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America's First New Crop in 100 years

- Centuries of Folklore
- Recent Scientific Rediscovery
- Today's Renewable Plant-sourced Resource

Jojoba is one of the finest cosmetic ingredients in the world. Its excellent inherent emolliency, moisturization and oxidative stability properties rank it as one of the top cosmetic lipid materials, natural or synthetic, in use today. However, simultaneously, jojoba in all likelihood, is also the most misunderstood cosmetic ingredient.

Many misconceptions are linked to jojoba, but none is more misleading than the misconception promulgated and propagated by its own common name, "Jojoba Oil". Jojoba is not a triglyceride oil! In fact, it is a complex mixture of naturally occurring long-chained linear esters with many functional cosmetic properties that are far superior to triglycerides. Over 97% of jojoba is composesd of an array of liquid wax esters, with a combination of mixed tocopherols, free sterols and other unsaponifiable material making up the balance.

In addition to the obvious chemical difference, jojoba differs from triglyceride seedoils in important functional features. Nearly all triglyceride fats and oils are easily hydrolyzed and oxidized for internal food metabolism. Jojoba, like other wax esters in nature, resists hydrolysis and oxidation for more effective, non-occlusive, moisture control and for photo-protection on the external surfaces of skin, hair, eyes and plant leaves. Astute international marketers who already recognize these differences are avoiding the word "oil" when referring to jojoba. With due

respect to those who refer to jojoba as an oil, for purposes of this publication the liquid wax esters from the jojoba tree will be described as *Natural Jojoba*.

Natural Jojoba's Use In Ancient America

For centuries *Natural Jojoba* has been held in high esteem for its valuable qualities by the Amerindians of Northern Mexico and the Southwestern United States. Early Spanish explorers and missionaries recorded that the native Amerindian inhabitants of the American Sonora Desert used it for sundry cosmetic and medicinal purposes, such as hair dressings, body oils, and skin salves. In addition, they attributed "mystical" powers to *Natural Jojoba* claiming that it could alleviate a myriad of bodily ills and cure external ailments such as cuts, scratches, and open sores.

Realizing that most legends have some basis in truth, research chemists in the 1930's first investigated the composition and properties of *Natural Jojoba*. These chemists realized, to their surprise, that Jojoba was <u>not</u> based on triglycerides (glycerol esterified to three long-chain carboxylic acids) as are essentially all naturally occurring liquid oils and solid fats. In fact, the researchers realized that the extract from jojoba seeds was the <u>only</u> plant-sourced material composed of liquid, long-chain esters. They were in-

trigued with Jojoba, but were very limited in their research due to the limitations of the technology of the day. Soon, *Natural Jojoba* fell into relative obscurity that lasted until the late 1960's and early 1970's.

Natural Jojoba's Rediscovery

In the late '60's and early '70's, two events transpired which brought Natural Jojoba into the limelight of cosmetic research and development. First, many nations of the world started to become "environmentally conscious" and realized the finite limitations on many of the world's resources. These nations, either collectively or independently, identified endangered plant and animal species around the world. Soon thereafter, they outlawed the hunting and/or harvesting of these species and prohibited the use of any materials derived from these sources. Among the endangered species was the sperm whale, whose spermaceti wax, a mixture of long chain esters, was greatly valued for its functionality in cosmetic applications. Scientists soon found that Natural Jojoba could not only replace spermaceti in all applications but discovered that it was actually superior to it.

Secondly, the cosmetic industry commenced a worldwide search for renewable, plant-sourced lipid materials to eventually replace nonrenewable, petrochemical sourced materials, when and if market, supply or cost factors dictated. It was obvious to many that *Natural Jojoba* completely satisfied the

needs created by both of the aforementioned events.

Natural Jojoba Is a Renewable, Plant-Sourced Ingredient

Natural Jojoba is sourced from the seeds of *Simmondsia chinensis*, which is a woody, evergreen, desert shrub indigenous only to the American Sonoran Desert. Jojoba seeds are a dark, reddish-brown color and about 1.0 to 1.5 centimeters long.

Approximately 50% of the weight of the seed is a mixture of long-chain liquid esters which is typically extracted by mechanical pressing. Unlike most triglyceride seed and nut crude oils, *Natural Jojoba* is very low in or virtually devoid of tars, gums, free carboxylic acids, hydroperoxides, phosphatides, chlorophylls, color bodies and malodorous low molecular weight carbonyl compounds. Expelled, crude Jojoba is naturally of high quality and purity as it flows from the mechanical presses.

In the past, the supply of jojoba depended on erratic rains in the desert. Today there is a very reliable supply from many millions of irrigated jojoba trees now grown in established orchards. Over the past 18 years American jojoba pioneers have for the first time in 100 years met the challenge of domesticating a wild plant and commercializing its product.

Structural and Functional Differences: Triglyceride Oils vs. Jojoba Esters

- Fat and Oil Chemistry
- Jojoba Chemistry
- Properties and Chemical Properties of Jojoba

Triglyceride oils are designed to be easily hydrolyzed and oxidized for their intended internal use as foods for energy.

Jojoba liquid wax esters are designed to resist hydrolysis and oxidation for their intended use in non-occlusive moisture control and photo-protection on external surfaces of skin, hair, eyes and plant leaves.

In understanding the functional differences between *Natural Jojoba* and triglyceride fats and oils, one must understand the molecular differences between long chain liquid esters and triacylglycerols. These differences are very significant even though jojoba, fats, and oils are all considered lipids.

(22 to 25° C). Triacylglycerol fats and oils, commonly known as triglycerides, are glycerols bonded to a myriad of carboxylic acids.

Lipids are important constituents of all plant and animal tissues. The lipid family of compounds includes members of many different structural groups such as fats, oils, waxes, sphingolipids, glycerophospholipids, and sterols. Although they do not share a common structure, lipids do share the property of being soluble in non-polar organic solvents, but insoluble in water. Their behavior differs from that of other important groups of biological molecules such as carbohydrates, proteins, and nucleic acids. Large alkyl portions found in the structures of all lipids are responsible for their solubility properties. Fats and oils are the most abundant lipids found in nature and are major components of storage fat cells in plants and animals. Fats and oils are very similar in chemical structure. The distinguishing factor is that fats are solid or semisolid at room temperature and oils are liquid at the same temperature

Figure I

$$\begin{array}{c} O \\ | \\ CH_2-O-CR \\ | \\ O \\ | \\ CH-OH \\ | \\ CH_2-OH \\ | \\ CH_2-O-CR \\ | \\ O \\ CH_2-O-CR \\ | \\ O \\ CH_2-O-CR \\ | \\ O \\ CH_2-O-CR \\ | \\ A \text{ triacylglycerol} \\ \end{array}$$

The carboxylic acids incorporated into fats and oils are customarily called "fatty acids". The most commonly encountered fatty acids have long, unbranched carbon chains and contain an even number of carbon atoms.

