Pizzey's Milling

SPECIALTY FLAXSEED INGREDIENTS

October 4, 2006

Valerie Frances
Executive Director
National Organic Standards Board
USDA-AMS-TM-NOP
Room 4008 – South Building, Ag Stop 0268
1400 Independence Ave., SW.
Washington, DC 2050-0020

Dear Madam,

Enclosed is a petition from Pizzey's Milling to have conventionally grown milled flaxseed recognized as an acceptable alternative to organically grown milled flaxseed particularly for use in processed foods.

This petition will cover aspects of shelf stability that are unique to flaxseed, as the major nutritional benefit of flaxseed is it's high content of Omega 3 fatty acids. As you can appreciate, Omega 3 is a very unstable fat, highly susceptible to oxidation (rancidity) and as such, must be handled in a different manner than other grain based ingredients.

You will notice as you read the petition, there are several attachments. Each attachment is meant to justify the comments and conclusions we have stated in the petition. Many of the attachments are charts of results of thorough research Pizzey's Milling has conducted over several years in an effort to understand the unique properties of flaxseed and how to maintain it's stability.

You will also find articles and letters from third parties that are meant to further your understanding of the petition. We recognize that there may be some parts of the information that are hard to follow. Please do not hesitate to call us for clarification on any of these points.

We can be reached at (800) 804-6433 at any time to answer any questions you may have.

Sincerely,

Linda Pizzey

Pizzey's Milling
Box 132, Main Street South
Angusville, MB R0J 0A0 Canada
Ph: (800) 804-6433 / Fax: (204) 773-2317
E-mail: info@pizzeys.com / Website: www.pizzeys.com

Note to Certified Operators

The following petition template may be used in petitioning ingredients to §205.606. The line items presented here are gleaned from the NOP website and NOSB recommendations. We have also made suggestions about additional documentation that should serve to facilitate the petition review process. Please be aware that the NOP may require other information not presented here at their discretion.

Petition of Nonorganically Produced Agricultural Products for Inclusion on the National List, § 205.606

ITEM A: Nonagricultural (nonorganic) substances allowed in or on processed products labeled as "organic" or "made with organic_____."

ITEM B

		Not Applicable
The substance's common name.	Milled Flaxseed	
The suppliers name, address and telephone number.	Pizzey's Milling, Box 132, Angusville, MB. Canada R0J 0A0 (204) 773-2575	
The intended or current use of the substance	Agricultural ingredient	
A list of the handling activities for which the substance will be used. The substance`s mode of action must be described (e.g. taste, color, texture, or other enhancement of finished product.)	For inclusion in baked goods, cereals, pastas, drinks, nutrition bars; as a method of delivering fiber, phytonutrients, and a vegetarian source of Omega 3 fatty acids.	
The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product. Petitioners with concerns for confidential business information can follow the guidelines in the Instructions for Submitting Confidential Business Information (CBI).	Flaxseed is a agricultural crop, needing no special processing other than cleaning to exclude any other plant materials, and dry milling to a flour texture.	
A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance. (i.e. any current allowance under certification agencies under commercial unavailability)		N/A
Information regarding EPA, FDA, and State regulatory authority registrations, including registration numbers.		N/A
The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of products that contains the petitioned substance.		
The substance's physical properties and chemical mode of action including (a)		NA – used as food

chemical interactions with other substances, especially substances used in organic production; (b) toxicity and environmental persistence; (c) environmental impacts from its use or manufacture; (d) effects on human health; and, (e) effects on soil organisms, crops, or livestock.		ingredient
Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies.	See Attached sheet	
Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List.	None Available	

A "Petition Justification Statement," which provides justification for use of nonorganically, produced agricultural ingredients in organic products.

The petition must include current industry information regarding availability of and history of non-availability of an organic form of the product, and all factors that may present a challenge to a consistent organic supply.

Documentation to include:

- Specific details of efforts made to obtain an organic source and the outcome of that effort.
- Specific the essential qualities required for the product to be suitable, e.g., liquid vs. powder, viscosity, color, flavor profile, etc.
- Specific organic alternatives that have been evaluated and reasons for unacceptability.
- Any other supporting documentation for your request for inclusion onto §205.606 (i.e. letter of support from other affected parties and interested parties)

Pizzey's Milling
SPECIALTY FLAXSEED INGREDIENTS

Material Safety Data Sheet

Section I: Manufacturer/Product Identification
Trade Name: ChoiceGrad Flaxseed (Brown and Golden)
Use: Human Food, Nutraceutical
Manufacturer: Pizzey's Milling
Address: Box 132, Main Street South, Angusville, Manitoba, Canada, R0J 0A0
Tel: 1-204-773-2575
Fax: 1-204-773-2317
Issue # 002

Section II: Physical Data
Physical State: Granules
Color: Medium Brown/Golden, uniform color
Texture: Free flowing granules

Section III: Fire and Explosion Hazard
Fire fighting Procedures: Wear self-contained breathing apparatus and protective clothing. Avoid any method which will create dust clouds. Use water fog or water spray.
Hazardous combustion products: Carbon monoxide and carbon dioxide on combustion
Explosion Data: powdered material may form an explosive dust-air mixture.
Flash point and method of determination: None

Section IV: Reactivity
Chemical Stability : Very stable.
Incompatibility (materials to avoid): Strong Oxidizing Agents.
Hazardous Polymerization: None

Section V: Health Hazard Data
Threshold Limit Value: Not determined
Other: Not considered hazardous for inhalation and ingestion at normal use.

Section VI: First Aid
Eye Contact: May cause irritation. Immediately flush with water for 15 minutes. If irritation persists, seek medical attention.
Skin Contact: If irritation occurs, wash area with soap and water and avoid further contact. If symptoms persist seek medical attention.
Ingestion: Ingestion of large quantities may cause gastro-intestinal discomfort including flatulence. In cases of persistent or severe symptoms seek medical attention.

Section VII: Spill or Leak Procedures
Clean-up method: vacuum or sweep material and place in disposal container. Avoid procedures which cause a dust cloud to be formed.
Waste disposal method: Place in a disposal container. Observe all local, provincial/state and federal environmental regulations.

Section VIII: Special Protection Information
Eye Protection: Dust resistant safety goggles
Skin Protection: gloves
Respiratory Protection: NIOSH/MSHA Approved dust mask.
Other protective equipment: Eye baths and emergency shower.

Section IX: Storage and Handling
Store in multi-walled poly lined paper bags at 22°C/71°F. Powdered material may form a dust-air mixture. Minimize dust generation and accumulation during use. To ensure best quality, use product within one year of manufacture date.

Section X: Additional Information
The information contained herein is based upon publicly available information and is considered true and accurate. Pizzey's makes no warranties express or implied as to the accuracy or adequacy of this information. This information is offered solely for the users consideration, investigation and verification. It is the users responsibility whether any use of this information and data is in accordance with applicable federal, provincial/state or local laws and regulations.

Box 132 /Main Street South
Angusville, MB ROJ OAO CANADA
Tel. (800) 804 – 6433 / Fax. (204) 773 – 2317
Email: technical@pizzeys.com / website: www.pizzeys.com

Petition Justification Statement.

