

FATTY ACID SALTS AND ESTERS DERIVED FROM PALM OIL,
AND SOAP COMPOSITIONS CONTAINING SAME

The present invention relates to fatty acid salts derived from palm oil (sometimes referred to hereinafter as palm oil fatty acid salts), to a soap composition containing such palm oil fatty acid soaps, to
5 a process for producing palm oil fatty acid salts, and to a process for producing fatty acid lower alkyl esters of palm oil.

Soap compositions are conventionally made from natural fats and oils by saponifying such raw materials
10 with an alkali to form a soap base comprised of fatty acid salts, whereafter conventional soap composition ingredients such as perfumes, colorants, glycerol, EDTA, etc, are added to the soap base. The characteristics of the soap, for example, its hardness, solubility, foaming
15 and detergency depend on the composition of the fatty acid salts in the soap base. Accordingly, a mixture of different fats and oils is normally used as a starting material for preparing the soap base in order to obtain soap of desired characteristics. One of the most
20 commonly used starting materials for preparing the soap base is a mixture of 80-85% by weight of beef tallow and 20-15% by weight of coconut oil.

In recent years, the production of palm oil has increased and its cost has correspondingly decreased,
25 with the result that palm oil has been considered as a raw material for soap. However, a soap composition obtained from a soap base derived from palm oil is found to have a serious disadvantage, as compared with a soap composition obtained from the conventional beef tallow,
30 in that perfumes which are incorporated into the soap base have poor stability, with the result that the perfume scent is lost on storage. This drawback has made the use of palm oil unsatisfactory as a starting

material for soap. Thus, it is first of all required to solve the above problem before palm oil can be successfully used as a starting material for soap in place of the conventional beef tallow.

5 In addition to the above-mentioned defect, soap made from palm oil has some other problems; the soap emits an unpleasant odor derived from the palm oil source, causes color change to dull red-brown with lapse of time, tends to form cracks when processed to a solid
10 soap, and easily dissolves out in water. The solution of these problems is therefore also necessary in order to obtain a soap of good quality from palm oil.

 Fatty acid lower alkyl esters are themselves useful for various applications and, for example, are
15 used as intermediate products for preparing sulfofatty acid esters, fatty acid alkylolamides, fatty acid nitrile compounds, etc. In order that these products should have a low content of impurities and excel in tint, scent and long-term storage stability, the fatty acid
20 lower alkyl esters from which they are prepared must themselves be excellent in quality.

 As described above, the cost of palm oil is decreasing and accordingly palm oil is now being considered also as a starting material for the production
25 of fatty acids and their derivatives. However, fatty acids obtained from highly unsaturated fats and oils including palm oil and rice bran oil contain many impurities comprised predominantly of unsaturated compounds, as compared with conventional fatty acids
30 obtained from beef tallow, coconut oil and palm kernel oil, etc. Fatty acid derivatives derived from such fatty acids have the drawback that they emit unpleasant odors associated with the original fats and oils. Even if the derivatives are incorporated with a perfume to
35 mask the unpleasant odor, there is the same problem of perfume instability already described above in connection with the use of palm oil to make soap. In addition,

these fatty acid derivatives have the further drawbacks that their tint deteriorates with lapse of time and their long-term stability is poor.

In order to try to solve these problems, the starting fats and oils are sometimes subjected to a preliminary treatment such as a clay treatment, a washing treatment with an alkali, a washing treatment with an acid, a distillation treatment or a hydrogenation treatment, but these preliminary treatments fail to give wholly satisfactory results. There are also known refining processes wherein the starting fats and oils are subjected to a transesterification reaction with a lower alcohol in the presence of an alkali catalyst to form fatty acid esters which are then subjected, after removing unsaponified products and colored substances by distillation, to a hydrogenation treatment with the aid of a nickel catalyst; and also wherein the starting fats and oils are converted into specific fatty acid alkyl esters and subjected directly to a hydrogenation treatment i.e. omitting the distillation treatment (Japanese Patent Publn. No. Sho. 62-33278). Although by means of these processes the above described drawbacks can be largely overcome, nonetheless the resultant fatty acid esters obtained in these processes wherein a complete hydrogenation (extreme hydrogenation) step is included have an increased melting point so that handling of the esters becomes inconvenient. Furthermore, for many applications, the esters are required to contain unsaturated moieties, but of course the fully hydrogenated esters obtained by such processes cannot be used as starting materials for such applications. Further, the above-mentioned refining processes wherein a mixture of fatty acid esters obtained according to a transesterification reaction of fats and oils is subjected as such to a hydrogenation treatment (complete hydrogenation) are poor in process efficiency.