Structure	Trivial Name (substitutive name)
CH ₃ (CH ₂) ₁₀ CO ₂ H	lauric acid
CH ₃ (CH ₂) ₁₂ CO ₂ H	(dodecanoic acid) myristic acid (tetradecanoic acid)
$\mathrm{CH_{3}(CH_{2})_{14}CO_{2}H}$	palmitic acid (hexadecanoic acid)
$CH_3(CH_2)_{16}CO_2H$	stearic acid (octadecanoic acid)
$CH_3(CH_2)_5$ $C=C$ $(CH_2)_7CO_2H$	palmitoleic acid (cis-9-hexadecenoic acid)
H $CH_3(CH_2)_7$ $(CH_2)_7CO_2H$	oleic acid
$C = C \left(\frac{CH_2}{H}\right)$	(cis-9-octadecenoic acid)
$CH_3(CH_2)_4$ $C=C$ CH_2 $C=C$ $(CH_2)_7CO_2H$	linoleic acid (cis,cis-9,12-
н н т н	octadecadienoic acid)
CH_3CH_2 $C=C$ CH_2 $C=C$ CH_2 $C=C$ CH_2 $C=C$ CH_2 $C=C$ CH_2 $C=C$	linolenic acid (cis,cis,cis-9,12,15- octadecatrienoic acid)

Fatty acids containing no double bonds are known as "saturated" fatty acids. Fatty acids containing only one double bond are known as "monounsaturated" fatty acids. Likewise, fatty acids containing two or more double bonds are known as "polyunsaturated" fatty acids. Triglycerides in which all

three hydroxyl groups of glycerol are esterified to the same fatty acid are known as simple triglycerides as seen in Figure III. Triglycerides that contain two or three different fatty acids are called mixed triglycerides as shown in Figure IV

Figure III Simple Triglycerides

 $\begin{array}{c|cccc} O & O & O \\ CH_2-O-C(CH_2)_{10}CH_3 & CH_2-O-C(CH_2)_{16}CH_3 \\ & O & & & \\ CH-O-C(CH_2)_{10}CH_3 & CH-O-C(CH_2)_{16}CH_3 \\ & O & & & \\ CH_2-O-C(CH_2)_{10}CH_3 & CH_2-O-C(CH_2)_{16}CH_3 \\ & CH_2-O-C(CH_2)_{10}CH_3 & CH_2-O-C(CH_2)_{16}CH_3 \\ & & & \\ CH_2-O-C(CH_2)_{10}CH_3 & CH_2-O-C(CH_2)_{16}CH_3 \\ & &$

Figure IV Mixed Triglycerides

$$CH_{2}-O-C(CH_{2})_{14}CH_{3}$$

$$CH-O-C(CH_{2})_{14}CH_{3}$$

$$CH-O-C(CH_{2})_{14}CH_{3}$$

$$CH_{2}-O-C(CH_{2})_{7}CH = CH(CH_{2})_{7}CH_{3}$$

Table I Fatty acid compositions of typical samples of widely used fats and oils (only components present to the extent of 1 to 2% or more are indicated).

		Saturat	ed Acids	d Acids Unsaturated Acids			ated Acids	
					1 C=	С	2 C=C	3 C=C
Graisse ou huile	C ₁₂ Lauric acid	C ₁₄ Myristic acid	${ m C_{16}} \ { m Palmitic} \ { m acid}$	C ₁₈ Stearic acid	$ m C_{16}$ Palmitoleic acid	C 18 Oleic acid	C 18 Linoleic acid	C ₁₈ Linolenic acid
Animal fat								
Butterfat ^a	4	12	29	11	4	25	2	
Lard		3	24	18	3	42	9	
Tallow (beef fat)		3	26	17	6	43	4	
Vegetable oils								
Coconut b		18	11	6		7	2	
Corn	44		13	4		29	54	
Cottonseed		1	29	4	2	24	40	
Linseed		6	4			22	16	52
Olive			14	2	2	64	16	
Palm		1	48	4		38	9	
Peanut c			6	5		61	22	
Safflower			8	3		13	75	1
Soybean			11	4		25	51	9

 a Butterfat also contains butanoic acid (3%), hexanoic acid (1%), octanoic acid (1%), decanoic acid (3%), and

^cPeanut oils also contains linear, saturated carboxylic acids with 20 carbons (2%) 22 carbons (3%), and 24 carbons (1%).

Figure V **Cis and Trans Double Bonds**

$$\begin{array}{cccc}
H & & H & \\
R & & R & \\
Cis & & Trans
\end{array}$$

Stereochemically, all double bonds of naturally occurring fatty acids are "cis" rather than the more stable "trans" configuration. Even though attractive forces between chains in different molecules tend to increase with increasing chain length, the cis double bonds make it more difficult for these chains to pack together thus inhibiting the formation of a solid from a liquid state. Due to the cis double bond characteristic and the overall triglyceride molecular configuration, fats and oils are susceptible to oxidation at the double bond sites and hydrolytic attacks at the ester

linkage. The oxidatively unstable temperament of natural triglycerides will be discussed further in a later section.

Natural Jojoba Is NOT A Triglyceride Fat Or Oil: Structurally or Functionally

Technically, Triglyceride fats and oils are used in plants and animals primarily as a source of energy. Wax esters are used primarily for moisture control, protection and emolliency. Wax esters are generally present only on the surface layers of animal skin and plant leaves. Only the jojoba tree produces commercial quantities of this functional liquid material in its seeds. (Solid carnauba wax is from the leaves of palm trees.)

Natural waxes are complex mixtures of organic compounds that include carboxylic acids, long chain alcohols and to a much lesser extent, alkanes. *Natural Jojoba* is a mixture of long chained, unbranched liquid wax esters that result from the esterification of an Omega-9 (double bond located between the ninth and tenth carbon), monounsaturated linear fatty acid and an Omega-9, monounsaturated linear fatty alcohol.

$$\text{R-OH} + \text{HO-C-R}^{\bullet} \longrightarrow \text{R-O-C-R}^{\bullet} + \text{H}_2\text{O}$$

The fatty alcohol and fatty acid moieties almost always contain an even number of carbon atoms. TABLE II lists the alcohol/acid combinations found in *Natural Jojoba*.