This petition centers around two points.

1. There is a current shortage of Omega-3 in the western diet. There are two primary sources of Omega 3, those being fish and flaxseed. Flaxseed is the only viable option for organic and vegetarian consumers.
2. Shelf stable products are critical for the food industry. Milled flaxseed is much more prone to rancidity than whole flaxseed. For this reason, only high quality organic flaxseed can be used if it is to be milled (ground).
3. There is a critical shortage of organically grown flaxseed *that is suitable for milling quality flaxseed.*

It is therefore important to consider alternate supply options for those who wish to offer organic processed foods to the retail market.

Background : What is flaxseed?

Flaxseed is an oilseed crop grown in Western Canada and the northern US states of North Dakota and Montana. Its primary use over the past 50 years has been in the paints and coatings industry, where it's been prized for its highly unsaturated oil content, which makes it prone to oxidation, thereby decreasing its drying time.

This same highly unsaturated oil, Omega 3 fatty acid, is what gives it its nutritional value. Therefore, it is vital that the nutritional value be protected through protection of the oil from oxidation. While whole flaxseed is very stable, and an ample supply of organic whole flaxseed is available, milled flaxseed (defined as whole flaxseed that has been ground into very fine particles) can be susceptible to rancidity. Therefore, this petition is with regard to the use of conventional *milled flaxseed only.*

How important is Omega 3 to the average American Citizen?

Increasing the consumption of Omega 3 fatty acids in the American diet is so important that in May of 2003, the White House issued a letter to the Departments of Health and Human Services (HHS) and Agriculture (USDA) to revise the nation's dietary guidelines to include new information that omega-3 fatty acids may reduce the risk of coronary heart disease. "Given the significant potential improvement in public health suggested by current evidence, we urge you to consider revising the Dietary Guidelines and Food Guide Pyramid to emphasize the benefits of reducing foods high in trans fatty acids and increasing consumption of foods rich in omega-3 fatty acid" reads the directive. A copy of the letter is attached.
According to a paper written by Artemis Simopoulos and published in 1999 in the American Journal of Clinical Nutrition, humans evolved on an equal balance of the two essential fats, Omega-3 and Omega-6. "*The current Western diet is very high in n-6 fatty acids (the ratio of n-6 to n-3 fatty acids is 20-30:1)*" (n-3 refers to Omega-3, and n-6 refers to Omega-6). Further, she comments "*Studies indicate that a high intake of n-6*

fatty acids shifts the physiologic state to one that is prothrombotic and proaggregatory, characterized by increases in blood viscosity, vasospasm, and vasoconstriction and decreases in bleeding time, n-3 fatty acids, however, have antiinflammatory, antithrombotic, antiarrhythmic, hypolipidemic, and vasodilatory properties. These beneficial effects of n-3 fatty acids have been shown in the secondary prevention of coronary heart disease, hypertension, type 2 diabetes, and in some patients with renal disease, rheumatoid arthritis, ulcerative colitis, Crohn disease, and chronic obstructive pulmonary disease." Am J Clin Nutri 199;Artemis P. Simopoulos.

Why is quality so important in Flaxseed?

In 2002, Pizzey's published a paper describing the affect of dark, discolored seeds on the oxidative stability of flaxseed. This work was presented at AOAC annual meeting in Montreal, Canada. A copy of the work is attached to this document. In summary, the document noted the following. "Lipid stability assays reveal a significant increase in levels of undesirable oxidation products as the percent dark seeds increase. The cause of the dark seed color is not well understood but it may have something to do with the growing season conditions. Dark seed color may indicate some breakdown in the natural anti-oxidant activity of the seed. Sample #1 in chart 2 reveals much lower levels of oxidation products in the milled sample. If the assay values are elevated in the fresh milled product, stability of the flaxseed will be even more pronounced following storage.",Effect of Seed Selection and Processing on Stability of Milled Flaxseed, G.R.Pizzey and T. Luba. (see attachment A). It should be noted that Samples 2 and 3 in this work were organic samples.

Pizzey's Milling has found that through the selection of very high quality seed (less than 5% darker or discolored seeds), the seeds can be successfully milled and protected from oxidation for a period of at least two years.

Why is oxidative stability in Flaxseed so important?

The stability of the flaxseed is directly related to its health safety and nutritional value. Flaxseed that is subject to oxidation will contain higher levels of free fatty acids, trans-fatty acids, and a lower component of Omega 3. A higher concentration of peroxides and free fatty acids can have negative affects on human nutrition. In a recent article on line the following comment was found. "*Oxidized oils and fats of other types have been shown to increase the risk of atherosclerosis and thrombosis in a small number of human trials. These effects have been seen with relatively low levels of oxidized product – similar to a regular dose of fish oil capsules*," said scientist Rufus Turner, *www.nutraingredients.com, October 20, 2005*. (see attachment B for a copy of this article) As well as the risk of a detrimental affect on human nutrition, it will have an affect on the keeping quality of the food. Please note attached paper entitled *"The*

Importance of Peroxide Value in Assessing Food Quality and Food Safety", JAOCS, Vol 83, no. 5 (2006) (see attachment C for this paper)
In comparisons of samples of organic flaxseed in our lab, we have found in as little as three months of storage, the organic flaxseed we tested had significantly higher peroxide values, free fatty acid values, malonaldehyde values and alkenal values. (See attachment D) Since all of the research showing nutritional benefits of flaxseed that has been done to date has been done on high quality seed, we would be reluctant to make the assumption that lower quality seed, such as the organic seed we have tested, would give the same nutritional benefits.

Why is Stability important in Specialty Processed Foods?

Flaxseed fits into the specialty ingredient market and is being used successfully now in many processed products such as hot cereals, pastas, and breads. Specialty processed foods such as cereals, mixes, and pastas need at least an 18 month shelf life. Therefore, it is essential that the ingredients have a very long shelf life. Most of these specialty processed foods do not have artificial preservatives to prolong the life of the ingredients, but still must preserve the integrity of the nutritional content. This is why specialty product retailers such as Whole Foods and Wild Oats have stringent ingredient standards that must be adhered to. (Please see the attached letter from Hodgson Mill for further information on this topic. attachment E).

When flaxseed is improperly processed and milled, the processed food it is incorporated into will exhibit a "painty" smell. This is because of the oxidation or "drying" of the omega 3 oils. One product that exhibited this smell was Nature's Path Plus Flax Organic Cereal. Upon testing of the Nature's Path Plus Flax Organic Cereal, it was found that the omega 3 fatty acid measured in the cereal was less that half that declared on the label (label declares 500 mg omega 3 per serving). This is likely due to the depletion of the omega 3 over time through the oxidation process. Please see attached results of testing on this product for actual results of this testing that support this conclusion. (attachment F)

How is stability measured?

One way of testing stability is to measure the levels of fatty acids over time, to determine if there are any changes. A second way is to measure four indicators of stability. Pizzey's Milling uses the Saftest MAPP System, a micro-analytical system that measures primary and secondary oxidation in food products. Four units of measurement are used, peroxides (pv), free fatty acids (ffa), malonaldehydes, and alkenals. The limits we have established for each of these is PV, 5meg/kg of oil; FFA's 2% of oil; Malonaldehyde, 30nmol/ml of sample; and Alkenals, 300 nmol/ml of sample. Once these limits have been reached or exceeded, the product would exhibit a "painty" odor, and/or the fatty acids would have degenerated to the point where they would not be measured as Omega-3 fatty acids.

