

JOJOBA OIL AS AN ORGANIC, SHELF STABLE STANDARD OIL-PHASE BASE FOR COSMETIC INDUSTRY

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ABSTRACT

Jojoba is one of the finest cosmetic ingredients in the world. It is excellent oxidative stability properties rank it as one of the top cosmetic materials, in use today. It is a complex mixture of naturally occurring long chained linear esters with many functional cosmetic properties that are far superior to tri-glycerides. Because of its stability towards rancidity it serves as a standard oil-phase base for the cosmetic industry. Jojoba oil has got the first priority in the preparation of personal care hygiene products. Today jojoba oil is an important ingredient of many cosmetic and hair care products. Jojoba oil is relatively shelf-stable when compared with other vegetable oils. Adding some jojoba oil to skin creams can help skin tone. Substantial quantity of good quality oil can be obtained from jojoba seeds for preparation of cosmetic base. Extraction of oil from jojoba seeds is also easy and it does not require any type of high cost sophisticated machinery. Jojoba seeds retain low moisture content. This gives an indication that good quality of oil with superior shelf life can be obtained from it. Superior shelf life of cosmetic base oil is essential to store the cosmetics over a longer period. Due to its chemical closeness to human sebum it can support the natural balance of the skin by forming a non-greasy film that holds moisture in while controlling the flow of sebum. It won't clog the pores and its regulating action is frequently helpful with acne. Jojoba provides excellent spread ability and lubricity. Hypoallergenic and pure, jojoba oil is perfect for any skin type especially those with large molecular structure. Since it blends well with the natural sebum of skin, jojoba oil may be effective in curbing over production of sebum - a condition that occurs in oily skins that are prone to acne. So it balances sebum level in skin.

Keywords: Iodine Value (IV); Saponification Value (SV); Acid Value (AV).

INTRODUCTION

Jojoba oil is a waxy ester³, which is derived from oil-rich seeds of an evergreen jojoba bush^{2, 4}, a desert plant that grows in the American South West and in Northern Mexico⁵. Native Americans and Mexicans used this oil for eczema, hair care and all kinds of skin types^{6, 7}. Jojoba oil and its derivatives have been widely used in the manufacture of cosmetics in the United States, Mexico, Israel, Japan and Europe^{18, 19}. The health and beauty care products have initially been successful largely because jojoba oil is easily substituted for other oils²⁰. Jojoba oil lacks the problems of conventional tri-glyceride oils¹ and has better stability than even mineral oils. Jojoba oil and its isomeric and hydrogenated derivatives⁸ are used in the cosmetic industry. The different products manufactured using jojoba oil are²¹: winter care lotions, shampoos, hair conditioners, hair restorers, body and bath oils, hand and body lotions, moisturizers, face creams, shaving creams, sun tan lotions, make-up foundation creams, specialty soaps, mascara, lipsticks and lip- gloss etc.

The extractable liquid from mature jojoba seeds ranges from 44-47%^{9, 11}. It is smooth and non-greasy and one of the most popular oil because by its chemical composition it is closest to sebum, humans natural skin oil¹². Since its structure is similar to natural oil produced by sebaceous glands in scalp, jojoba oil is a natural moisturizer and conditioner for hair. Regular application of jojoba oil can go a long way in tackling tangles, split ends and dry hair¹⁷. So it does the same for the human skin that it does for its mother plant- sealing in moisture during day time heat to prevent dehydration while protecting and

sheltering against the adverse night time conditions of desert. Jojoba is non-allergenic and non-comedogenic (non-clogging). It is molecular comparable to the ester we produce in our skin^{15,16}. Our sebaceous glands produce sebum, which is composed primarily of esters like jojoba. It is used as a skin softener, conditioner and soother¹³. It conditions the scalp and hair and assists in eliminating dry scalp. It removes make up. A mild massage of jojoba oil can reduce epidermal water loss and keep the skin plump and healthy. So this way wrinkles can be kept at bay⁵.

