FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

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QUALITY STANDARD FOR ANIMAL AND PLANT FATS

INTRODUCTION

The rendering industry is many times referred to as the " invisible industry". Few people, in most countries, know that it exists and have no understanding of its purpose and important role it plays in the recycling of edible and inedible by - products from the slaughter of animals into useful commodities. Unfortunately few livestock producers are acquainted with the industry that processess more pounds of the animals that they sell, than is sold over the meat counter. The rendering industry is sometimes referred to as the " unsung hero " of the agriculture community (Grummer, 1991).

The 336 U. S. rendering plants produce approximately eight to nine billion pounds of animal fat each year from the approximately 36 billion pounds of offal, carcass bones , bones and fat trimmings and spent cooking fats and oils that are generated from packing houses , meat fabrication plants , custom slaughtering facilities , supermarkets and restaurants.

In an attempt to unravel the many questions relating to animal feeding fats , the U. S. rendering industry formed the Fats and Proteins Research Foundation in the early 1960's when only 3 - 400,000,000 pounds of feeding fat was used annually. This group which is primarily funded by members of the independent rendering industry, has sponsored research projects for 30 years that are designed to demonstrate the efficacy of animal fats in livestock and poultry rations. The success of these studies and many others are responsible for the present yearly U.S. feed, fat and oil utilization of over 3 billion pounds.

SPECIE UTILIZATION

The primary animal species whose feeds may contain added fat are beef and dairy cattle, swine, poultry and companion animals (dogs and cats). Within each species, the percentage of the total animal population receiving fat-supplemented rations varies widely, ranging from about 10% for laying hens to more than 90% for broilers and dogs. In most animal rations, fat is typically added between the 0.5% to 6.5% range.

As mentioned earlier, if renderers processed all inedible by-products from slaughtered animals and restaurant grease, except the parts that are sold uncooked into the pet food industry, they would produce approximately 8000 to 8500 million pounds of fats per year. The Department of Commerce surveys established a total animal fat production (including restaurant grease) of 7382 million pounds in 1990. This does not include all vegetable by-products or vegetable oils used in feed. Table 1 lists the domestic consumption of inedible tallow/grease by industry.

The difference in the estimated total fat production of 8250 million pounds and the government's figure of 7382 million pounds is approximately the difference between private estimates of feeding fat usage and the 2013 million pounds government figure.

TRADING STANDARDS FOR TALLOW AND GREASES

As the science of soap making grew the specifications for animal fat (grease/tallow) quality expanded to more precisely meet the various needs of the soap industry. The terminology and specifications form the basis for defining quality and characteristics as used today by the soap and chemical industries in purchasing fats.

The "soaper" specifications were used exclusively by the feed industry for many years. Today many feed companies are writing their own specifications based on AFCO definitions and research trials. The specifications place an emphasis on titre (hardness) free fatty acid (FFA) and color of the fat in determining its grade and value. This is because hard fats make firm soap, soft fats make soft soap. The harder fats resist oxidation in a bar of soap and this is also true when they are used as a feeding fat. Dark fats make poor quality soaps and the higher the free fatty acid the greater the glycerine loss. Therefore, for the soap and chemical industry there is distinct price variation between grades. In feeding fats the variation in hardness, color and FFA does not have the same impact on price except in feeds such as milk replacers, certain pet foods and dry fat products.

STRUCTURE AND COMPOSITION OF FATS AND OILS

Natural fats and oils vary widely in their physical properties, even though they are made up of the same or similar fatty acids. This is because (a) individual fats and oils vary over relatively large ranges in the proportion of the component fatty acids, and (b) the structure of the individual component triglycerides vary.

Natural vegetable and animal fats are made up of triglycerides which are esters of the alcohol glycerol and fatty acids. Most fatty acids found in natural fats vary in chain length from 8 to 24 carbon atoms. In feed fats the most predominant fatty acids are 16 and 18 carbon atoms in length. Fatty acids contain none or one to three double bonds and are classified as follows:

No double bonds - Saturated

One or more double bonds - Unsaturated

Two or more double bonds - Polyunsaturated

Titre is a measure of the hardness or softness of fat through a determination of the solidification point of the fatty acids in degrees, Centigrade. Animal fats with a titre over 40 are considered tallow and under 40 grease. Many buyers erroneously consider these terms as meaning beef or pork fat. Iodine Value (IV) is another measurement of the hardness or softness of fat and is defined as the grams of iodine absorbed by 100 grams of fat. Unsaturated fats have a higher IV than saturated fats. Consequently, the higher the IV the softer the fat.