Table II	Wax Ester Isomeric (of Jojoba	
Wax Ester Chain Length	Combination of Alcohol / Acid	Percentage by GLC and GC/MS
34	18 / 16	0.1
36	18 / 18	0.1
	20 / 16	1.8
38	16 / 22	0.2
	18 / 20	1.0
	20 / 18	5.4
	22 / 16	0.2
40	16 / 24	0.6
	18 / 22	1.5
	20 / 20	24.3
	22 / 18	3.6
	24 / 16	0.3
42	18 / 24	1.5
	20 / 22	10.5
	22 / 20	37.0
	24 / 18	1.0
44	20 / 24	0.9
	22 / 22	2.1
	24 / 20	7.0
46	24 / 22	0.8
48	24 / 24	0.1

Table III Composition and Structure of Fatty Alcohols and Fatty Acids Derived from Jojoba Oil (Analysis by GLC, Ozonolysis-GC and GC-MS)

Alcohols	(%)	Acids	(%)
Tetradecanol	trace	Dodecanoic	trace
Hexadecanol	0.1	Tetradecanoic	trace
Heptadec-8-enol	trace	Pentadecanoic	trace
Octadecanol	0.2	Hexadecanoic	1.2
Octadec-9-enol	0.7	Hexadec-7-enoic	0.1
Octadec-11-enol	0.4	Hexadec-9-enoic	0.2
Eicosanol	trace	Heptadecenoic	trace
Eicos-11-enol	43.8	Octadecanoic	0.1
Hecos-12-enol	trace	Octadec-9-enoic	10.1
Docosanol	1.0	Octadec-11-enoic	1.1
Docos-13-enol	44.9	Octadecadienoic	0.1
Tetracos-15-enol	8.9	Octadecatrienoic	trace
Hexacosenol	trace	Nonadecenoic	trace
		Eicosanoic	0.1
		Eicos-11-enoic	71.3
		Eicosadienoic	trace
		Docosanoic	0.2
		Docos-13-enoic	13.6
		Tricosenoic	trace
		Tetracosenoic	trace
		Tetracos-15-enoic	1.3

The dominant fatty alcohols and fatty acids of Jojoba are of C-20 and C-22 in length. Note that the unbranched, long-chain nature of the alcohol and acid moieties give jojoba

esters their non-polar behavior. TABLE IV lists and quantifies the five major liquid esters found in *Natural Jojoba*.

Tableau IV

Five Major Jojoba Esters

Docos—cis—13—enyl Eicos—cis—11—enoate	37 %	
Eicos—cis—11—enyl Octadec—cis—9—enoate	24	
Eicos—cis—11—enyl Docaos—cis—13—enoate	10	
Tetracos—cis—15—enyl Eicos—cis—11—enoate	7	
Eicos—cis—11—enyl Octadec—cis—9—enoate	6	
(Number of other combinations $= 21$)		

Natural Jojoba esters are beautifully simple in molecular configuration, symmetry and stability. These esters are surprising in their cosmetic multifunctionality, and are very similar to the esters that make up 25-30% of human sebum. An even higher level

of similar esters from modified sebaceous glands called Meibomian Glands forms a monolayer of lipids that covers the outer surface of the aqueous tearfilm of the eye. When it is deficient, the tears evaporate four times faster.

Figure VI



Stereochemically, jojoba's double bonds are cis in character. It is believed that this cis configuration in jojoba's linear ester mol-

ecules actually adds superior emolliency traits to the *Natural Jojoba* esters.

Figure VII

$$CH = CH \qquad O \qquad CH = CH$$

$$/ \qquad | | \qquad / \qquad |$$

$$CH_3 - (CH_2)_7 \qquad (CH_3)_m - C - O - CH_2 - (CH_2)_n \qquad (CH_2)_7 - CH$$

$$m = 7-13$$

$$n = 8-14$$

Physical and Chemical Properties of *Natural Jojoba*

Physical and chemical properties often define and distinguish chemical compounds and mixtures from one another. Based on these properties market specifications can be determined. *Natural Jojoba* is no different from other cosmetic ingredients in this aspect. TABLE V lists typical values for many of the physical and chemical properties associated with *Natural Jojoba*.

Freezing point, C	10.6-7.0
Melting points, C	6.8-7.0
Boiling Point at 757 mm under N ₂ , C	389
Heat of fusion by DSC, cal/g	21
Refractive index at 25 C	1.4650
Dielectric constant (27 C)	2.680
Specific conductivity (27 C) mho/cm	$8.86.10^{-13}$
Specific gravity, 25 / 25 C	0.863
Viscosity Rotovisco (25 C)	
MV-1 rotor in MY cup, cp	35
Plate and cone with PK-1, cp	33
Brookfield, spindle #1, 25 C, cp	37
Cannon-Fenske, 25 C, cp	50
Cannon - Fenske, 100 C, centistoke	es 27
Saybolt, 100 C, SUS	127
Saybolt, 210 C, SUS	48
Smoke point (AOCS Cc 9a - 48), C	195
Flash point (AOCS Cc 9a - 48),C	295
Fire point (COC), C	338
Iodine value	82
Saponification value	92
Acid value	<2
Acetyl value	2
Unsaponfiable matter, %	51
Total acids, %	52
Iodine value of alcohols	77
Iodine value of acids	<76
Average molecular weight of wax esters	606
Peroxide value	<1.0
Moisture	<300 ppm
Phosphorus	50-100 ppm
Viscosity index	232
Color (Lovibond 5.25" cell)	< 65Y, 5.0 R
Organoleptic	mild, typical fatty

Experience garnered by United States jojoba growers and processors over the past 15 years has shown that many of jojoba's properties do not vary from year to year or from lot to lot. There are, however, some properties that do vary depending on the condition of the seed that is crushed. Armed with the knowledge that to a significant degree, the quality of the end product depends on the condition of the seed to be crushed, U.S. producers have developed advanced methods of harvesting, seed handling, processing, and storage that result in optimal seed condition for the highest quality end product. TABLE VI lists the most used and most important inherent properties that define the quality of Natural Jojoba.

Table VI Properties and Analytical Methods for Jojoba Quality

Acid Value	AOCS Ci 4-91
Moisture	AOCS Ca 2c-84
Phosphorous	AOCS Ca 12b-92
Color	AOCS Cc 13b-45
Oxidative Stability (OSI)	AOCS Cd 12b-92
Peroxide Value	AOCS Cd 8-53

Acid value is the most frequently determined property of *Natural Jojoba*. Total acid value of jojoba is typically in the range of 0.2-0.5 (mg of KOH to neutralize acid in 1 gram of sample) and it can be reduced to less than 0.2 with refining methods.

The moisture content of *Natural Jojoba* is typically less than 300 ppm. It typically contains between 50 and 100 ppm of phosphorous in the form of hydratable and nonhydratable phospholipids. The phospholipids are considered a positive component in many cosmetic applications, but too high a level may cause turbidity and cloudiness in the jojoba.