EXPERIMENTAL

For collection of seed samples of jojoba, healthy plants were first identified and tagged. Seeds were harvested from plants and taken as samples of Jojoba seeds. First of all seeds from seven locations mentioned below were collected. For R. & D. work two Kg. of seeds from all the seven locations chosen were collected. Oil from samples of jojoba seeds was then extracted through cold press, installed by Association of the Rajasthan Jojoba Plantation and Research Project- Jaipur at its Dhand Farm. This oil expeller has been imported by AJORP-Jaipur from Germany. Pure jojoba oil of International quality for cosmetic and industrial use is available from Jojoba Farm Dhand.

To study the characteristics of oil, seed samples were collected from the following seven locations selected in Rajasthan-

1. Dhand Jojoba Farm of AJORP, District- Jaipur, Rajasthan.
2. Fatehpur Jojoba Farm of AJORP Tehsil Fatehpur, District- Sikar, Rajasthan.
3. Central Arid Zone Research Institute, Jodhpur, Rajasthan.
4. Jojoba Farm of Mr. Kunji Lal Dhaga, Mathania, Jodhpur.
5. Jojoba Farm of Mr. Sant Lal Verma.Chak-23PTDTeh-Raisinghnagar District-. Sriganganagar, Rajasthan.
7. Jojoba Farm of Mr. Mahaveer Dhaga, Shabili Ghati, Bikaner, Rajasthan.
8. Jojoba Farm of Mr. Hawa Singh Poonia, Village-Gardana Kala, Tehsil- Chirawa, District- Jhunjhnu.

Chemical properties of jojoba oil important for cosmetic value are Moisture content, Oil content, Iodine value, Peroxide value, Saponification value, Unsaponifiable matter and Acid value. Jojoba oil was analysed at S.G.S. Lab Gurgaon, (Haryana) which is of International standard.

Moisture content and Oil content:

Moisture content and Oil content of the jojoba seed samples collected from seven locations of Rajasthan was first determined by NMR.

Iodine value:

Iodine Value is the number of grams of Iodine that combines with 100g of oil or fat. Iodine Value of an oil or fat indicates the amount of unsaturated acids present in it. In practice the given oil is dissolved in carbon tetrachloride and then treated with iodine monochloride solution, the unused Iodine is determined by titration against standard sodium thiosulphate (hypo) solution. An Iodine solution is violet in colour and any chemical group in the substance that reacts with iodine will make the colour disappear at a precise concentration. The amount of Iodine solution thus required to keep the solution violet is a measure of the amount of Iodine sensitive groups.

Peroxide value:

One of the most widely used tests for oxidative rancidity, peroxide value is a measure of the concentration of peroxides and hydro peroxides formed in the initial stages of lipid oxidation. Milliequivalent of peroxide per kilogram of fat are measured by titration with Iodide ion.

Saponification value:

The Saponification Value is the number of milligrams of KOH required to neutralize the fatty acids resulting from complete hydrolysis of 1 g of fat. The Saponification Value gives an indication of the

nature of the fatty acids in the fat since the longer the carbon chain the less acid is liberated per gram of fat hydrolyzed.

Unsaponifiable matter:

Many fats and oil contain substances that are not tri-glycerides. Saponifying the fat by heating with strong caustic soda or potash solution until all the tri-glycerides have been decomposed into glycerin and soap does the determination of non-fat materials often other than water. These are soluble in water and may be washed away. What remains behind is the non-triglyceride part of the fat and may be weighed. It is known as unsaponifiable matter.

Acid value:

During storage, fats may become rancid as a result of peroxide formation at the double bonds by atmospheric oxygen and hydrolysis by microorganisms with the liberation of free acid. The amount of free acid present therefore gives an indication of the age and quality of the fat. The acid value is the number of milligrams of KOH that is required to neutralize the free fatty acid present in 1 g of fat. A known amount of sample dissolved in an organic solvent is titrated with a solution of potassium hydroxide with known concentration and with phenolphthalein as a colour indicator.