The hardness or softness of fat is in direct relationship to the make up of the fatty acid profile of the lipid. The more saturated fatty acids, the harder, the more unsaturated, the softer. The fat's fatty acid profile is its fingerprint, so buyers of fats should be concerned with the relationship of unsaturated to saturated fatty acids of the fats they are puchasing as it plays an important role in the determination of the dietary energy value of the fat for animals.

Table 5 are typical fat structures of commonly traded feeding fats which illustrate how to compute the percentages of each fat category and the unsaturated to saturated ratio frequently referred to in fat research.

It is advisable to check incoming fat using the iodine value analysis for less expensive determination and interpreting fat structure using Table 6. Specific fat structure can be spot checked by the more comprehensive gas liquid chromotography method (Rouse, 1988).

FIVE BASIC ANIMAL FATS

The U.S. inedible rendering industry produces five basic fats and from these products come blends of two or more and/or combinations with vegetable oil by-products.

Mixed Rendered Fat - A naturally blended fat produced by an independent renderer who processes a combination of several specie's raw material. The finished fat structure will reflect the specie percentage of the raw material. More cattle by-products, the harder the fat. Should be purchased by a minimum or maximum titre and/or iodine value or on a guaranteed U/S fatty acid ratio range. Many renderers will purchase 100% cattle tallow to blend up their low titre mixed fat in able to meet customer specificiations.

Specific Specie Fat - produced by an integrated broiler operation or a packing house slaughtering only one specie of animals. Poultry fat, all-hog grease and 100% cattle tallow are descriptive words used to describe these products by some purchasing agents. They are normally sold as choice white grease, tallow and poultry fat.

Restaurant Grease - The 440,000 commercial food service units in the United States are the predominant sources of spent cooking fats and oils for processing into yellow grease. Restaurant grease is accumulated by renderers at approximately 9,000,000 pounds per day or 2,250,000,000 pounds annually. The raw product will yield 60-65% yellow grease. Most spent grease is made up of partially hydrogenated (hardened) vegetable oils and/or animal fats. Until 1985 many of the large fast food chains used deep frying compounds made up of 90% edible tallow and 10% vegetable oil products. Today, due to adverse publicity about the association of saturated fat with human health concerns, the fats are practically all partially hydrogenated vegetable oils containing trans fatty acid.

For many years fat blenders added ācidulated vegetable oils soapstock to restaurant grease to raise the linoleic acid content to 15 or 20%. With the current high utilization of partially hydrogenated vegetable oils in restaurant grease the IV is approximately 80 to 87 which dictates a 20 to 25% linoleic acid content. Properly processed and stabilized restaurant grease is an ideal feeding fat for poultry and other monogastric animals.

One of the most frequent questions posed to renderers is the concern about the quality of restaurant grease due to the high heat it is subjected to in the deep frying process. A study was conducted to determine the effect of polymer content obtained with normal restaurant grease on a ME of the fat for young and old chickens (Jensen, 1990). Three samples of vegetable fat delivered to different restaurants for use in deep frying were obtained and samples of the same three fats were obtained were sent to Diversified Laboratories to determine the polymer content. The samples were identified as A, B and C and their total polymer content was .78, 2.78 and 2.19 respectively. This corresponds to tests conducted by Proctor and Gamble which found a maximum of 5% polymers in used deep frying oils (Spinner, 1989).

The effect of the different fat sources on body weight gain and feed efficiency in broiler chickens during the second and fifth weeks of age is presented in Table 7. There were no significant differences in body weight gain at either age and for feed efficiency during the fifth week. Although a significant difference among the treatments in feed efficiency during the second week was observed, there was no significant difference between the restaurant greases before and after use. There were no significant differences in fat retention among the treatment (Table 8). Some significant difference among the fat sources in terms of ME content of the diet fed from one to two weeks of age were observed (Table 9). However, a direct comparison between the new and used restaurant grease within each sample failed to show a significant difference. The results indicate, however, that long use of the fats in restaurants did not have a significant effect on the feeding value of the fats.