The present invention has been made from a consideration of the above described problems of (a) using palm oil to make soap and (b) manufacturing good quality fatty acid lower alkyl esters.

5 In accordance with one aspect of this invention, there is provided a fatty acid salt or ester product derived from palm oil and comprising fatty acid salts or esters of 18 carbon atoms in which the content of fatty acid salts or esters having at least two double
10 bonds is 2% by weight or less.

 In accordance with another aspect of this invention, there is provided a soap composition comprising a fatty acid salt product derived from palm oil and including fatty acid salts of 18 carbon atoms in
15 which the content of fatty acid salts having at least two double bonds is 2% by weight or less.

 In a further aspect, the present invention provides a process for the production of fatty acid salts which comprises the steps of (a) subjecting palm oil to a
20 transesterification reaction with a lower alcohol, (b) separating glycerol from the resultant product to obtain a mixture of fatty acid esters, (c) fractionating the mixture of fatty acid esters into a first fraction comprised predominantly of fatty acid esters having 18
25 carbon atoms and a second fraction comprised predominantly of other fatty acid esters, (d) subjecting said first fraction to a hydrogenation treatment, and (e) saponifying the hydrogenated product with an alkali.

 In a yet further aspect, the present invention
30 provides a process for the production of fatty acid lower alkyl esters which comprises the steps of (a) subjecting palm oil to a transesterification reaction with a lower alcohol, (b) separating glycerol from the resultant reaction product to obtain a mixture of fatty acid
35 esters, (c) fractionating the mixture of fatty acid esters into a first fraction comprised predominantly of fatty acid esters having 18 carbon atoms and a second

fraction comprised predominantly of other fatty acid esters, and (d) subjecting said first fraction to a hydrogenation treatment whereby fatty acid lower alkyl esters are obtained which comprise less than 2% by weight of the fatty acid components having 18 carbon atoms and at least two double bonds and at least 20% by weight of fatty acid esters having 18 carbon atoms and a single double bond.

By the term "palm oil fatty acid salts" is meant fatty acid salts derived from palm oil. Likewise, the term "coconut oil fatty acid salts" means fatty acid salts derived from coconut oil, while the term "palm kernel oil fatty acid salts" means herein fatty acid salts derived from palm kernel oil. The weight and content of the fatty acid salts are reported herein in terms of the sodium salts.

The palm oil fatty acid salts according to the present invention include fatty acid salts of 18 carbon atoms in which the fatty acid salts component having at least 2 double bonds (this state will sometimes be referred to hereinafter as $C_{18}F_{2+}$, or more generally such compounds with 18 carbon atoms and n double bonds as $C_{18}F_n$) is contained in an amount of 2% by weight or less, preferably 1% by weight or less, more preferably 0.5% by weight or less. In contrast, conventional palm oil fatty acid salts generally contain $C_{18}F_{2+}$ component in an amount of about 10% by weight based on the weight of the total fatty acid salts and in an amount of about 20% by weight based on the weight of the fatty acid salts with 18 carbon atoms. By decreasing the content of the $C_{18}F_{2+}$ fatty acid salt components in the palm oil fatty acid salts to 2% by weight or less, and more preferably, by decreasing the content of $C_{18}F_3$ fatty acid salt components to 0.05% by weight or less, preferably 0.01% by weight or less, the stability of a perfume incorporated therewith can be improved and the peculiar odor associated with such palm oil fatty acid salts can

be inhibited. Further, the stability to discoloration of the salts can also be improved remarkably.

Consequently, by decreasing the content of the specific fatty acid salt components in accordance with the teachings of this invention, palm oil fatty acid salts of high quality and which are suitable for making a soap base can be obtained. This surprising effect was found for the first time by the present inventors.

Prior to completion of the present invention, the present inventors attempted to decrease the content of the $C_{18}F_{2+}$ components in the palm oil fatty acid salts of 18 carbon atoms by subjecting the starting palm oil or a mixture of palm oil fatty acid derivatives to a hydrogenation treatment or a urea addition treatment and then treating the resultant product with an alkali. However, the object of this invention could not be achieved entirely satisfactorily by this process.