RESULTS AND DISCUSSION

During two years of experimentation, mean Oil content (Table-1) varied from 44.50 to 46.50 percent, which is quite high as compared to other vegetable oils. This parameter indicates that substantial quantity of good quality oil can be obtained from jojoba seeds for preparation of cosmetic base. Mean Moisture content varied from 0.039 to 0.061 percent. This low Moisture content indicates that jojoba seeds retain very little moisture under normal agro-climatic conditions. This gives an indication that good quality of oil with superior shelf life can be obtained from it. Superior shelf life of cosmetic base oil is essential to store the cosmetics over a longer period. Perusal of data presented in table 2 shows that mean Iodine value (g/100g) of jojoba oil varied from 80.50 to 81.50 g/100g during two years of experimentation. The mass of Iodine in gram absorbed by 100 g the oil/fat in the natural state is known as Iodine number/Iodine value. It is an index of the degree of unsaturation of the fat. Iodine value represents true unsaturation of fats only when double bonds are unconjugated and addition is not interfered by other groups. The higher the Iodine value, the more unsaturated fatty acid bonds are present in a fat/oil. This can also be said in another way also that application of Iodine value is in the determination of saturation of fatty acids as double bonds in fatty acids also react with Iodine compounds. It is a measure, which indicates the potential of a fat to be oxidized. The method measures the reaction of Iodine with double bonds of unsaturated fatty acids. Greater the numbers of double bonds more are the sites for oxidation. The moderate Iodine value of jojoba oil extracted from seed samples collected from seven locations of study during two years of experimentation reveals that alcohols and acids have one double bond in each of them. Mean Peroxide value varies between 0.59 to 2.64 milli equivalent/Kg. Peroxide value is a measure of the concentration of peroxide and hydro peroxides formed in the initial stages of lipid oxidation. Milli equivalents of Peroxide per Kg. of fat are measured by titration with Iodide ion. High Peroxide values are a definite indication of rancid fat.

As shown in table-2 the Peroxide values of jojoba oil are low which means minimum oxidation has occurred. This shows that low aldehydes are resulted because they may have volatilized. So low Peroxide values provide a clear guideline relating jojoba oils good shelf life. Since jojoba oil does not oxidize or become rancid, it can be added to other oils to extend their shelf life. Mean Saponification value (mg/g KOH) of jojoba oil varied from 86.50 to 89 mg/gKOH and mean Unsaponifiable matter (percent) varied from 48.23 to 48.96 percent from all the locations of study during two years of experimentation as shown in Table-3.

The Saponification number is the number of milligrams of Potassium hydroxide required to convert one gram of the fat completely into soap and glycerine. It gives information concerning the character of the fatty acids of the fat and in particular concerning the solubility of their soaps in water.

The higher the Saponification number of a fat free from moisture and Unsaponifiable matter, the more soluble the soap that can be made from it. That is why it is used from making specialty soaps, shampoos, hair conditioners, moisturizers, shaving creams etc. The Acid value of jojoba oil is less than one and the value does not change with time (Table-4), so it can be concluded that it has a long shelf life, which is an important parameter as far as cosmetic value of oil is concerned.

CONCLUSION

The aesthetic and technical qualities of jojoba oil make it a wide spread basic cosmetic ingredient. Chemical structure of jojoba oil is different from other vegetable oils²³. During storage, fats may become rancid because of Peroxide formation at the double bonds by atmospheric oxygen and hydrolysis by microorganisms with the liberation of free acids. Low Peroxide values provide a clear guideline relating jojoba oils good shelf life. Since jojoba oil does not oxidize or become rancid, it can be added to other oils to extend their shelf life. Saponifiable substances are those that can be converted into soap. The higher the Saponification number of a fat free from moisture and Unsaponifiable matter, the more soluble the soap that can be made from it. That is why it is used from making specialty soaps, shampoos, hair conditioners, moisturizers, shaving creams etc. The Acid value of Jojoba oil is less than one and the value does not change with time, so it can be concluded that it has a long shelf life, which is an important parameter as far as cosmetic value of oil is concerned. The low Acid Value, moderate Iodine Value and Saponification Number, Less Unsaponifiable matter and Peroxide Value make jojoba oil especially useful for cosmetic applications. It is a natural emollient, making skin softer, cleaner and all round healthier. Since jojoba is completely miscible with sebum, it forms a very thin, non- greasy, lipid layer of jojoba and sebum when it is applied to the skin.