Why does Organic Flaxseed tend to be less stable?

Flaxseed, as a field crop, is known to be less competitive than other crops and therefore more susceptible to the harmful affects of volunteer grains and weeds. This competition in the field for nutrients and for moisture puts the flaxseed plant under stress. This stress is a contributing factor to the higher incidence of darker, damaged seeds. Most organic farmers will delay seeding in an effort to cultivate out any volunteer grain and weeds before planting the crop. This delayed seeding subjects the flaxseed crop to a higher risk of frost in the fall, and a delayed harvest, which often can lead to wetter, cooler conditions during harvesting of the grain. All of these factors will increase the risk of higher dark seed counts, which then lead to decreased stability of the oil content.

Availability of good quality, shelf stable organic flaxseed.

Pizzey's has tested organic flaxseed samples from four sources. Of these, three samples exhibited high peroxide values and/or high alkenal values. Only one sample had acceptable levels of all four measurements. This means that 75% of the product that was available showed unacceptable levels of all four measurements of oxidation. Results of this testing that support this conclusion are attached. (see attachment D & G)

Shelf life....an important concern.

Many organic milled flaxseeds are sold in vacuum sealed, nitrogen flushed packaging. The packages also call for refrigeration once the package has been opened. This makes it impractical for use in a processed food, as the product once it has been opened and used, cannot always be refrigerated. Most processed foods, such as cereals, mixes, and pastas are not refrigerated in the stores.

Limited supply....growing demand.

In an article published at www.nutraingredients-usa.com July 5, 2006, the following comment was made "Indeed, over half of the OTA (Organic Trade Association) survey respondents reported that a lack of dependable supply of organic raw material has restricted their company from generating more sales of organic products."

In a recent survey by BNP Media Market Research, 45% of respondents listed inadequate sources of ingredient supply as being one of the top three greatest challenges in developing organic food products.

Is Conventionally grown Flaxseed safe?

Flaxseed is a very natural ingredient, with little or no pesticide and fugicide usage in the growing season. Herbicides are only used in the early growing stages, and multiple residue analysis on Pizzey's conventional flaxseed has shown no chemical residue.

Options for using Conventional Flaxseed in Organic Products.

There are currently processed food products on the market that are 95% organic raw material, and that use conventional flaxseed at less than 5% of the product. Of these, Pizzey's has tested Hodgson Mills Organic Spagetti with flaxseed and the results show that over the year that the product was tested, it performed very well when compared to a whole wheat pasta. (see attachment H for actual results of the testing conducted on this product).

We wholeheartedly endorse the concept of organically grown crops for human consumption, and if it were possible, we would endorse the use of organic flaxseed. However, it has been our experience to date that in most cases, certified organic flaxseed does not meet the high quality standards we find are necessary for milling flaxseed. The difficulty in producing organic products containing omega 3 will be compounded if an ingredient such as highest quality organic flaxseed becomes unavailable in the market due to the difficulty in growing high quality organic flaxseed. This will deny vegetarians who rely on organic food, the availability of processed foods that contain omega 3 fatty acids, as foods that incorporate milled flaxseed are the only sources of omega 3 fatty acids for those on an organic, vegetarian diet.

In summary, we feel it is important to consider conventionally grown flaxseed as an alternative to organically grown flaxseed for use in milling. The following are points to consider.

1. **Flaxseed is an excellent source of Omega-3, a nutrient that the American diet is critically short of.**
2. **To be useful and to deliver the health benefits safely to the consumer, flaxseed must be of highest quality.**
3. **75% of the organic flaxseed we have tested would not be of the quality necessary to be used in processed specialty foods that require a long shelf life.**
4. **One of the primary restraints in the growth of the organic industry according to food processors is the availability of good quality organic ingredients.**
5. **Conventionally grown flaxseed is a crop that does not require excessive amounts of chemical.**
6. **Multiple residue analysis testing has not shown any evidence of chemical residue on conventional flaxseed used in the food industry.**

We believe the potential benefits to the consumer in allowing this petition are many. There are limited other options for those who are vegetarian and wish to purchase only organic products.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

FOR IMMEDIATE RELEASE
May 28, 2003

2003-13

To Save Lives, OMB Urges Revising Dietary Guidelines

New information on reducing heart disease risk encouraged

Washington, DC – OMB today urged the Departments of Health and Human Services (HHS) and Agriculture (USDA) to revise the nation's dietary guidelines to include new information that omega-3 fatty acids may reduce the risk of coronary heart disease (CHD), while *trans* fatty acids may increase the risk of CHD. Since CHD kills over 500,000 Americans each year, even a small improvement in dietary habits could save thousands of lives. A copy of the letter sent to HHS and USDA follows this release.

"Health researchers have found that Americans can significantly reduce the risk of heart disease with a modest change in their diets. The government should make this life-saving information as widely available as possible," said Dr. John Graham, Administrator of OMB's Office of Information and Regulatory Affairs (OIRA).

In the letter, OMB recommends that HHS and USDA modify the *Dietary Guidelines* and *Food Guide Pyramid,* the cornerstones of the government's nutritional information. The *Dietary Guidelines* affect the content of more than 25 million school lunches, while the *Food Guide Pyramid* appears on many food products, providing consumers with an outline of what to eat each day. Revised every five years, the *Dietary Guidelines* are scheduled to be updated in 2005. The *Food Guide Pyramid* has not been updated since 1992.

According to recent articles in the *American Journal of Clinical Nutrition*, following the current *Dietary Guidelines* only reduces slightly the risk of cardiovascular diseases such as CHD. In the letter, OMB recommends that HHS and USDA take into account new evidence on the benefits of omega-3 fatty acids and risks of *trans* fatty acids when revising the nation's dietary guidelines. For example, the American Heart Association recently revised its dietary guidelines to recommend consuming fish, which is high in omega-3 fatty acids, twice weekly to prevent CHD.

The letter continues the Bush Administration's efforts to help Americans lead longer, better, and healthier lives. The President's 2004 budget proposes a $100 million increase for combating diabetes, reducing rates of obesity, and alleviating the health complications due to asthma. In 2002, the President launched the HealthierUS Initiative, which promotes physical fitness and sports participation among all Americans, with an emphasis on children and adolescents.

OMB's recommendations come in the form of a "prompt" letter, a tool introduced by the Bush Administration. While not forcing agency action, prompt letters alert agencies to issues that OMB considers worthy of priority status. All "prompt" letters, as well as agency responses, can be viewed at www.omb.gov.

-- letter follows --

May 27, 2003

Honorable Claude A. Allen
Deputy Secretary
Department of Health and
Human Services
Washington, D.C. 20201

Honorable James R. Moseley
Deputy Secretary
Department of Agriculture
Washington, D.C. 20250

Dear Mr. Allen and Mr. Moseley:

The purpose of this letter is to request that the Department of Agriculture (USDA) and the Department of Health and Human Services (HHS) further incorporate the large body of recent public health evidence linking food consumption patterns to health and disease as the *Dietary Guidelines for Americans* is revised for its scheduled 2005 release and to update the *Food Guide Pyramid,* which was introduced in 1992.