The peroxide value of *Natural Jojoba* is used as a measure of its relative oxidation state at a single point in time. Typically, jojoba's peroxide value at time of packaging is less than 0.8 milliequivalents of peroxide per Kg of sample. Oxidative stability of jojoba will be discussed further in a later section.

Many properties of *Natural Jojoba* remain constant or at least vary within a known range. Variation in the values beyond the ranges presented could indicate that contamination or adulteration have occurred. TABLE VII shows the more important analytical tests which monitor *Natural jojoba's* purity.

Table VII Properties and Analytical Methods for Jojoba Purity

Hydrocarbons	AOCS Ca 6c-65
Triglycerides	AOCS Ci 2-91
Iodine Value	AOCS Cd 1-25
Saponification Number	AOCS Cd 3-25

Natural Jojoba contains no hydrocarbons in the form of mineral oils and very little if any triglycerides. The hydrocarbon analysis tests for mineral oil adulteration at levels of 5.0% or more. Likewise, the triglyceride analysis can also test for levels of 5% or more.

Iodine Value is a measure of unsaturation (number of double bonds). *Natural Jojoba* is almost exclusively composed of "dienes" making its Iodine Value similar to that of oleic acid. Iodine values are typically in the range between 78 and 90.

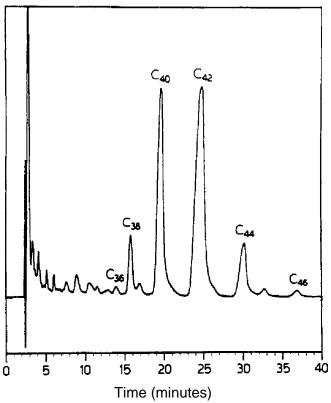
The Saponification Number of *Natural Jojoba* also is constant and ranges from 85-100. The Saponification Number measures the amount of KOH in mg required to saponify 1 gram of sample.

The American Oil Chemists Society in cooperation with the American jojoba industry has in recent years implemented new chromatographic techniques in the determination of purity of *Natural Jojoba*. Originally, these techniques were developed in studies on triglyceride fats and oils. Modifications of procedures were necessary because liquid wax esters differ significantly from fats and oils and warrant special steps in order to optimize results. Three chromatographic methods are used commonly in jojoba purity determination today.

- 1) High-Performance Liquid Chromatography (HPLC)
- 2) Gas-Liquid Chromatography (GLC)
- 3) Capillary GLC

With the advent of pulse-free pumps and micro-particulate column packings, HPLC is an excellent test for distinguishing between similar structures. When used on *Natural Jojoba*, HPLC will render a complete separation of the homologous long chain esters and if the HPLC instrument is calibrated properly, the refractive index detector can be used as a quantitative tool. HPLC provides convenient acquisition of the homologs without harsh treatments and each "peak" can be collected easily as it emerges from the detector.

Figure VIII

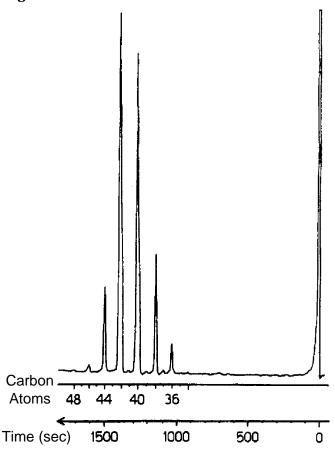


High-performance liquid chromtography jojoba oil. Column: 250x4.5 mm ODS (octadecylailane) (Whatman). Solvent: Acetone/acetonitrile (3/1). Detection by differential refractometry.

GLC provides very good qualitative and quantitative information about components in *Natural Jojoba*. The percentage of each long chain ester plus the overall fatty acid and fatty alcohol compositions can be easily obtained. Determinations of purity are commonly done on packed columns. Although GLC procedures give accurate compositional data, many purity determinations are being performed using the more sensitive capillary GLC technique. Capillary GLC offers more information about *Natural Jojoba* samples than the standard GLC.

HPLC, GLC, and Capillary GLC all effectively determine purity at a reasonable cost, thus allowing many producers and marketers of *Natural Jojoba* to perform routine, in-house quality control analyses.

Figure IX



Gas-liquid chromatography of jojoba oil. Column: OV-1, 3mx 0.28 mm, with a 0.1 m film thickness. Injector-325 C; detector-350 C; oven: 1 min at 190 C then programmed to 340 C at 5 C/min. From Graille et al.

Jojoba's Extraordinary Oxidative Stability

- Jojoba Meets the Special Stability Challenge of "Naturals"
- Jojoba Exceeds the Stability of Vegetable Oils
- It Improves Shelf-life and Protects from Free Radicals

Natural Jojoba is Extremely Stable

Natural Jojoba has been shown to be extraordinarily stable in extreme temperatures. Jojoba can be heated to 370°C over a 96 hour period without displaying degradation in general composition and carbon chain length. In addition to thermal stability and of more importance to the cosmetic chemist, jojoba also has unsurpassed oxidative stability.

One of the most important functional characteristics of any non-polar cosmetic material is its oxidative stability. This is even a more important consideration when dealing with natural materials. For thousands of years ointments, salves and many cosmetic preparations were single phase lipid systems. Civilizations up through the 19th century used triglyceride fats and oils sourced from plants and animals in their cosmetic preparations. Some of the more commonly used oils were olive, sunflower, safflower, rubberseed, soybean, and sesame. These plant oils, as with animal fats, had the unwanted characteristic of quickly developing rancid odors due to oxidation. In an effort to counteract these malodorous notes, high concentrations of pleasant scents and aromatic fragrances were added. This practice of "masking" continued through the ages until two technological breakthroughs occurred in the 20th century which dramatically contributed to changes in the cosmetic industry.

The first advance was the contribution of

petroleum refining technology to yield relatively pure paraffinic hydrocarbon oils by use of distillation towers. These essentially odorless hydrocarbon oils provided long-term oxidative stability. The official nomenclature of these paraffinic hydrocarbon oils is mineral oil, petrolatum and paraffin wax. Since these hydrocarbons offered resistance to oxidation, they quickly replaced natural triglycerides resulting in cosmetic formulations with reduced potential of developing rancid odors and greatly improving shelf life. Their lack of biodegradability was not a serious concern at that time.

The second technological breakthrough was the emergence of synthetic emulsifiers and emulsifier technology. This led to the formulation of stable emulsions combining both water and lipid phases greatly increasing functionality and cosmetic product diversity.