MOST COMMON FEED FATS SOLD

Feed Grade Animal Fat - Could be derived from by-products from many species, but it is primarily from rendered beef and pork raw material.

Poultry Fat - Is fat from poultry by-products. A large amount of this commodity is sold for use in companion animal rations.

Choice White Grease - primarily comes from the rendering of pork tissue. Certain blends of beef, pork and poultry fat are sold as choice white grease as they meet the so-called soaper specifications.

Tallow - primarily derived from rendered beef tissue, but could contain other animal fat. Most chemical and soap companies require a minimum of 40.5 or 41.0 titre. If the product meets this specification it is usually sold as tollow with the understanding it is not 100% cattle fat. In able to make customer specifications many renderers are purchasing 100% cattle tallow to blend up their low titre mixed fat.

Yellow Grease - primarily restaurant grease but can contain dead stock fat and/or dark color, high free fatty acid and high MIU fat from any type of rendering operation. Many times dark color and high free fatty acid tallow is sold as yellow grease.

Blended Animal and Vegetable Fat - Can include blends of all types of animal fat, vegetable oil, acidulated vegetable oil, soapstock and/or restaurant grease.

Labeling and trading rules for industrial uses of fat are well established. Fats for animal feeds are not clearly defined and current definitions do not always reflect the composition or quality of the product marketed. Table 10 suggests some quality specifications for commonly traded fats.

Many animal producers can't justify the equipment necessary to store and handle liquid animal fat but would like to use it in their mixing systems. More and more producers are mixing their feed requirements on the farm from a premix and are now turning to a dry fat ingredient. The expertise for producing dry fats has progressed until fats now are available with over 95% active ingredient in the available products. These products are more expensive than traditional liquid fats but until the volume of use gets to a point to justify the necessary equipment, they offer a high quality alternative.

Hard fats are easier to prepare in a dry form than softer fats or greases but may not match the animals requirement for best utilization.

When dry products are being selected, careful attention to the type and quality of the product should be given to the animals requirements and ratio of unsaturated to saturated previously discussed.

As long as there are animals, the rendering process offers the only logical and environmentally acceptable procedure for recycling the inedible components into useful and worthwhile products. The renderers responsibility is to conduct the process in a safe and efficient manner. All of society is well served when the rendering system is in place and working.

SELECTING FATS FOR ANIMAL FEEDS

Generally, the most efficient use of fats for animal feed results from an unsaturation-saturation ratio resembling that of the animal being fed.

	U to S Ratio
Ruminant Fat	1.1
Swine Fat	1.6-1
Poultry Fat	2-1

In addition to benefits such as dust control, equipment lubrication, increased palatability, and easier pelleting, fat is justified as an animal feed ingredient for its energy value. It has always been assumed that animal fat has 2.25 times the energy value of corn based on comparative energy values. Recent studies demonstrated indicate that fat has a synergistic response in swine feeds and can be worth as much as 3.8 times carbohydrates as an energy source (Stahly, 1988). Some specific feeding energy levels for fats and oils are listed in Table 11.

Two experiments were conducted to evaluate the influence of dietary linoleic acid concentration on carcass fat and lean quality and firmness in swine (Schoenherr, 1990). The first experiment to determine the critical level of linoleic acid addition which affects carcass fat and lean quality and firmness is finished. Linoleic acid was included at levels of 1.76, 3.20, 4.60 and 6.10% of the total diet via safflower oil replacement of tallow. Increasing the linoleic concentration of the diet did not alter gain, efficiency of feed utilization, tenth rib backfat, longissimus muscle area or percent lean in the carcass. Carcass firmness, determined by subjective and objective measurements, decreased as linoleic acid concentration of the diet increased. Increasing dietary linoleic acid produced a linear increase in the concentration of linoleic acid (18:2) and 20:2 in the backfat and lean. Increasing the amount of linoleic acid in the diet decreased the concentration of 16:0, 18:1 in the backfat and all other fatty acids were unaffected. The decreased firmness of the carcass as dietary and carcass linoleic acids levels increased demonstrates the close relationship between the linoleic acid and carcass qualtiy in swine. The growth performance and carcass data is given in Table 12.