Secretary Thompson has made it clear that both childhood overweight and adult obesity and the associated chronic health problems such as heart disease are widespread in the United States, and have become one of our nation's most important public health problems. However, recent studies suggest that adherence to the *Dietary Guidelines* has only modest impact on the risk of cardiovascular disease and no significant impact on other chronic diseases such as cancer. OMB believes that these and other studies should play a prominent role as USDA and HHS revise the guidelines. Given the wide reach of the federal nutrition guidelines, we believe that good nutrition habits fostered by improved information on the links between diet and health will have a significant health impact, especially in reducing heart disease. Coronary heart disease (CHD) is our nation's largest cause of premature death for both men and women, killing over 500,000 Americans each year. Even a modest improvement in dietary habits may lead to significant reductions in the number of premature deaths from CHD.

We recognize that the 2000 *Dietary Guidelines* made some changes in recommendations that may reduce cardiovascular risk. We nonetheless urge you to reconsider all available nutritional and medical evidence as you develop the new guidelines. For example, in a previous letter addressed to HHS, we encouraged the Food and Drug Administration (FDA) to finalize a rule to require a product's Nutrition Facts panel to include the amount of *trans* fatty acids present in foods. As you know, there is a growing body of scientific evidence, both experimental and epidemiological, that suggests consumption of *trans* fatty acids increases the risk of CHD. Another important risk factor is the omega-3 fatty acid content of food. Both epidemiologic and clinical studies find that an increase in consumption of omega-3 fatty acids results in reduced deaths due to CHD. The recent revision of the American Heart Association's (AHA's) dietary guidelines recognizes this evidence by recommending consuming fish, which is high in omega-3 fatty acids, at least twice weekly to reduce the risk of CHD. In addition, the AHA recommends the inclusion of oils and other food sources high in omega-3 fatty acids.

The current *Dietary Guidelines* targets only the reduction of saturated fat and cholesterol, with only a brief reference to the risks from *trans* fatty acids and benefits of omega-3 fatty acids. We encourage you to consider strengthening the language in the guidance and to modify the *Food Guide Pyramid* to better differentiate the health benefits and risks from foods. As noted in the *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans* (2000), consumers find the *Food Guide Pyramid* to be the most useful part of the *Guidelines* and the *Guidelines* itself encourages readers to "let the pyramid guide your food choices." Yet the current *Food Guide Pyramid*, for example, groups meat, poultry, fish, dry beans, eggs, and nuts into a single "Meat and Beans Group" when research suggests that these foods may not be equivalent in terms of their health effects.

Given the significant potential improvement in public health suggested by current evidence, we urge you to consider revising the *Dietary Guidelines* and *Food Guide Pyramid* to emphasize the benefits of reducing foods high in *trans* fatty acids and increasing consumption of foods rich in omega-3 fatty acid.

We would like to set up a meeting with your agencies in the next few weeks to discuss this issue. As always, the OIRA staff stands ready to assist you in these efforts.

Sincerely,

John D. Graham
Administrator
Office of Information and Regulatory Affairs

Attachment A

Effect of Seed Selection and Processing on Stability of Milled Flaxseed

G.R. Pizzey and T. Luba
Pizzey's Milling, Box 132, Angusville, MB, Canada R0J 0A0

BACKGROUND

Flaxseed is one of the oldest known cultivated plants with a history of use as both an edible seed and as a fiber source. In recent years flaxseed has attracted a lot of interest as a functional food due to its high content of two beneficial components: alpha linolenic acid (ALA), an essential omega-3 fatty acid and lignans, a type of phytoestrogen. Functional foods are targeted to provide selective protection against some of the most common disease risks such as cardiovascular diseases, cancers, digestive disorders, autoimmune disorders and others associated with sub optimal nutrient intake. ALA alters membrane phosopholipids, inhibits arachidonic acid biosynthesis from linoleic acid, inhibits the production of proinflammatory eicosanoids from arachidonic acid, and suppresses lymphocyte proliferation and cytokine production. 1,2,3 Recent research suggests both ALA and lignans in flaxseed modulate the immune response and may play a beneficial role in the management of autoimmune diseases.4 ALA is a compound known to have anti-atherogenic and anti-inflammatory properties. Flaxseed is also the richest source of lignans, which have potent anti-mitotic and PAF-receptor antagonist properties. Platelet activating factor (PAF) plays a key role in promoting inflammatory reactions.5 Through these actions flaxseed has the potential to be used in the treatment of disorders characterized in part by activated lymphocytes and a hyper-stimulated immune response. Such disorders may include rheumatoid arthritis, psoriasis and multiple sclerosis.5

Lignans have numerous biological properties, including antimitotic, antifungal and antioxidant activities.6 Flaxseed lignans may have anticancer effects, particularly on hormone sensitive cancers such as breast, endometrium and prostate cancers, by interfering with sex hormone metabolism.7,8 Lignans have also been shown to stimulate hepatic synthesis of sex hormone binding globulin (SHBG), thus enhancing the clearance of circulating estrogen.9

The opportunity for the broader public to enjoy the health benefits and appealing aesthetic qualities of flaxseed is growing as it is incorporated into an increasing number of foods. Pet owners are also realizing the tremendous health benefits of flaxseed for their animals. The sustainable value of flaxseed in the nutraceutical market will depend upon its consistent quality and oxidative stability. Lack of attention to the initial seed selection and processing of flaxseed can possibly compromise the ability of flaxseed to deliver its potential health benefits. There has been some hesitation within the Food Industry to incorporate flaxseed into food products because of concerns over lipid stability. Some anectodal evidence suggests that dark seed color imparts some negative organoleptic

properties. This study evaluates the effect of seed selection and processing on the overall quality and lipid stability of milled flaxseed.

OBJECTIVE

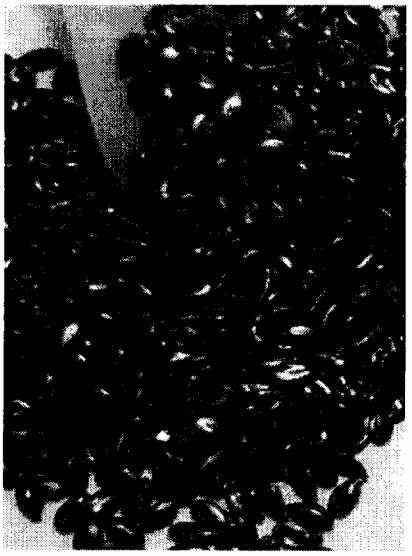
The objectives of this study are to:

- evaluate the effects of varying levels of processing on the alpha linolenic acid (ALA) content of flaxseed samples.
- establish if a correlation exists between percent dark seeds and the oxidative lipid stability of milled flaxseed.