Segments of the cosmetic industry are now coming full circle. Many of today's cosmetic consumers are demanding that cosmetic formulators produce formulations utilizing natural ingredients once again. These "naturals" for the most part are not oxidatively stable. Thus, the consumer has created an apparent dilemma for the cosmetic formulator by demanding oxidative stability and increased usage of naturals, while simultaneously requiring the 21st century functionality of a high-end "cosmeceutical." In response to market demand, the cosmetic industry is searching for renewable, plant-sourced lipid alternatives to mineral oils,

petrolatums and paraffin waxes. *Natural Jojoba* has definitely been identified as a natural material that meets these criteria and satisfies consumer demand.

Natural Jojoba liquid esters help stabilize oxidatively sensitive natural and synthetic active ingredients. For example, a major cosmetic manufacturer's U.S. Patent No.4393043 states that "Essential fatty acids are rendered oxidation stable by mixture with jojoba oil to form a solution." It describes a cosmetic system which utilized Natural Jojoba for "its remarkable properties." The patent states," The present invention relates to a solution, which is stable to oxidation, of at least one essential fatty acid, in particular vitamin F, and of a vegetable oil, and also to various cosmetic compositions in which a solution of this type is present The cosmetic use of vitamin F has come up against a particularly acute difficulty essentially due to its high instability to oxidation by the oxygen in the atmosphere. In fact, it has been found that decomposition products with a rancid odor form very rapidly In an attempt to overcome these various disadvantages and to obtain compositions of high stability to atmospheric oxidation, it has been found, surprisingly, according to the present invention, that this result can be achieved if the essential fatty acid, in particular, vitamin F is used in association with a particular vegetable oil, namely jojoba oil which stability is not present with other vegetable oils, such as sunflower seed oil."

The kinetic mechanism of rancidity is autoxidation. Autoxidation is an autocatalytic reaction which forms free radicals that in turn catalyze and promote further oxidation reactions. This chain reaction of oxidation on lipid molecules can be broken down into three reaction components:

1) Initiation. Abstraction of a proton from a carbon atom of a fatty molecule forms a free radical (RH represents a fatty molecule in which H is the allylic hydrogen):

$$RH \longrightarrow R^{\cdot}$$

2) Propagation. Reaction of a free radical. The reaction of the peroxide free radical with another fatty molecule (abstracting a proton from a carbon atom) forms a hydroperoxide and another free radical:

$$\begin{array}{ccc} R^{\cdot} + O_2 & \longrightarrow & ROO \\ ROO & \longrightarrow & ROOH + R^{\cdot} \\ ROOH & \longrightarrow & RO^{\cdot} + OH \end{array}$$

3) Termination. Reaction of two free radicals together can terminate the autoxidation reaction:

$$R' + ROO \longrightarrow ROOR$$

 $R' + R \longrightarrow R - R$

As a result of oxidation, hydroperoxides and decomposition products of hydroperoxides (such as low molecular weight carbonyl compounds) are formed which at the very least are malodorous. In addition to reducing shelf life with rancidity, free radicals have been strongly implicated in premature aging and cancerous changes in the skin. One effect is strong cross-linkage of collagen and an increase in soluble collagen to cause thin, inflexible, wrinkled skin. Free radical breakdown of hyaluronic acid diminishes the skin's water-holding capacity. Free radicals can attack the vulnerable phospholipids of the cell membranes, thereby gaining access to DNA, increasing the risk of cancer mutations.

The two most dominant factors inherent in natural lipid materials that affect their oxidative stability are <u>molecular configuration</u> and the presence of antioxidants.

Molecular Configuration: *Natural Jojoba* esters enjoy a relatively simple yet very stable configuration. The long chain linear esters of jojoba are recognized to be significantly less reactive to oxidation than their structure (eg Lewis structure model) would predict. In part, jojoba's superior stability is attributed to the resonance effect along the molecule's chain. This enhances the resistance of the double bonds to oxidation

Natural Jojoba esters are dienes. The

double bonds are widely separated and are more or less equidistant from the central ester linkage. These bonds are considered "isolated" and their shared electrons are well protected against oxidation. Polyunsaturated fatty acids esterified to glycerol on the other hand, typically have their double bonds in close proximity to one another (the first double bond usually starting at the Omega-6, Omega-9, or Omega-12 position) and often are separated only by two single covalent bonds.

Figure X Structure du jojoba comparée à celle de l'huide de carthame

Huile de carthame (structure de triglycéride)

Due to this close proximity, reactions at these double bond sites are complex and react interdependently, resulting in double bond sites that are very weak to attack by oxidizing agents because they cannot hold their shared electrons. The basic configuration of the triglyceride molecule incorporating polyunsaturated fatty acids expedites chemical reactivity. This makes triacylglyerols efficient, internal, food energy sources, but reduces their efficiency as external protectants.

Antioxidants: *Natural Jojoba*, as well as fats and oils from plants, all contain tocopherols which are known to act as free radical scavengers. The mix of Vitamin E and its isomers found in jojoba, is shown in the

following Table VIII. However, the level of oxidative stability demonstrated by jojoba is higher than would be expected from its 50 ppm tocopherol content. Scientists have, therefore, postulated the presence of a more powerful antioxidant.

Table VIII The Tocopherols Present in Jojoba Oil

Jojoba sample .	Amo	unt of isomer	(ppm)
1	16.9	37.7	12.5
2	10.2	25.0	7.4
3	10.9	23.8	7.4
4	9.0	21.9	8.5
5	10.2	40.5	5.6
6	11.2	42.5	7.5
7	19.0	38.7	0

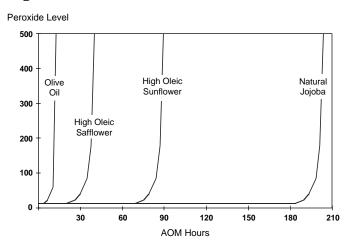
Comparison Studies Prove *Natural Jojoba's* Superior Stability

Oxidative stability studies comparing *Natural Jojoba* to commonly used triglyceride fats and oils demonstrate jojoba's incomparable stability. These studies were of three different types:

- 1) Active Oxygen Method (AOM)
- 2) Thermogravimetric Analysis (TA)
- 3) Oil Stability Index (OSI)

The Active Oxygen Method (AOCS Cd 12-57) for determining the stability of fats and oils has been used widely for years. Oxidation is slow until the resistance of a material is overcome at which point oxidation accelerates and becomes very rapid. The length of time before this rapid acceleration of oxidation is the measure of the resistance to oxidation and is commonly referred to as the "induction period. "In the AOM, the induction period is determined by bubbling a stream of purified air through a sample of known weight which is held in a thermostated bath. Five gram samples are extracted on a regular basis and analyzed for hydroperoxide content using the Peroxide Value method previously mentioned. When the peroxide value reaches 100, the test is considered completed and the induction period is calculated usually in hours.