BENEFITS OF FAT ADDITION TO ANIMAL FEEDS

1. Energy	- 2.25 to 3.8 times value of carbohydrates
2. Dust Control	- Health Hazard
3. Palatability	- Increased consumption and efficiency
4. Lubrication	- Equipment and pelleting
5. Formula Density	- Less product and waste to move

Also, poultry research has indicated an extra-caloric value from fats that is associated with level of use as well as nutrient density of other nutrients along with temperature of the environment.

SYNERGISM

Blenders of fats and oils add unsaturated vegetable oil by-products to saturated animal fats to meet a specified linoleic or U/S ratio. It is unquestioned that unsaturated fats have higher dietary energy values than saturated fats for poultry with all other things being equal. However a further consequence of variability in degree of saturation is the phenomenon of 'synergism'. This may be defined as the ability of a relatively unsaturated fat to promote the utilization of one that is relatively saturated such that the combined dietary energy value of a mixture of the two is greater than that which would be predicted from values for the two fats separately. Physiologically, such interactions between two individual fatty acids differing in degree of saturation have been recorded and in the amphiphilic index describing individual fatty acids, this interaction procedes in a predictable manner. 'Synergism' however has become increasingly associated with blended fats rather than individual fatty acids in the formulation of fats for non-ruminants.

ANALYTICAL PROCEDURES TO DETERMINE FAT QUALITY

Fat Condition		Procedure
Hardness	–	Titre - Congealing Temperature C°
Composition	–	Total Fatty Acids and Free Fatty Acids
Color	–	F.A.C. and Lovibond
Impurities	–	Moisture-Impurities-Unsaponifiables
Saturation	–	Iodine Value
Stability	–	Peroxide value and AOM

The following descriptions and terminology refer to animal feed use. Currently more than half of domestic uses for inedible fat is as an energy source for animal feed.

TOTAL FATTY ACIDS: (TFA)

Comprises both the free fatty acids and those combined with glycerol (intact glycerides). Fat is composed of approximately 90% fatty acids and 10% glycerol. Glycerol contains about 4.32 calories per gram compared with 9.4 calories for fatty acids. Since fatty acids contain over twice the energy of glycerol, the TFA content of fat acts as one indicator of energy.

FREE FATTY ACIDS: (FFA)

Are those fatty acids which are not linked to glycerol by an ester linkage, but are in the free form. Oxidation of fat produces FFA as a by-product, therefore the presence of high levels of FFA in whole animal fats causes concern about rancidity. Hydrolyzed fats in which the free fatty acids are created by deliberately splitting glyceride from whole fat contain higher levels of FFA than whole fats. This high FFA level is not a problem in ruminant and poultry rations if these fats contain anti-oxidants to prevent oxidation from creating additional FFA levels.

MOISTURE

Moisture is primarily an indication of the control and care used in handling the fat.

If the fat is to be used <u>immediately</u>, the presence of a little excess moisture is not serious, but excess water will cause hydrolysis during storage, hence a deterioration of the fat and subsequent glycerine loss in storage. It should indicate to the producer that he either is not settling the fat long enough, or he has poor control of his operations.

INSOLUBLE IMPURITIES:

Usually consist of small particles of fiber, hair, hide, bone, soil or polyethylene. These are insoluble in kerosene or petroleum ether and can cause clogging problems in fat handling screens, nozzles, etc., and contribute to the build up of sludge in storage tanks.

UNSAPONIFIABLE

Fats contain a number of compounds such as sterols, hydrocarbons, pigments, fatty alcohols and vitamins which are not hydrolyzed by the alkaline saponification used to split triglycerides into glycerol and fatty acids. Normal unsaponifiable has feeding value comparable to the facts involved. Certain problem compounds such as the edema factor, are contained in the hydrocarbon diene portion of the unsaponifiable.

FAT COLOR:

Fats vary in color from the pure white of refined beef tallow, through the yellow of grease and poultry fat to the very dark color of acidulated soapstock. Color does not affect the nutritional value of fat, but may be a consideration in pet foods and other consumer oriented products. Two color scales are frequently used with fats - F.A.C. and Lovibond. Lovibond is far more accurate with light colored fats.

FAT STABILITY & ANTI-OXIDANTS:

To prevent the development of oxidative rancidity which can destroy vitamins A, D & E and can cause other problems in feeds, anti-oxidants are recommended for all feed fats.