METHOD

To evaluate the effects of processing, a sample was selected with a commercial grade of No.1 in the USA and Canada. This sample was subjected to four cleaning and grading procedures to produce four sub-samples. Cleaning removes the foreign material and grading removes the lower density light-weight seeds. The sub-samples were then analyzed for total fat with complete fatty acid profiles, using AOAC method #996.06. Calculations were done to determine the relative equivalency of omega-3 levels using lab analysis results. Data is presented in chart 1 in results and discussion.

In order to establish if a correlation exists between percent dark seeds and the oxidative lipid stability in a freshly milled flaxseed sample, three flaxseed samples were selected. As in the previous study these samples were chosen from seed sources that met No.1 grade specifications in the USA and Canada. The samples were differentiated only on the basis of percent dark seed content. These "dark seeds" are visually distinguishable but are physiologically mature with normal seed weight and therefore cannot be removed with cleaning and grading procedures. See picture :



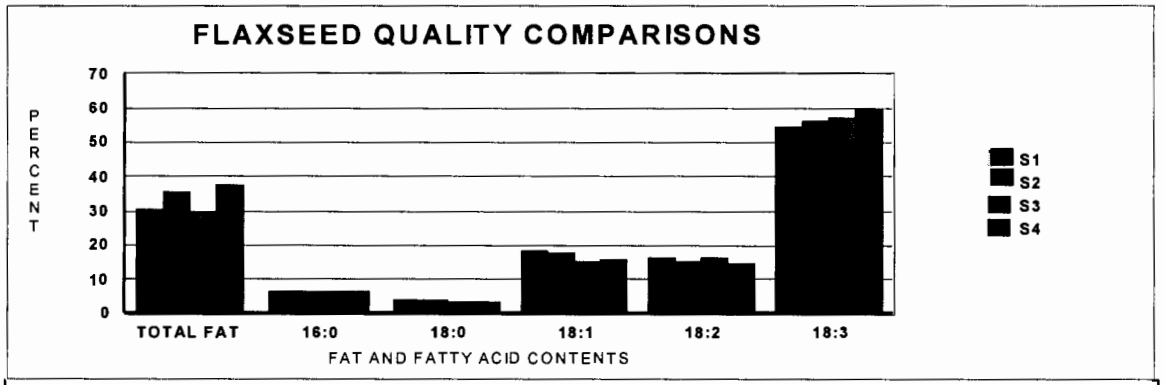
Food Grade Flaxseed

Flaxseed with Variation in Quality
➪ Dark Seeds
Immature Seeds

Sample 1 (2% dark seeds), Sample 2 (7% dark seeds) and Sample 3 (25% dark seeds). Our data includes results for fresh milled flaxseed samples. We evaluated primary and secondary oxidation in the milled flaxseed using the Saftest❶ MAPP❶ System, a microanalytical testing system that measures primary and secondary oxidation in food products. 11 Data is presented in chart 2 in results and discussion.

RESULTS AND DISCUSSION

.Chart 1



S1 Commercially clean, Ungraded, 2% Foreign Material
S2 Commercially clean, Graded, 2% Foreign Material
S3 Commercially clean, Lighter Test Weight, meets No.1 Grade Standard, <0.1% Foreign Material
S4 Food Grade Specifications – Highest in Total Fat & 18:3 Fatty Acids

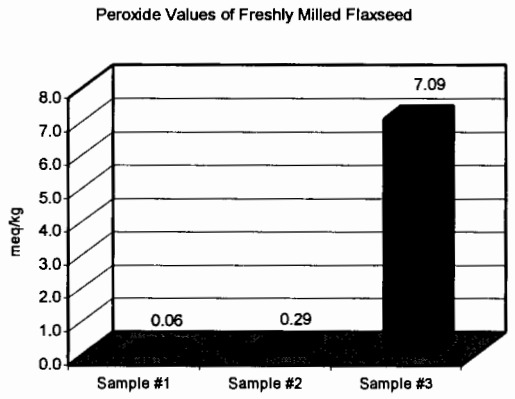
Sample ID	Total Oil %	C18:3/Oil %	C18:3/Product	n-3 Rel. Value	*Product Req'd for n-3 equiv.
S1	29.00	54.75	15.88	0.70	**1.42**
S2	35.00	56.12	19.64	0.87	**1.15**
S3	29.50	57.46	16.95	0.75	**1.33**
S4	37.68	59.88	22.56	1.00	**1.00**

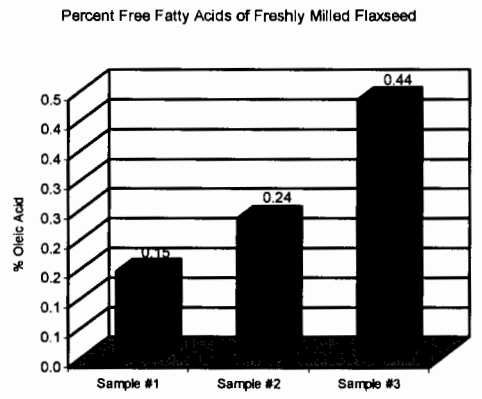
Samples S1, S2 and S3 have lower total oil and lower omega-3 fatty acid contents than S4 Food Grade Flaxseed.

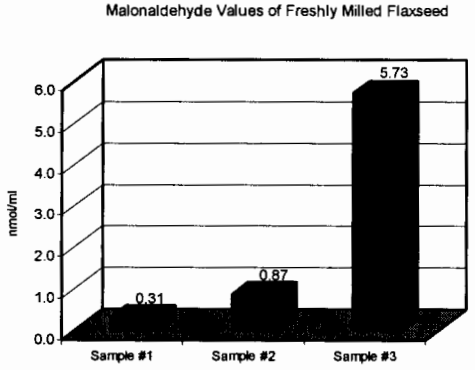
*This column compares all of the samples on an Omega-3 equivalency basis. The data shows that it would take 1.42 lbs of sample S1, 1.15 lbs of S2, 1.33 lbs of S3 to replace 1 lb of S4 Food Grade Flaxseed on an omega-3 content basis.

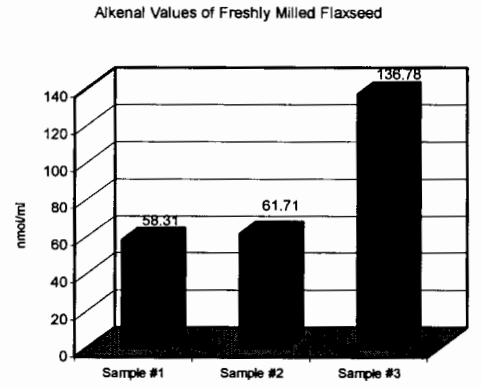
Chart 2

Primary and Secondary Oxidative Lipid Stability of Freshly Milled Flaxseed









Sample #1 – 2% dark seeds
Sample #2 – 7% dark seeds
Sample #3 – 25 % dark seeds

Assay results reveal a significant increase in levels of undesirable oxidation products as the percent dark seed level increases. (see table 1)

Percent Increase in Oxidation Product Levels over Sample #1		
	Sample #2 (7% dark seeds)	Sample #3 (25% dark seeds)
Peroxide Value	307	8914
Free Fatty Acids	61	197
Malonaldehyde	178	1723
Alkenals	6	135

CONCLUSION

These results indicate that flaxseed constituent levels are effected by both processing and selection. Seed processing, like growing location can effect the total oil content and percent alpha-linolenic acid of the finished product as summarized in chart 1. Lipid stability assays reveal a significant increase in levels of undesirable oxidation products as the percent dark seeds increase. The cause of the dark seed color is not well understood but it may have something to do with the growing season conditions. Dark seed color may indicate some breakdown in the natural anti-oxidant activity of the seed. Sample #1 in chart 2 reveals much lower levels of oxidation products in the milled sample. If the assay values are elevated in the fresh milled product, stability of the flaxseed will be even more pronounced following storage.