As a result of further research made by the present inventors, it has been found that fatty acid salts which meet the requirements of the soap industry more satisfactorily can be obtained by subjecting palm oil to a transesterification reaction with a lower alcohol, separating glycerol from the resultant reaction product to form a mixture of fatty acid esters, fractionating therefrom a fraction comprised predominantly of fatty acid esters having 18 carbon atoms, subjecting the fraction to a hydrogenation treatment, and thereafter saponifying the fraction with an alkali. It is to be noted that the hydrogenation treatment and subsequent saponification are to be performed on a fraction which is comprised predominantly of C_{18} fatty acid esters; a satisfactory product is not obtained by merely hydrogenating and saponifying a mixture of C_{14-18} fatty acid esters.

In order to prepare the fatty acid salts of the present invention, palm oil is firstly subjected to a transesterification reaction with a lower alcohol. This

reaction can be carried out in a conventional manner. Illustrative of the lower alcohol are, for example, alcohols of 1-6 carbon atoms, preferably methanol. For this transesterification reaction, an esterifying catalyst such as sodium hydroxide can be used. The reaction is suitably carried out at a temperature of 50-80°C, preferably 60-70°C and under pressure of 1-5 atmospheres (Gauge pressure), preferably 2-3 atmospheres.

In the next stage, glycerol is separated from the reaction product of the transesterification reaction, to yield a mixture of fatty acid esters. In general, the separation of glycerol suitably can be carried out according to the conventional "stationarily standing" method.

In the method of the present invention, a fraction of fatty acid esters which is comprised predominantly of fatty acid esters of 18 carbon atoms is now selectively separated from the resulting mixture of fatty acid esters, and this fraction is subjected to a hydrogenation treatment. The separation of the fraction can be carried out by a conventional fractional distillation method in which the starting fatty acid esters are supplied to a distillation column and fractionated under atmospheric or subatmospheric pressure to obtain a C₁₄ fraction, a C₁₆ fraction of 16 carbon atoms and a C₁₈ fraction. In some cases, a part of the bottom fraction is removed as a still residue.

The hydrogenation treatment of the C₁₈ fraction comprised predominantly of fatty acid esters having 18 carbon atoms can be carried out in a conventional manner in the presence of a hydrogenation catalyst. Illustrative of suitable hydrogenation catalyst are, for example, nickel catalysts such as nickel, nickel formate and Raney nickel; noble metal catalysts such as platinum, platinum black, palladium and rhodium; copper-chromite; copper-chromium-barium oxide; iron-pentacarbonyl; and cobalt-carbonyl. If using a

nickel catalyst, the reaction preferably is carried out at a temperature of 140-200°C, more preferably 150-170°C. The hydrogen pressure for this reaction suitably is 1-6 atmospheres, preferably 1-2 atmospheres.

5 The hydrogenation treatment is performed so that the content of $C_{18}F_2+$ fatty acid esters in the resultant hydrogenated product is reduced to 2% by weight or less, preferably 1% by weight or less of the total palm oil fatty acid salts of 18 carbon atoms, in terms of
10 fatty acid sodium salts, while the content of $C_{18}F_3$ fatty acid esters preferably is reduced to 0.05% by weight or less, more preferably 0.01% by weight or less of the total C_{18} palm oil fatty acid salts, again as measured in terms of fatty acid sodium salts.

15 The resulting hydrogenated product of the C_{18} fraction is then saponified in the presence of an alkali. This saponification reaction can be conducted in a conventional way. Examples of suitable alkalis include inorganic alkali such as hydroxides and carbonates of
20 alkali metals such as potassium or sodium, as well as organic alkalis, for example organic amines such as ethanolamine. In this saponification reaction, a lower alcohol is obtained as a by-product which may be recycled to the foregoing transesterification reaction for reuse.

25 In the fractionating step, both a C_{14} and a C_{16} fatty acid fraction are also obtained, and a similar saponification treatment can also be applied to these fractions. If a mixture of fatty acid salts of 18 carbon atoms with fatty acid salts of 14 and/or 16 carbon
30 atoms is to be prepared, the hydrogenated product of the fatty acid esters having 18 carbon atoms is advantageously mixed with the fraction of the fatty acid esters of 14 and/or 16 carbon atoms and the resulting mixture is then saponified, or alternatively the
35 fractions can be saponified separately and then admixed.