Two main tests are used to measure stability of fats:

PEROXIDE VALUE - Sometimes called Initial Peroxide Value because it is determined on a sample as submitted. This test measures the me. of peroxide per kg. and reveals the current state of oxidative rancidity. A low PV (less than 5.0 me peroxide/kg.) indicates the sample is currently not rancid.

AOM TEST - (20 hours stability) - This is a measure of the Peroxide Value after 20 hours of bubbling air through the sample. This test is intended to determine the ability of the fat to resist oxidative rancidity in storage. The validity of this test as it applies to feed fat has been questioned in the U.S. and Europe in recent years.

There is a tendency for certain toxins to bed accumulated in fatty tissues of animals. It is a common practice for renderers to obtain analytical profiles on every batch of fat and to certify their product is below regulatory "tolerance" levels.

TABLE 1. UTILIZATION OF INEDIBLE FATS IN THE U.S. (1990)[1]

Use	% of Total	Lbs.	% Change from previous year
Animal feed	61.1	2,013,000,000	+5
Fatty acids	22.0	722,000,000	+8
Soap	12.1	397,000,000	+8
Lubricants	3.5	110,000,000	+55
Other	1.3	43,000,000	+6

[1]Dept. of Commerce M20K Report

TABLE 2. ESTIMATED USAGE OF FATS IN ANIMAL FEEDS

(Millions of Pounds)

	1987[1]		1991[2]	
Type of feed	Yellow Grease	Added Fat	Yellow Grease	Added Fat
Swine	160	250	250	300
Beef cattle	195	240	200	250
Dairy cattle	55	100	50	200
Broilers	310	1025	400	1200
Layers	15	30	20	35
Turkeys	120	350	300	500
Dogs	90	365	50	400
Cats	20	75	10	100
Other species (Veal)	20	40	25	50
Total	985	2475	1305	3035

[1]SRI International 1987

[2]Fats and Proteins Research Foundation

TABLE 3. TRADING STANDARDS FOR TALLOW AND GREASE

	Titer Minimum	FFA Maximum	MIU Basis	Maximum	FAC Color Maximum
TALLOW	C^0	%	%	%	untreated
Extra Fancy	42	2	1		5
Fancy	40.5	4	1		7
Bleachable Fancy	40.5	4	1	2	none
Prime	40.5	6	1	2	13–11B
Edible	42.5	1	1		5
Special	40.5	10	1	2	19–11C
#1	40.5	15	2	4	33
#3	40.5	20	2	4	39
#2	40	35	2	4	none
GREASE					
Choice White (Hog)	36	4	1	2	13–11B
Yellow	36	15	2	4	37
Brown	38	50	2		none

TABLE 4. TITRE AND IV VALUES FOR FAT FROM VARIOUS LIVESTOCK SPECIES

Species	Titre, °C	IV
Sheep	44–48	42–43
Beef	42–45	43–45
Hog	36–40	63–65
Horse	35–38	80–85
Poultry	31–35	77–80

TABLE 5. TYPICAL FAT STRUCTURES

		Fat Source and % FA				
Profile	Fatty Acid	Tallow	Choice White Grease	Yellow Greases		Soybean Oil
C14:0[b]	Myristic	3.1	1.5	1.3	.86	—
C14:1[a]	Myristicoleic	1.0	—	0.3	.24	—
C15:0[b]	Pentadecanoic	0.5	—	—	.12	—
C15:1[a]	Pentadecanoic	.02	—	0.2	—	—
C16:0[b]	Palmitic	25.8	23.5	17.6	15.15	11.5
C16:1[a]	Palmiticoleic	4.3	3.4	2.3	1.94	—
C17:0[b]	Heptadecanoic	1.2	0.4	0.3	.40	—
C17:1[a]	Heptadeceoic	0.8	0.4	—	—	—
C18:0[b]	Stearic	20.4	12.0	10.2	7.88	4.0
C18:1[a]	Oleic	39.1	44.3	45.9	49.82	24.5
C18:2[a]	Linoleic	2.3	10.7	20.3	20.54	53.0
C18:3[a]	Linolenic	1.3	3.1	.9	1.81	7.0
Others		—	0.7	.7	1.25	—
a. Total % Unsaturated		49.0	61.9	69.9	74.35	84.5
b. Total % Saturated		51.0	37.4	29.4	24.40	15.5
Approximate Ratio u/s		1-1	1.65-1	2.38-1	3-1	5.45-1

TABLE 6.