The stability and overall quality of a flaxseed product can be optimized by seed selection and processing.

****

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B(1)

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Breaking News on Supplements & Nutrition - Europe

Previous page : Oxidised fish oils on market may harm consumer, warns researcher

Oxidised fish oils on market may harm consumer, warns researcher

20/10/2005- **Better methods for stabilizing fish oils are needed to protect consumers from the toxic products produced when they go off, says a team of New Zealand researchers.**

Sales of fish oil supplements are booming in many markets as consumers become aware of their benefits for the heart, joint health and mental function. However, fish oil is easily oxidised and a team at New Zealand's Crop & Food Research institute believe that industry's failure to control this process could be putting consumers at risk.

Dr Carlene McLean, the institute's oils expert, says that she has tested many fish oil samples from the UK and Asian markets and found them to contain oxidation byproducts, despite being within the sell-by date.

These products could have the opposite effect that a consumer is hoping for when he consumes the product.

"Oxidised oils and fats of other types have been shown to increase the risk of atherosclerosis and thrombosis in a small number of human trials. These effects have been seen with relatively low levels of oxidised product – similar to a regular dose of fish oil capsules," said scientist Rufus Turner.

Fish oil at a late stage of oxidization will smell rancid but the initial breakdown products, which are still harmful, have little aroma, according to the researcher.

"It is very worrying because nobody has really put this together yet they are doing large trials using high dose supplements," added Dr Carlene McLean, the institute's oils expert.

"But they don't consider the level of oxidation in the supplements."

Oxidised oil could explain some of the variable results in these trials, she told NutraIngredients.com.

McLean has co-authored a review submitted for publication to *Nutrition Research Reviews* that compiles data on the toxic oxidation products borne out of fish oils.

Fish oil is a highly unstable product and as soon as it is extracted from fish, and exposed to oxygen, metals, light and heat, it begins to oxidise.

Most fish oil producers remove many of the oxidation products during the purifying process but this is not enough, says McLean.

They may also add vitamin E, an antioxidant, to prevent further oxidation but many producers use the more readily available form, alpha-tocopherol, which is not such a potent antioxidant as another more expensive form, gamma-tocopherol.

"Many fish oil supplements have a best-before date of three to four years. But fish oil starts to go off within days," McLean said.

The products are often encapsulated in a gelatine shell making it difficult for the consumer to notice, she added.

Claire Packer, marketing director at fish oil supplier Croda, said she was surprised by the findings but added that there is a wide range of different types of fish oils on the market.

The New Zealand team is currently investigating whether antioxidant plant extracts could be added to fish oils to make them more stable. Working with the country's leading fish processor, Sea Lord, they are looking at adding antioxidants as soon as the oil is extracted to combat the oxidization even before further processing and purification.

Extracts of kumara, a sweet potato, have shown good results in lab tests, although the researchers still have not identified the active components.

They are currently testing seaweed extracts that compare favourably to the commercial antioxidants ascorbic acid and butylated hydroxytoluene (BHT). Long-term storage trials will be required to test the efficacy of the antioxidants.

contact the editor

Print

The Importance of Peroxide Value in Assessing Food Quality and Food Safety

Sir:

Fats and oils in foods are oxidized during processing, circulation, and preservation. This reaction causes deterioration in taste, flavor, odor, color, texture, and appearance, and a decrease in the nutritional value of the foods (1). Furthermore, the reaction can induce food poisoning. Therefore, from a food quality and food safety perspective, this oxidation reaction must be suppressed. Instant noodles are a fried food, and therefore instant noodles contain a lot of fat and oil. In 1964 and 1965, Japan had a food poisoning epidemic caused by the degradation of the fat and oil in instant noodles (2). Many people who ate the degraded instant noodles developed acute symptoms such as diarrhea, nausea, emesis, abdominal pain, fatigue, and headache, but fortunately, no one died. After the incidents, the Ministry of Health and Welfare, currently the Ministry of Health, Labor and Welfare, in Japan set standards for instant noodles in the Food Sanitation Law to protect against food poisoning and to control the quality of instant noodles. In that law, peroxide value (PV) and acid value (AV) were chosen as useful indices to control food safety and quality, and the standard values of PV and AV were set at no more than 30 mequiv/kg and 3, respectively. These values were chosen because they indicate the initial stage of fat and oil deterioration. After setting these values, there have been no reported cases food poisoning caused by instant noodles in Japan.

At the initial stage of fat and oil deterioration, the reasons for measuring PV and AV are very different because of the different mechanisms underlying the formation of hydroperoxide and FFA from fat and oil. Hydroperoxide is formed by the oxidation of fat and oil, whereas FFA are formed by the hydrolysis of fat and oil. PV is an index to quantify the amount of hydroperoxide in fat and oil. Several studies have reported that secondary oxidized oil products are generally toxic (3). Also, weakly oxidized fat and oil at levels of only 100 mequiv/kg of PV are neurotoxic (4). Therefore, the formation of hydroperoxide, the primary oxidized product of fat and oil, must be suppressed to protect against the oxidation of fat and oil and the formation of secondary oxidized products from both food quality and food safety perspectives. Meanwhile, AV is an index to measure the amount of FFA. The FFA themselves are not toxic; however, the presence of FFA affects food quality. Consequently, measuring both indices is indispensable to control food quality and safety.

There is currently a movement worldwide to use only AV to control food quality and safety. For example, the 36th session of the Codex Committee on Food Additives and Contaminants held at Rotterdam, The Netherlands, in 2004 expressed the opinion that PV is not a safety factor (5,6). As a result, the 28th session of the Codex Committee on Methods of Analysis and Sampling held at Budapest, Hungary, in 2005 determined that only AV is useful as an index of fat and oil deterioration to control the quality and safety of instant noodles. PV was not recommended as an index in this standard (7). This is very dangerous, because there is evidence that the oxidized products of fat and oil formed from deteriorated fat and oil are the real cause of food toxicity (3,4). Furthermore, it is impossible to predict the magnitude of the PV from the AV because the underlying mechanisms of formation are completely different.

As an illustration, 218 kinds of fried-type instant noodles of package and cup-type were collected from commercial sources all over the world (including Brazil, China, England, Germany, India, Indonesia, Japan, Korea, The Netherlands, The Philippines, Singapore, Thailand, USA, and Vietnam), and PV and AV were measured to determine the levels of deterioration of instant noodles sold in the market and the relationship between PV and AV.