Figure XI Auto-oxidation Curves



The TA method measures weight increase of a sample as a function of 0_2 uptake. The TA method places samples of known weight (generally 0.5 ± 0.01 grams) in 10 ml beakers which then are placed in a thermal gravity oven set usually at around 80° C with a continuous and uniform stream of purified air blown into the oven. The samples are then left in the oven for a given period of time (up to two weeks). At daily intervals, the beakers are removed, allowed to cool in a desiccator for 15 minutes, weighed in a uniform sequence and replaced in the oven.

A TA comparison test was performed on jojoba and some oils used in cosmetics. The results are listed in TABLE IX.

Natural Jojoba was unquestionably superior to the safflower oils and the bioengineered, high-oleic, sunflower oils. It should be noted that the mineral oil designed for cosmetic applications was received from a commercial source which routinely included mixed tocopherols as an antioxidant.

Apparent change in weight* of various oils at 80 C (500 mg samples)

Days	Jojoba Oil	Hydrogenated Jojoba Oil	Mineral Oil**	Safflower Oil Food Grade	Safflower Oil High Oleic	Safflower Oil High Oleic 83	Safflower Oil High Oleic 89
1	0	0	-4.7	0	0	-	-
$\overline{2}$	-	0.4	-5.5	2.7	0.6	0	0
3	0	0.5	-9.0	3.8	-0.3	0.1	0.1
4	2.6	1.0	-8.6	4.0	2.9	0.5	1.0
5	0.4	0.7	-8.2	-	4.4	-0.1	0.5
6	1.2	0.5	-7.8	-	-	-0.3	0.2
7	1.0	0.9	-8.4	-	-	0.2	0.5
8	0.4	0.7	-8.6	-	-	2.4	0.6
9	1.9	0.7	-9.6	-	-	5.3	0.4
10	2.2	0.5	-9.7	-	-	-	0.6
11	1.0	0.4	-9.7	-	-	-	1.6
12	2.0	0.7	-9.7	-	-	-	6.3
13	2.0	1.0	-9.7	-	-	-	-
14	1.9	1.0	-9.8	-	-	-	-
15	1.9	1.0	-9.8	-	-	-	-

^{*} Actual weight considered as initial weight. All values in mg units.

The newest and preferable method is the OSI. The OSI was developed as an automated replacement for the AOM. This method is applicable in general to all fats and oils as well as Natural Jojoba. For determining the induction period, a stream of purified air is passed through a sample of known weight which is held in a thermostated bath. The effluent air from the oil sample is then bubbled through a vessel containing deionized water. The conductivity of the water is continually monitored. The effluent air contains volatile organic acids swept from the oxidizing oil that increase the conductivity of the water as oxidation proceeds. The conductivity of the water is monitored by a computer or strip chart recorder. The OSI is defined as the point of maximum change of the rate of oxidation, or mathematically as the maximum of the second derivative of the conductivity with respect to time.

Pigure XII

Raw data

2nd Derivative

1st Derivative

OSI determined by first and second derivatives.

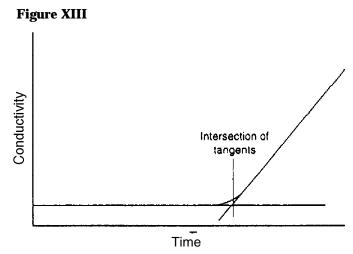
This time-based end-point may be determined by a computer which can calculate the maximum of the second derivative with respect to time, or by a slope-change algorithm, which is similar to detecting the onset of peaks for integration of GLC or capillary

^{**} Initial weight was considered the smallest weight before a weight increase.

GLC Chromatograms. The end-point may be approximated by using other methods. One commonly used approximation is a graphic method in which tangents are drawn.

The OSI may be run at any temperature, but 110° C. was chosen due to its covenience for most oils. In order to standardize research and specification communication, all results should be reported at or factored to 110° C. All OSI results should specify the OSI time with the analysis temperature reported immediately after (i.e. "OSI 11.7 hours at 110° C").

Natural Jojoba and several triglyceride oils and oil blends were tested using the OSI method at 110° C and 130° C.



OSI determined by tangential method.

Table X Statistical results of interlaboratory study in which samples were analyzed at 110 C

	Sample ^a								
	A	В	С	D	E	F	I	J	L
Number of									
labs after removal of									
outliers	15	14	15	15	13	14	13	12	13
n	58	55	56	57	48	52	49	45	51
Outliers	0	3	1	1	8	4	0	4	0
Means, hours ^b	10.1	7.7	17.9	23.7	13.9	46.5	68.1	69.7	18.6
Repeatability									
S	0.6	0.4	0.8	0.9	0.3	1.2	4.2	3.5	1.8
RSD	5.96	4.80	4.34	4.00	2.11	2.51	6.22	5.03	9.62
r (2,8 x S)	1.68	1.12	2.24	2.52	0.8	3.36	11.76	9.80	5.04
Reproducibility									
S _R	1.3	0.9	2.0	1.9	1.14	4.1	13.5	9.0	4.4
RSD R	12.33	11.23	11.09	8.13	8.18	8.92	19.88	12.92	23.93
$R (2.8 \times S_R)$	3.64	2.52	5.60	5.32	3.19	11.48	37.91	25.23	12.32

^a Key to samples: A, sunflower/soybean oil blend; B, nonhyrdogenated soybean oil; C, liquid/hydrogenated soybean old blend; D, hydrogenated soybean oil/cottonseed oil blend; E, liquid/hydrogenated corn oil blend; F, hydrogenated corn oil/cottonseed oil blend; I, jojoba; J, high-stability oil; L, crude corn oil.

^b Induction period in hours.

Table XI Statistical results of interlaboratory study in which samples were analyzed at 130 C

	Sample ^a						
	A	С	D	Е	F	I	J
Number of							
labs after							
removal of							
outliers	14	14	14	14	14	11	14
n	51	51	53	54	50	41	49
Outliers	1	0	2	2	3	4	4
Means, hours ^b	2.6	4.4	5.8	3.4	10.9	11.5	16.1
Repeatability							
S	0.13	0.18	0.18	0.13	0.46	0.39	0.60
RSD	4.96	4.14	3.13	3.85	4.24	3.44	3.70
r (2,8 x S)	0.36	0.50	0.50	0.36	1.29	1.09	1.01
Reproducibility							
S_R	0.32	0.49	0.54	0.39	1.09	1.74	1.70
RSD_R	12.26	11.04	9.27	11.37	10.01	15.17	10.51
$R (2.8 \times S_R)$	0.90	1.37	1.51	1.09	3.05	4.87	4.76

^aKey to samples: A, sunflower/soybean oil blend; C, liquid/hydrogenated soybean old blend; D, hydrogenated soybean oil/cottonseed oil blend; E, liquid/hydrogenated corn oil blend; F, hydrogenated corn oil/cottonseed oil blend; I, jojoba; J, high-stability oil.