GUIDE TO ESTIMATE FAT STRUCTURE, U/S RATIO FROM IODINE VALUE

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IODINE VALUE	45	55	60	65	70	75	80	85	90	100	110	125	130
Key Fatty Acids:													
C12 Lauric	.5	.5	1.0	2.0	2.0	2.0	2.0	2.0	1.0	.5			
14 Myristic	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	.5			
16 Palmitic	26.0	25.0	23.0	22.0	21.0	20.0	20.0	20.0	18.0	17.0	13.0	11.0	10.0
16-1 Palmitoleic	1.5	1.5	2.0	2.0	3.0	3.0	3.0	3.0	2.0	1.0	1.0	1.0	1.0
18 Stearic	21.0	19.0	16.0	15.0	12.0	10.0	10.0	8.0	8.0	4.0	4.0	4.0	3.0
18-1 Oleic	47.0	45.0	43.0	42.0	41.0	39.0	38.0	36.0	35.0	33.0	30.0	24.0	20.0
18-2 Linoleic	2.0	6.0	10.0	12.0	15.0	18.0	20.0	23.0	28.0	40.0	46.0	50.0	55.0
18-3 Linolenic	1.0	1.0	1.5	1.5	1.5	1.5	2.0	2.5	3.0	3.5	4.0	7.0	7.0
Unsat./Sat. Ratio	1.07	1.15	1.35	1.40	1.62	1.79	1.85	2.02	2.43	3.50	4.76	5.46	6.30

The table should be used only with tallow, grease, poultry fat and or soybean or corn vegetable fats or soapstocks or blends of these fats.

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TABLE 11. CURRENT NRC ENERGY LEVELS FOR FATS AND OILS

	Poultry	Swine	Beef		Dairy		
	ME-Cal/lb	ME-Cal/lb	NEm	NEg	NEm	NEg	NEL
Corn	1522	1555	916	780	855	585	800
Soybean oil	4000	3309	2160	1595	2650	2650	2650
Tallow	3545	3588	2160	1595	2650	2650	2650
Choice white grease	3935	3541	2160	1595	2650	2650	2650
Yellow grease	3840	3800	2160	1595	2650	2650	2650
Poultry fat	3727		2160	1595	2650	2650	2650

TABLE 12. GROWTH PERFORMANCE AND CARCASS DATA

Criterion	Treatment			
	1	2	3	4
Initial wt., lb	132.3	131.1	131.9	132.1
Daily gain, lb/d	1.89	1.86	1.82	1.86
Feed intake, lb/d	5.93	5.77	5.89	5.96
F : G	3.13	3.09	3.22	3.19
Hot carcass wt., lb	161.5	163.1	162.9	162.6
Carcass length, in[a]	31.2	31.2	31.3	31.5
Loin area, sq. in[a]	4.18	4.10	4.13	4.09
10th rib backfat, in[a]	1.62	1.57	1.52	1.58
% muscle[a]	43.8	44.1	44.6	44.1
% linoleic acid	1.76	3.20	4.60	6.10
Carcass firmness[b,c]	2.57	2.46	3.31	3.77
Penetrometer depth, mm[c]	49.57	51.45	57.30	60.05

[a] Hot carcass weight used as a covariate to adjust means.

[b] Subjective score on a scale of 1 to 5 (1=very firm, 5=very soft).

[c] Linear effect of dietary fat source ($P < .001$).

TABLE 10. SOME QUALITY SPECIFICATIONS FOR COMMONLY TRADED FATS

	Tallow	C. White Grease	Yellow Grease	Hydrolized A/V Blend
Total fatty acids, %	90	90	90	90
Free fatty acids, %	4-6	4	15	40-50
FAC color	19	11A	37-39	45
Moisture, %	0.5	0.5	1.0	1.5
Impurities, %	0.5	0.5	0.5	0.5
Unsaponifiables, %	0.5	0.5	1.0	2.5
Total MIU, %	1.0	1.0	2.0	4.0
Iodine value	48-58	58-68	58-79	85
AOM, hours	20	20	20	20
Fatty Acids				
Lauric / myristic	3.5	1.0	1-3	2.5
Palmitic	26	26	26	18-24
Steric	19.5	11.5	12-18	7-16
Oleic	41	58	45-55	35-50
Linolenic				2
Linoleic	2.5	8-10	15-20	22-28

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