Figure 1 shows the relationship between PV and AV in instant noodles. The results demonstrate that both values range widely and sometimes exceed the criteria (PV: ≤30 mequiv/kg and AV: ≤3) established in the Food Sanitation Law in Japan. Because almost all samples were sold in cool conditions, samples exceeding 30 mequiv/kg in PV might have been exposed to strong light for a long period. On the other hand, the samples exceeding 3 in AV might have been stored under high humidity. Light and humidity strongly affect the degradation of fat and oil. If both AV and PV increase simultaneously during storage, then a plot of the two indices would produce a plot with a positive slope and there would be a significant correlation between them. This, however, is not the case (Fig. 1). The correlation coefficient for PV and AV was –0.1083 (calculated using Pearson's product-moment coefficient of correlation), indicating that the plot had a negative slope. In addition, the correlation between PV and AV was low, indicating that PV and AV do not form simultaneously in instant noodles during the initial stage of deterioration. Furthermore, the P value was 0.1106, indicating that the relation between PV and AV was not significant. These results strongly support that PV cannot be estimated from AV.

During food storage, many kinds of reactions, such as oxidation, hydrolysis, polymerization, cyclization, and β-scission can occur in the fats and oils. It is very difficult to determine how the individual reactions interact to form toxic compounds. Almost all of these reactions, however, relate to oxidation and

*Paper no. J11284 in *JAOCS 83*, 473–474 (May 2006).

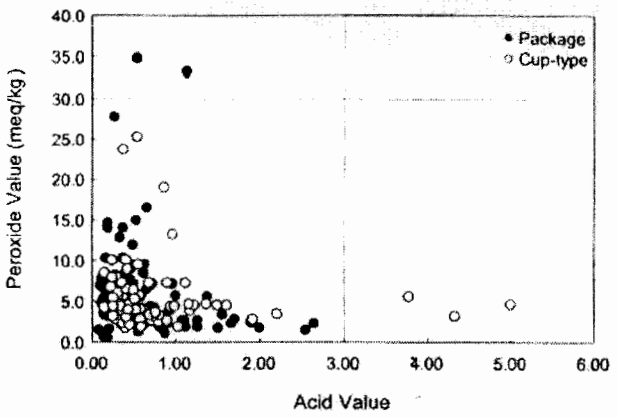

FIG. 1. Plot of acid value vs. peroxide value (PV) in instant noodles collected from around the world (n = 218).

proceed *via* the formation of lipid hydroperoxides. Consequently, protecting against the formation of lipid hydroperoxides is the best way to maintain food safety and quality. In the Food Sanitation Law of Japan, PV is set to no more than 30 mequiv/kg because deteriorated instant noodles with a PV as low as 100 mequiv/kg have caused food poisoning in Japan (2). A PV value of 100 mequiv/kg might not be very high, but animal studies reveal that this level of deteriorated fat and oil is neurotoxic (4). During the oxidation of fat and oil, sudden oxidation, i.e., the propagation period, occurs after the induction period once the antioxidants in food have been consumed during the induction period. Although 30 mequiv/kg is much less than 100 mequiv/kg, once the sudden oxidation starts during the propagation period the 100 mequiv/kg level would be reached soon after the 30 mequiv/kg level. Furthermore, this initial stage of PV alteration cannot be estimated by changes in AV because the two indices do not increase simultaneously (Fig. 1). Consequently, setting a criterion of 30 mequiv/kg for PV in instant noodles is important to control food safety.

It is not sufficient to monitor food deterioration with AV alone to maintain food quality and food safety. We conclude that PV must be adapted as an index in the Codex standard for instant noodles.

ACKNOWLEDGMENTS

The present study was supported in part by a Grant-in-Aid for Scientific Research from the Ministry of Health, Labor, and Welfare. We are grateful to the Japan Convenience Foods Industry Association for collecting the samples and for requesting the analysis of PV and AV by the Japan Food Research Laboratories.

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Attachment D

Three month stability testing on two organic samples

	Pizzey	Organic 1	Organic 2
Free Fatty Acids (%)	0.15	0.24	0.44
PV (meq/kg of oil)	0.06	0.26	5.68
Alkenals (nmol/ml)	58.31	61.71	136.78
Malonaldehyde (nmol/ml)	0.31	0.87	5.73

*dft value	**alkenals**	58.31	64.28	136.78

E(1)

September 26, 2006

USDA
1400 Independence Avenue, SW
Washington, DC 20250-0020

Dear Sir or Madam,

The purpose of this letter is to support Pizzey Milling's "Petition of Nonorganically Produced Agricultural Products for Inclusion on the National List – 205.606".

Hodgson Mill is a small family owned company that currently employs eighty (80) people. Our company specializes in the manufacturing and marketing of grain based foods for the Specialty Food Market. The majority of customers we sell to are Specialty and Natural Food Distributors such as UNFI, Kehe Foods, Haddon House, Millbrook and Tree of Life. We sell our products to distributors like these who in turn sell them to various retail customers across the United States.

Three important keys that we must have in order to compete with the food giants of today like Quaker, Barrila, Nestle and AIPC are (1) superior food quality (which starts with high quality ingredients), (2) shelf stability and (3) being able to supply those products on a 99% fill rate that is on time 99% of the time. In our business, shorting orders is an unacceptable practice.

Once our products are produced, they are stored in our warehouse for future sales. After an order has been placed, these same products are later shipped to specialty and natural food distributors where they are again stored for future shipment. These products can often sit idle in these warehouses for weeks and sometimes months at a time. After a specialty food product leaves the distributor, the next stop can either be the retail store itself, or a food retailer's warehouse where again it is stored for future shipment to individual grocery stores. As you can see, the process for getting the product produced to actually being placed on the retail shelf is lengthy, and products are often handled many times by different warehouses.

The Specialty Food market is what the name implies. Specialty Food companies like Hodgson Mill market specially made products that will ultimately be sold by retailers to a small group of consumers who are looking for specific, unique food items. It is a defined, multi-category market that comprises less than 10% of all retail food sales. In addition to catering to a very small market, which in and of itself reduces shelf velocity, specialty food products also sell slowly in part because they are often placed in the specialty/natural food or international food sections of supermarkets, as opposed to being placed in the main food shopping aisle. In other words, instead of finding pasta in the main pasta aisle, you may have to look for it on the store's periphery. Coupled with being a part of the specialty/natural food distribution system, these two factors demand that our products have as long a shelf life as possible.

Shelf life is critical. Products like yeast, wheat germ and milled flax seed do not have as long of a shelf life as many other food products. Milled flax seed (whole flax seed that has been ground by a mill into small particulates) is particularly susceptible to rancidity and this is especially true after it has been cooked and reheated to dry before it is placed in packages to sell.

Supply and demand.....We know that with the tremendous growth of Organic food sales, the supply is often times very tight. This is particularly critical when sourcing high quality organic ingredients. This growth rate coupled with the fact that the occurrences of infestation associated with organic grains is higher than those associated with conventional grains, presents a significant challenge in trying to keep organic products in the "pipeline".