Hydrogenation is a common practice used to increase the stability of many fats and oils. Hydrogenation breaks double bonds of the

fatty acid components of triglycerides and adds hydrogen to the carbon atoms resulting in a single covalent bond.

Figure XIV

Hydrogenation of "trioleate" to "tristearate"

$$\begin{array}{c} O \\ | \\ CH_2-O-C(CH_2)_7CH = CH(CH_2)_7CH_3 \\ | O \\ | CH-O-C(CH_2)_7CH = CH(CH_2)_7CH_3 \\ | O \\ | CH_2-O-C(CH_2)_7CH = CH(CH_2)_7CH_3 \\ | O \\ | CH_2-O-C(CH_2)_7CH = CH(CH_2)_7CH_3 \\ | CH_2-O-C(CH_2)_7CH_3 \\ | CH_2-O-C($$

Hydrogenation does change the chemical and physical properties of the oils, and in many cases makes them aesthetically less appealing cosmetically due to increased "greasiness" and "heaviness."

The OSI comparative study clearly shows in another format that Natural Jojoba is superior to most oils and fats. Surprisingly, jojoba even compared favorably to synthetically produced "high stability" oil which was designed for use in experimental oxidative stability studies.

Oxidation and rancidity are primary adversaries to the cosmetic formulator. They have been and will continue to be a challenge in formulating. Natural Jojoba's extraordinary oxidative stability helps meet that challenge.

bInduction period in hours.

Jojoba's Use in Cosmetics

- Different Grades of Jojoba
- Very Well Established Safety
- Applications in Skin and Hair Products

Different Grades of Jojoba

Simmondsia chinensis produces a marvelously consistent mixture of liquid esters. Extraction of *Natural Jojoba* from seeds that are in optimal condition results in a very pure and clean initial product that requires minimal processing and/or refining to produce a very high quality, consistent end product.

After mechanical extraction, Jojoba is generally screened to remove tiny bits of sediment called "footes" and then filtered. The jojoba is then placed into an insulated processing tank, where it is pasteurized to further ensure product safety and quality. Four grades of Jojoba can then be produced:

- 1) Pure, natural, golden grade
- 2) Refined and bleached grade
- 3) Decolorized/deodorized grade
- 4) Molecular distilled grade

With the <u>pure</u>, <u>natural</u>, <u>golden grade</u>, no further processing is needed after filtration and pasteurization, although for some enduse applications removal of phospholipids is preferable. The jojoba is simply packaged for storage and shipment. This grade of jojoba has a golden-yellow color (Lovibond of approximately 50-60 Yellow, 3.0-5.0 Red). Organoleptically, this grade has a very slight, pleasant odor peculiar to jojoba.

From the early 1980s <u>refined and bleached</u> grade jojoba has also been available. The

color bodies are removed with bleaching earths and filtration. Various degrees of decolorization can be attained by this method with Lovibond readings that are typically between those of pure golden jojoba and decolorized/deodorized grade. This grade of jojoba retains a slight odor.

More recently, many cosmetic manufacturers are requiring a colorless and odorless jojoba for fine cosmetic formulations with delicate color and scent schemes. The <u>decolorized/deodorized grade</u> of Jojoba was developed specifically for these applications, but can be used in a more diverse range of cosmetic products. It is deodorized under an effective vacuum at certain "retention" times and temperatures that do not modify the liquid wax esters. The organoleptic odor characteristics of this grade are virtually eliminated and color is reduced to almost water-white with Lovibond colors of = 1.0 Yellow and = 0.2 Red.

Molecular distilled grade jojoba is produced in only minimal quantities today. Molecular distillation is very expensive and losses are considered high. In years past, this grade was produced for formulations requiring an odorless and colorless jojoba. With great strides in refining technology, this expensive physically refined grade is being replaced by the more economical decolorized/deodorized grade whose characteristics, on the whole are not significantly distinguishable from those of molecular distilled jojoba.

Jojoba's Safety Is Very Well Established

In formulating cosmetic products, the cosmetic chemist needs problem-free ingredients that have been tested and found to be safe and effective. The Scientific Literature Review and Technical Analysis prepared for the highly respected Journal of the American College of Toxicology concluded that jojoba is safe as a cosmetic ingredient in concentrations from 0.1% to 25%. This extensive review documents studies on toxicity, skin irritation, comedogenicity, skin sensitization, mutagenicity, phototoxicity and photoallergenicity.

University of Michigan studies revealed that jojoba with its hypocaloric profile, does not support growth of common microorganisms including pathogens such as Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans. Natural Jojoba's oxidative stability, thermal stability and lack of support for microbial growth can also increase a products safety and/or decrease its dependence on antioxidants, preservatives and stabilizers. Extensive use of jojoba as an ingredient in a wide diversity of products by millions of consumers over the past 15 years, as well as widespread use of 100% pure jojoba on skin and hair without adverse effects also verifies its safety.

Jojoba In Skin Care Cosmetics

Many of the most effective ingredients for skin care formulations are those with chemical composition and physical properties similar to the skin's own surface layers. Since jojoba is completely miscible with sebum, when it is applied to the skin, a very thin, non-greasy lipoid layer of jojoba and sebum forms. This partially porous layer provides exceptional transepidermal respiration and moisture control. Unlike greasy occlusive materials such as petrolatum, mineral oils and some lanolin products,

jojoba provides an absolutely non-tacky and non-greasy, DRY EMOLLIENCY.

At the same time jojoba significantly reduces transepidermal water loss without totally blocking transpiration of gases and water vapor. This function is enhanced by the kinking at jojoba's cis configuration that helps avoid tight packing of hydrocarbon chains. *Natural Jojoba* serves as an excellent moisturizing agent with exceptional spread and lubricity, and leaves a rich velvety non-oily feel on the skin while retarding water loss and enhancing the flexibility and suppleness of the skin.

Through continued research work, there is growing evidence that jojoba quickly permeates the skin and exhibits softening ability from within. Pharmacodynamic studies of the penetrability of lipids have shown that there are six general factors that influence the rate of permeation into the stratum corneum:

- Viscosity: Low viscosity oils poses higher rates than high viscosity oils. *Natural Jojoba* has a low viscosity.
- Degree of Unsaturation: Unsaturated oils exhibit higher rates of permeation.
- Saponification Value: The lower saponification value, the higher the rate.
 Natural Jojoba has a low saponification number.
- Carbon Chain Length: The shorter the chain length, the higher the rate.
- Lecithin Content: The lesser the amount of lecithin in an oil, the greater the rate of penetration. Jojoba has no lecithin.
- Molecular Configuration: Straight chain and branched esters penetrate better than do triglyceride oils.