For use as a solid soap base the palm oil fatty acid salts preferably have a content of the $C_{18}F_1$ fatty

acid salt component in the C_{18} fraction of 10-96% by weight, more preferably of 20-92% by weight. As palm oil originally contains about 45% by weight of the $C_{18}F_1$ fatty acid component (about 75% by weight in the C_{18} fraction) and as at least a part of the $C_{18}F_{2+}$ fatty acid component is converted by the hydrogenation treatment into the $C_{18}F_1$ fatty acid component, the content of the $C_{18}F_1$ fatty acid salt component can easily be adjusted by controlling the hydrogenation treatment conditions.

More precisely, the catalyst, hydrogen pressure at the time of reaction, reaction temperature and reaction time of the hydrogenation treatment are all appropriately selected so as to obtain a hydrogenated product wherein the contents of the $C_{18}F_{2+}$, $C_{18}F_1$ and $C_{18}F_3$ components are within the desired ranges.

The palm oil fatty acid salts of this invention are suitable for use as various kinds of soap base. If required, the fatty acid salts may also be used with a soap base made from other fats and oils. Examples of the other soap bases (fatty acid salts) include coconut oil fatty acid salts, palm kernel oil fatty acid salts, soybean oil fatty acid salts, olive oil fatty acid salts and cotton seed oil fatty acid salts. The use of coconut oil fatty acid salts and/or palm kernel oil fatty acid salts in conjunction with the palm oil fatty acid salts of this invention is preferred.

Up to 80%, preferably 15-60% by weight based on the total fatty acid salts, of such other fatty acid salts may be used in conjunction with the palm oil fatty acid salts of this invention. In order to obtain a soap base comprised of a mixture of the palm oil fatty acid salts and the other fat and oil fatty acid salts, various methods can be used in addition to the straightforward method of mixing both fatty acid salts. For example, one can add the other starting fats and oils, or fatty acid esters thereof, to the palm oil fatty acid lower alkyl esters being subjected to the saponification

treatment; or one can add the other starting fats and oils at the stage of saponifying the palm oil fatty acid esters which have been treated for decreasing the $C_{18}F_2+$ content thereof.

5 A preferred solid soap composition of this invention, for example, a toilet soap is composed of a soap base containing both the above-mentioned palm oil fatty acid salts of this invention as well as coconut oil fatty acid salts having at most 12 carbon atoms, wherein
10 the content of the fatty acid salts having at most 12 carbon atoms is 5-50% by weight, preferably 10-40% by weight, the content of the fatty acid salts having 14 carbon atoms is 0-15% by weight, preferably 2-10% by weight, the content of the fatty acid salts having 16
15 carbon atoms is 0-45% by weight, preferably 10-40% by weight, and the content of the fatty acid salts having 18 carbon atoms is 10-95% by weight, preferably 20-75% by weight.

 The soap composition of this invention based on
20 the palm oil fatty acid salts preferably incorporates an elaidic acid salt. (Elaidic acid is a trans-isomer of oleic acid and oleic acid is a $C_{18}F_1$ fatty acid of the formula $Me(CH_2)_7CH=CH(CH_2)_7CO_2H$.) According to a study by the present inventors, it has surprisingly been found
25 that when the soap composition contains an elaidic acid salt its foam durability is remarkably improved as compared with a conventional soap composition, and so is especially suitable either for making a toilet soap or a body shampoo. The content of elaidic acid salt in the
30 soap composition relative to that of oleic acid salts preferably is in a ratio of 5/95 - 70/30, more preferably 10/90 - 50/50 in terms of the weight ratio of the elaidic acid salt to oleic acid salt contained in the soap base. However, if the content of the elaidic acid salt is too
35 small then the effect on foam durability is insufficient but on the other hand, if the content is too large then the foam-forming effect will tend to be deteriorated.

The elaidic acid salt may be incorporated into the soap composition by direct addition to the starting soap base, or elaidic acid or an ester thereof may be added at the time of producing the soap by saponification with an alkali. However, it has also been found by the present inventors that a part of linolic acid component is advantageously isomerized to the elaidic acid component during the step of hydrogenating the C₁₈ fraction. Accordingly, adoption of the hydrogenation treatment enables the production of a soap composition containing the elaidic acid composition without the necessity of adding the elaidic acid component externally.