In closing, I will recap my reasons for supporting this petition. Again, these reasons all encircle our absolute need to provide superior food products that can be delivered on time without disrupting the supply chain and which have extended shelf life capabilities. They are as follows:

- The Specialty/Natural Food Distribution system is slower to get products to the market than direct sales items.
- Specialty food products (natural and organic) sell to niche markets represented by a smaller group of consumers.
- Specialty Food products are usually placed in the slower moving "specialty/natural" sets in retail stores.
- Less than 10% of all food sales are specialty (natural and organic) food items.
- Generally speaking, the sales velocity and sales volume of specialty food products in supermarkets is substantially less than mainstream products.
- The supply of organic ingredients is limited and is being strained by increased demand. The entry of Wal Mart into the Organic arena will exacerbate this condition.
- A stable shelf life of at least 18 months is essential for most of our specialty food items. This is especially true of products like our Organic Pastas with milled flax seed. These pastas start with flour and milled flax seed, have water added to them, are then blended and cooked, extruded through high pressure dies and are then dried in ovens before being placed in cardboard boxes. Key words here are water, cooked, extruded and dried. Only high quality milled flax seeds will stand the test of time.

I thank you in advance for your kind consideration in this matter. If you have any questions or need any further information, please feel free to contact me.

Best regards,

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F(1)

MEDALLION LABS
9000 Plymouth Avenue North, Minneapolis MN 55427
1-800-245-5615 (763) 764-4453 Fax: (763) 764-4010

Final Report

Report Date: August 23, 2006
Date Submitted: August 10, 2006
Company Code: **PIZZEYS02**

Medallion Labs Sample ID: **2006051494** *N.P. Cereal*

Customer Sample ID: ***ACCESS# 395*** Twila Luba, Pizzey's Milling & Baking Co.

Assay	Component	Results	Units
Fatty Acid Analysis w/Profile	Total Fat	2.53	%
	Saturated Fat	0.54	%
	Monounsaturated Fat	0.43	%
	cis-cis Polyunsaturated Fat	1.42	%
	trans Fat	0.03	%

* * * * * * * * * * * * * * * * * * *

F(2)

Fat Profile/Fatty Acid Analysis (with cis-cis polyunsaturates)

TO: Medallion Labs

LIMS SAMPLE ID 2006051494 Library No.: 2006-06343 Revision: nitial Release

CUSTOMER ID ACCESS# 395 Date Analyzed: 21Aug06

Reference #: C081706D0003 Analyst: Eric Hedstrand

Description: N.P. Cereal

	Normalized by Weight	% (w/w) as Triglyceride in Product	% (w/w) Fatty Acids in Product: Saturated Fatty Acids	Monounsaturated Fatty Acids	cis-cis Polyunsaturated Fatty Acids	trans Fatty Acids
4:0 Butyric						
6:0 Caproic						
8:0 Caprylic						
10:0 Capric						
12:0 Lauric						
13:0 Tridecanoic						
14:0 Myristic	0.118%	0.003	0.003			
14:1 t-Tetradecenoic						
14:1 Myristoleic						
15:0 Pentadecanoic	0.079%	0.002	0.002			
15:1 Pentadecenoic						
16:0 Palmitic	19.589%	0.496	0.473			
16:1 t-Hexadecenoic						
16:1 Palmitoleic	0.118%	0.003		0.003		
17:0 Margaric	0.158%	0.004	0.004			
17:1 Margaroleic						
18:0 Stearic	1.896%	0.048	0.046			
18:1 trans Elaidic	1.027%	0.026				0.025
18:1 Oleic	16.904%	0.428		0.410		
18:2 t-Octadecadienoic						
18:2 Linoleic	42.022%	1.064			1.018	
20:0 Arachidic	0.197%	0.005	0.005			
18:3 g-Linolenic						
20:1 Gadoleic	0.474%	0.012		0.012		
18:3 Linolenic	16.627%	0.421			0.403	
21:0 Heneicosanoic						
18:2 conj-Linoleic	0.197%	0.005				
18:4 Octadecatetraenoic						
20:2 Eicosadienoic	0.118%	0.003			0.003	
22:0 Behenic	0.197%	0.005	0.005			
20:3 g-Eicosatrienoic						
22:1 Erucic	0.079%	0.002		0.002		
20:3 Eicosatrienoic						
20:4 Arachiodonic						
23:0 Tricosanoic						
22:2 Docosadienoic						
24:0 Lignoceric	0.197%	0.005	0.005			
20:5 Eicosapentaenoic						
24:1 Nervonic						
22:3 Docosatrienoic						
22:4 Docosatetraenoic						
22:5 Docosapentaenoic						
22:6 Docosahexaenoic						
Totals	**100.0%**	**2.53**	**0.64**	**0.43**	**1.42**	**0.02**

Percent of Fatty Acid Components based on Total Fat	22.37%	17.59%	58.80%	1.03%
Omega-3 Fatty Acids, Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA)				

Attachment G

Three Pizzey samples of various ages tested to compare with organic samples found in retail stores

Three Pizzey samples were chosen from retained samples, they were 1, 2 and 3 years old.

	Pizzey's Premium fresh	Organic 3 8 months until expiration	Organic 3 1 month after expiration	Organic 4 5 months until expiration	Pizzey's 1 yr old	Pizzey's 2 yr old	Pizzey's 3 yr old
PV	0.1	7.3	88.5	1.4	0.3	0.3	0.3
FFA	0.1	0.3	2.0	0.3	0.7	0.7	0.9
ALK	58.3	69.1	3459.0	143.3	107.5	101.8	112.4
ALD	0.3	6.2	135.0	4.7	1.3	1.3	1.5

The organic product Sample 1 tested above the PV threshold 8 months prior to expiration and below the threshold for the three remaining assays (FFA, ALK and ALD). Testing one month after expiration revealed results above threshold limits for all four assays.

Following three years of storage Pizzey's flaxseed tested below the threshold levels for all four assays.

Sample 2 organic product was tested with 5 months remaining until expiration and results for all four assays were below the threshold limits.

Attachment H

		Apr. 16/02	Apr. 30/02	June 20/02	July 18/02	Aug. 21/02	Sept. 19/02	Oct. 25/02	Nov. 28/02	Dec. 20/02	Feb. 3/03
Free Fatty Acids	Sample 1	lo	lo	0.20	lo	lo	lo	lo	0.12	lo	lo
	Sample 2	0.14	lo	0.58	0.56	0.55	0.64	0.71	0.62	0.67	0.56
Peroxide Values	Sample 1	lo	lo	lo	lo	3.73	lo	lo	2.71	0.88	lo
	Sample 2	9.07	lo	lo	lo	lo	0.35	lo	3.98	0.36	lo
Alkenals	Sample 1	lo	31.30	27.79	26.04	lo	25.60	26.48	22.53	35.24	lo
	Sample 2	37.66	lo	39.18	35.24	34.36	42.25	34.36	42.25	43.56	27.03
Malonaldehydes	Sample 1	lo	7.09	5.34	8.13	8.83	9.18	6.56	1.29	4.93	2.65
	Sample 2	6.39	lo	5.52	7.61	8.66	9.18	6.39	2.71	5.13	3.05

Sample 1 - Whole wheat pasta
Sample 2 - Organic pasta with Selectgrad conventional flax