Natural Jojoba is comprised of monounsaturated fatty acids and monounsaturated fatty alcohols. It has a comparatively low saponification value and contains little to no lecithin. Table XII shows that jojoba compares extremely well to specialty oils used in cosmetics. The iodine value is a measure of unsaturation specific gravity that indicates the heavy feel of an oil.

Table XII

	Iodine	1	Specific Gravity
Oil	Value	Value	(35°C)
Jojoba	81-88	92-97	0.863
Almond	95-115	183-200	-
Aloe Vera	-	192-201	0.840
Apricot Kermel	95-115	185-195	0.917
Avocado	65-94	177-198	0.913
Castor	83-88	176-185	0.936
Cherry Pit	95-115	182-202	0.940
Olive Oil	79-88	190-195	0.912
Peach Kernel	96-110	187-192	0.921
Rice	100-105	180-190	-
Safflower	135-155	182-202	0.923
Sesame	103-116	188-195	0.918
Sunflower	120-140	185-195	-
Wheat Germ	120-140	175-195	0.920

Percutaneous absorption studies at the University of Michigan demonstrated that jojoba is quickly absorbed into the skin. Absorption is apparently via the transappendegeal mechanism and occurs through the pores and hair follicles. Additionally, because jojoba is rapidly absorbed, the pores and hair follicles can remain open and thus maintain their proper functioning ability. From the pores and hair follicles, jojoba diffuses into the corneal layer of the skin probably via a pilosebaceous mechanism.

Viscoelastic dynametric tests have registered a 37% increase in skin compliance only 30 minutes after application. Moisturizing efficacy experiments have demonstrated that jojoba can effectively reduce superficial facial lines by 26, 28, and 11% after one, four and

eight hours respectively. Gasbearing electrodynamometer studies have shown that "neat" jojoba and jojoba incorporated in cosmetic formulations significantly increases skin softness well in excess of 8 hours. In short, it appears that jojoba effectively moisturizes and softens the skin by a dual action of forming a lipid layer which is partially occlusive and by the diffusion of jojoba into the intercellular spaces of the stratum corneum to soften this tissue.

Figure XV Natural Jojoba Reduces Fine Lines

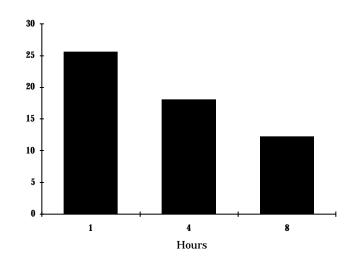
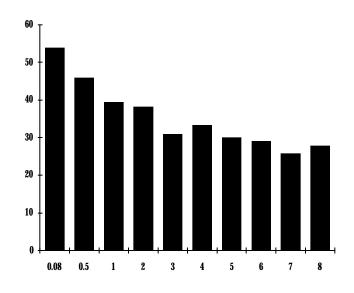


Figure XVI Natural Jojoba Softens Skin



The incorporation of jojoba into the oil phase of skin care formulations is a straight forward process. *Natural Jojoba* has a required hydrophilic/lipophilic balance number (HLB) of approximately 6. It is considered compatible with almost all anionic, cationic, amphoteric, and non-ionic cosmetic ingredients. Not only can multi-functional jojoba be considered as a replacement for mineral oil, triglycerides, lanolin, squalane and synthetic esters, but it can bring a whole new level of functionality to products.

Jojoba in Hair Care Products

Jojoba is an extremely functional ingredient in hair and scalp preparations. Many scalp related problems are caused by a hardened build-up of sebum that clogs the hair follicles and may cause some types of scaling. If this hardened build-up is not removed, it can eventually obstruct the hair follicle's ability to function properly, which can lead to a loss of the hair shaft, and ultimately, death of the follicle. Jojoba rapidly penetrates down to the scalp and hair shaft, and readily loosens and dissolves this hardened build-up. The scalp and hair follicles are left clean and free to continue their normal function.

Jojoba is also an excellent soil solubilizing agent which can remove sticky build-up on the hair from many modern hair preparations as well as airborne particulates. Jojoba will leave the hair clean and supple. Jojoba exhibits a matchless keratoplastic effect which leaves the hair shimmering and brings out the hair's natural color overtones and brilliance. Jojoba can be used with confidence in most hair preparations at a level ranging from 0.5-3%.

One of the essential functions of lipids on the hair is moisturizing to improve texture and manageability. Keeping the hair fully hydrated is a guarantee of manageability, softness and shine. This is exactly what *Natural Jojoba* does: it conditions the hair, and prevents it from becoming brittle and dull when exposed to unfavorable conditions.

Cosmetic Applications

Over the past 15 years the use of *Natural Jojoba* has steadily increased in a widely diversified plethora of cosmetic formulations. Table XIV lists some of the more common usages for jojoba in cosmetics.

Summary:

Natural Jojoba's excellent moisture control and superb dry emolliency meet today's needs for simple, natural botanical ingredients that really work. Its safety is well-established by extensive testing and millions of uses without complications. Its extraordinary oxidative stability can help formulators avoid the risk of rancidity. This characteristic also reduces the consumer's risk of damage from free radicals.

Decision makers around the globe are weighing all of these factors as they become more aware of the ever-increasing supply of high quality *Natural Jojoba* now being harvested from the many millions of jojoba trees planted over the past 15 years.

Natural Jojoba offers a substantial solution for formulators to meet their challenges with a renewable, plant-sourced material that is oxidatively stable with multifunctional cosmetic characteristics. Using Natural Jojoba, the cosmetic chemist can develop a broad range of products incorporating appealing natural materials, while still maintaining the scientific stability and functionality of 21st century products.

Table XIII

Current Uses of Jojoba

Hair Care:

Shampoos

Hair Conditioners

Hair Oils

Scalp Treatments Wave Set Lotions

Stick Pomades

Hair Creams

Hair Tonics

Hair Sprays

Skin Care:

Facial Moisturizers

Facial Cleansers

Eye Makeup Remover

Eye Treatments

Body Moisturizers

Hand Creams

Shaving Lotions and After-shave

creams and oils

Scrubs & Masks

Foot Care Products

Massage Oils

Baby Care:

Lotions, Creams & Oils

Sun Care:

After-Sun Creams and Lotions

Sun Protection Products Self-tanning Products Tan Extending Products

Lip Balm

Cuticle and Nail Care:

Cuticle Oil

Cuticle Remover Nail Hardener

Makeup Products (Color Products)

Cream Foundations Liquid Foundations

Lipsticks

Solid Foundations

Concealers/Blemish Sticks

Eyeshadow/Blusher

Eyeliner

Bath Oils

Dispersing Floating

Soaps

Liquid Bar

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