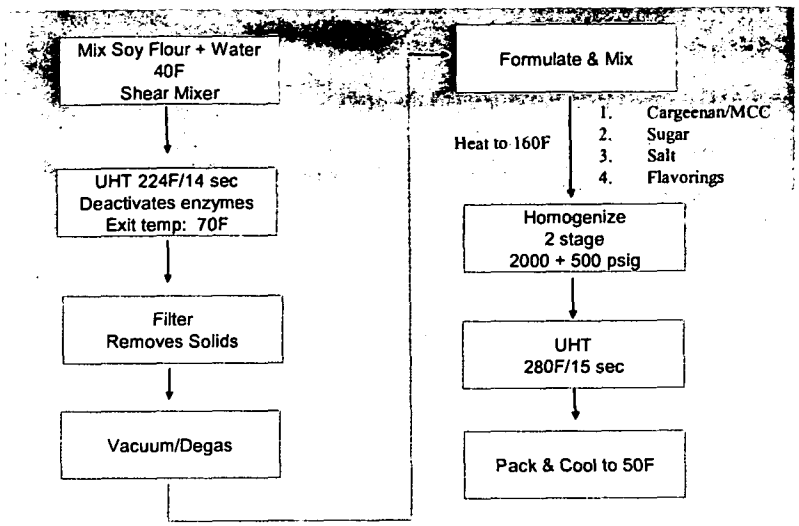

Mix Soy Flour + Water
40F
Shear Mixer
UHT 224F/14 sec
Deactivates enzymes
Exit temp: 70F
Filter
Removes Solids
Vacuum/Degas
Formulate & Mix
Heat to 160F
1. Cargeenan/MCC
2. Sugar
3. Salt
4. Flavorings
Homogenize
2 stage
2000 + 500 psig
UHT
280F/15 sec
Pack & Cool to 50F

FIG. 8

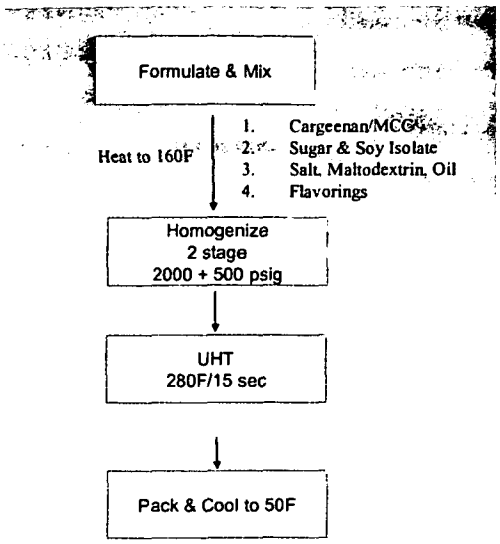

Formulate & Mix
Heat to 160F
1. Cargeenan/MCG
2. Sugar & Soy Isolate
3. Salt, Maltodextrin, Oil
4. Flavorings
Homogenize
2 stage
2000 + 500 psig
UHT
280F/15 sec
Pack & Cool to 50F

FIG. 9

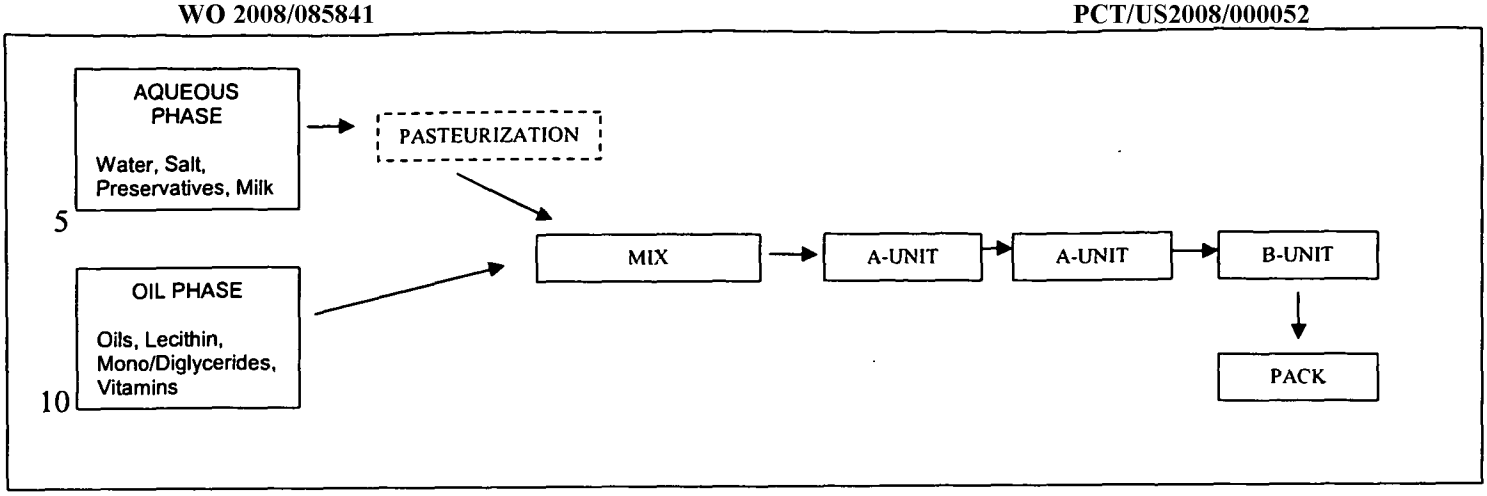
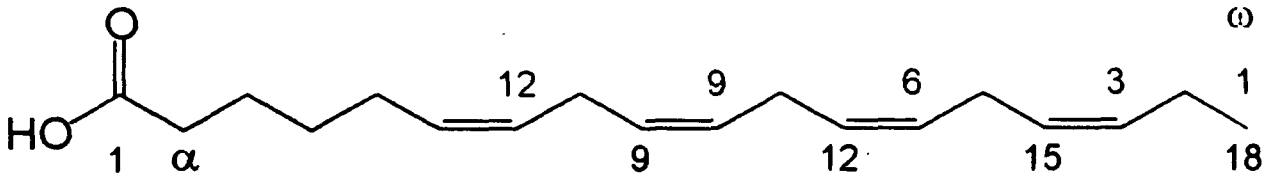

AQUEOUS PHASE
Water, Salt, Preservatives, Milk
PASTEURIZATION
OIL PHASE
Oils, Lecithin, Mono/Diglycerides, Vitamins
MIX
A-UNIT
A-UNIT
B-UNIT
PACK

FIG. 10



Stearidonic Acid [Chemical structure of stearidonic acid showing physiological (red) and chemical (blue) numbering conventions.]

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US08/00052

A. CLASSIFICATION OF SUBJECT MATTER
IPC: **A23D 9/00**(2006.01)

USPC: 426/601
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 426/601, 424/439

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
&	US 2006/0111578 A (ARHANCET et al) 25 May 2006 (25.05.2006)	
Y	EP 0,936,266 (JUNG et al) 13 February 1998 (13.02.1998), abstract	1-101
Y	US 2004/01726802 A (KINNEY et al) 02 September 2004 (02.09.2004),paragraphs 0029-0039, 0209-0218, 0378, Table 8.	1-101

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* *Special categories of cited documents:*

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
27 May 2008 (27.05.2008)

Date of mailing of the international search report
11 JUN 2008

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