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Table-1: Moisture and Oil content (percent) of Jojoba seed samples collected from different locations of Rajasthan in Year 2005 & 2006

S.No.	Location	MOISTURE CONTENT (%)			OIL CONTENT (%)		
		2005	2006	MEAN	2005	2006	MEAN
1	L1	0.050	0.050	0.050	45.000	46.000	45.500
2	L2	0.080	0.042	0.061	46.000	45.000	45.500
3	L3	0.030	0.047	0.039	44.000	47.000	45.500
4	L4	0.050	0.042	0.046	45.000	44.000	44.500
5	L5	0.040	0.043	0.042	47.000	43.000	45.000
6	L6	0.050	0.042	0.046	47.000	46.000	46.500
7	L7	0.050	0.043	0.047	43.000	47.000	45.000
	SED ±	0.004	0.00073		0.296	0.395	
	CD 5%	0.009	0.0016		0.644	0.861	
	CV %	10.690	2.038		0.801	1.067	

Table-2: Iodine Value (g/100g) and Peroxide Value (meq/Kg) of Jojoba oil samples collected from different locations of Rajasthan in Year 2005 & 2006

S. No.	Location	IODINE VALUE (g/100g)			PEROXIDE VALUE (meq/Kg)		
		2005	2006	MEAN	2005	2006	MEAN
1	L1	80.00	81.00	80.50	0.64	0.54	0.59
2	L2	81.00	82.00	81.50	0.99	1.11	1.05
3	L3	82.00	80.00	81.00	1.02	0.81	0.92

4	L4	80.00	81.00	80.50	2.78	2.49	2.64
5	L5	82.00	80.00	81.00	0.81	0.53	0.67
6	L6	80.00	82.00	81.00	1.36	1.59	1.48
7	L7	81.00	81.00	81.00	1.19	1.01	1.10
	SED_±	0.253	0.242		0.020	0.006	
	CD5%	0.553	0.528		0.045	0.013	
	CV %	0.385	0.366		2.027	0.655	

Table-3: Saponification value (mg/g KOH) and Unsaponifiable matter(percent) of Jojoba oil samples collected from different locations of Rajasthan in Year 2005 & 2006

S.No.	Location	SAPONIFICATION VALUE(mg/g KOH)			UNSAPONIFIABLE MATTER (percent)		
		2005	2006	MEAN	2005	2006	MEAN
1	L1	86.00	88.00	87.00	48.44	48.75	48.60
2	L2	88.00	87.00	87.50	48.77	48.15	48.46
3	L3	86.00	90.00	88.00	48.28	48.17	48.23
4	L4	87.00	86.00	86.50	48.42	48.38	48.40
5	L5	90.00	88.00	89.00	49.16	48.75	48.96
6	L6	89.00	87.00	88.00	48.56	48.45	48.51
7	L7	87.00	89.00	88.00	48.95	48.76	48.86
	SED_±	0.574	0.447		0.411	0.514	
	CD5%	1.252	0.974		NS	NS	
	CV %	0.804	0.623		1.034	1.298	

Table-4: Acid value (mg/g KOH) of Jojoba oil samples collected from different locations of Rajasthan in 2005 just after the extraction of oil & 6, 12 and 18 month after the extraction of oil

S.NO.	Location	Just after Extraction	6months After Extraction	12months After Extraction	18months After Extraction	Mean
1	L1	0.54	0.55	0.55	0.55	0.55
2	L2	0.66	0.66	0.66	0.67	0.66
3	L3	0.89	0.89	0.89	0.89	0.89

4	L4	0.62	0.62	0.62	0.63	0.62
5	L5	0.76	0.77	0.77	0.78	0.77
6	L6	0.85	0.85	0.86	0.86	0.86
7	L7	0.63	0.64	0.64	0.55	0.62
	SED \pm	0.015	0.014	0.013	0.013	
	CD 5%	0.033	0.030	0.028	0.030	
	CV %	2.637	2.415	2.270	2.372	

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