The soap composition of this invention may incorporate various conventional soap ingredients, as is well known to those skilled in the art. Illustrative of such conventional soap ingredients are, for example, perfume, EDTA, colorants, ethane-1-hydroxy-1, 1-diphosphonic acid or an alkali salt thereof, an organopolybasic acid or a salt thereof and the like stabilizer. Again, in order to enhance detergency, the soap base of this invention may be incorporated with a surfactant which is different from the soap base. Illustrative of such surfactants are, for example, α -sulfofatty acid esters, isethionic acid esters, alkylarylsulfonic acids, alcoholsulfuric acid esters, alcholethoxylate sulfates, olefinsulfonic acids, paraffinsulfonic acids, N-acylglutamic acids and their salts, alkylbetaine and alkylsulfobetaine.

Another conventional soap ingredient which may be incorporated in the soap composition is a skin-protecting agent such as super fattening agent, in order to adjust the oil retention effect to skin. Illustrative of such skin-protecting agents are, for example, hydrocarbons such as squalene, squalane, olefin oligomers, waxes, vaseline and mineral oils; fatty acids such as isostearic acid and behenic acid; fatty acid esters such as various glycerides, sugar esters,

lanoline, isopropyl myristate, isopropyl palmitate and isobutyl stearate; aliphatic alcohols such as cetyl alcohol, stearyl alcohol and oleyl alcohol; polyols such as glycerol, polyethylene glycol and polypropylene glycol; ethoxylates of alcohols and fatty acids; silicones such as dimethylsilicone; various kinds of proteins and protein derivatives; and vitamins.

The soap composition of this invention may further include an anti-inflammatory agent such as allantoin or glycyrrhizic acid dipotassium salt; or a bactericide such as 2,4,4'-trichloro-2'-hydroxydiphenylether, 3,4,4'-trichlorocarbanilide and benzoic acid.

In order to produce a soap composition of this invention from the soap base and the above mentioned conventional auxiliary soap ingredients, any known method can be employed. For example, the soap base may be homogeneously mixed with the other ingredients in a mixer and the mixture then extruded by the aid of rolls or plotters and molded. Alternatively the soap base may be incorporated with a sugar, a polyhydric alcohol, ethanol or water and with other ingredients and the mixture is heated at 70-80°C to form a homogeneous transparent soap liquid which is then flowed into a solidifying frame, cooled to solidify, cut, dried and then molded.

The preferred palm oil fatty acid salts of this invention have the great merit for use as a soap base that the scent of incorporated perfume will not be significantly lost even after long storage. In addition, they do not emit the peculiar odor of palm oil and moreover they are of improved stability.

The properties are in marked contrast to those obtained when using conventional palm oil fatty acid salts.

Further, soaps derived from these conventional palm oil fatty acid salts have poor stability to discoloration so that they tend to become light brown in

color when stored for a long period of time. This defect can also be overcome by the use of the preferred palm oil fatty acid salts of this invention.

The palm oil fatty acid salts of this invention are particularly suitable for use as a soap base for solid soap compositions. A conventional solid soap composition derived from palm oil tends to form cracks and to disintegrate on dissolving in water. However, such drawbacks can be overcome by using the palm oil fatty acid salts of this invention. A soap base or soap composition of this invention which contains elaidic acid salts is particularly improved in its foam durability.

The soap composition of this invention can be produced, with high efficiency, in various forms such as flake, powder or liquid, in addition to the solid form.

In order to produce fatty acid esters of high quality with excellent stability of scent retention of an incorporated perfume and of color, and of good fluidity because of its unsaturated fatty acid component, advantageously on a commercial scale from palm oil the palm oil is first subjected to a transesterification reaction with a lower alcohol as described above. In this case, it is necessary to separate the C_{18} fraction selectively from the resultant mixture of fatty acid esters and then subject the C_{18} fraction to a moderate hydrogenation treatment under controlled conditions whereby the content of the $C_{18}F_{2+}$ component in the C_{18} fraction is decreased to 2% by weight or less while the content of the $C_{18}F_1$ fatty acid component is maintained at at least 20% by weight. In contrast, a product of good quality cannot be obtained efficiently when the hydrogenation treatment is applied to the starting oil itself or a mixture itself of fatty acid esters obtained by the transesterification reaction of the palm oil.

Thus, according to this aspect of the invention, only a part of the specific fraction among the fatty acid esters obtained by the transesterification

reaction of the starting palm oil is subjected to the hydrogenation treatment thereby converting it into fatty acid esters of high quality. Thus, the present invention can lead to a high process efficiency.

5 The fatty acid esters derived from palm oil obtained by the present invention have a moderate content of unsaturated fatty acids. Accordingly, they have a relatively low melting point and are high in fluidity so that they are readily handled and are suitable as an
10 intermediate in the production of fatty acid derivatives having unsaturated moieties.

 The fatty acid esters of this invention can be utilized, for example, for hair and skin cosmetics, softening agents, detergents, plasticizers, binders, etc.
15 by virtue of their beneficial characteristics.

 The present invention will now be illustrated by the following Examples and Comparative Examples.

Example 1

 A palm oil having a fatty acid composition as
20 shown in

Table 1 below was used as a starting material.

Table 1

Saturated moieties (% by weight)			Unsaturated moieties (% by weight)		
C ₁₄	C ₁₆	C ₁₈	C ₁₈ F ₁	C ₁₈ F ₂	C ₁₈ F ₃
1.5	45.7	4.3	38.2	10.1	0.2

The palm oil was subjected to a transesterification reaction with methanol conducted at a temperature of 60°C under pressure of 2 atm. in the presence of sodium hydroxide catalyst. From the resultant ester mixture, glycerol was removed according to a usual stationary separation method and the mixture was subjected to a distillation treatment to obtain a fraction of esters having 18 carbon atoms. This fraction was subjected to a hydrogenation treatment at a temperature of 160°C under hydrogen pressure of 1.5 atm. in the presence of a nickel catalyst by varying the reaction time and the stirring condition. The resultant hydrogenated product was reacted with sodium hydroxide to obtain sodium salts of the palm oil fatty acids.

Next, the moisture content of the resultant palm oil fatty acid sodium salts was adjusted at 12% by weight and used as a soap base. This soap base was incorporated with 1.5% by weight of a perfume ingredient as shown in Table 2 and then with 0.15% by weight of EDTA and 0.3% by weight of titanium dioxide, and kneaded in a usual manner to prepare a sample.

Table 2

Perfume ingredient	Parts by wt. .
Aldehyde C-10 (content 10%)	5
Aldehyde C-11 (content 10%)	15
Ambroxan (content 10%)	20
α -Amylcinnamic aldehyde	60
Oakmoss	20
Benzyl salicylate	30
Cashmeran	10
Cedramber	20
Rosephenone	5
α -Damascone (content 10.%)	15
linalool	100
Linalyl acetate	50
Bergamot oil	50
Orange oil	30
Phenethyl alcohol	80
Lilial	20
Geraniol	15
Citronella oil	35
γ -methylionone	80
Styrallyl Acetate	10
Vertfix Coeur	60
Triplal (content 10 %)	10
Galaxolide	60
Tonalide	30
Eugenol	30
Ethylene brassylate	20
α -Hexylcinnamic aldehyde	50
Patchouli oil (content 10 %)	20
Ethylvanilin (content 10%)	30
Isobutyl quinoline (content 10 %)	10
Isoeugenol	10

The soap composition thus obtained was examined and evaluated for its perfume scent and color in the following manner, and a result of the evaluation is shown in Table 3 below.
(Perfume scent)

5 After storage of the sample for 30 days at 50°C, a functional evaluation of the perfume scent was carried out by 20 persons (testers) according to the following five-step method (among the evaluations, A and A' stand for the product having a commercial value while B, B' and C for the product having no
10 commercial value):

A: No difference in perfume scent in comparison with the sample (control) just after preparation

A': Not so different from A but a slight odor of palm oil soap base (odor of a known conventional palm oil soap)

15 B: The scent of the incorporated perfume was lost but the odor of the palm oil soap base was strong

B': The scent of the incorporated perfume was lost but the odor of the palm oil soap base was strong with some putrid smell

20 C: Almost no perfume scent but the odor of palm oil soap base and putrid smell were strong

(Color)

25 After storage of the sample for 30 days at 50°C, any change in the color of the sample was evaluated by way of the five reference numerals 0-4 in the following manner:

0: No difference in color in comparison with the sample (control) just after produced

30 1: Very slight discoloration in comparison with the sample just after produced

2: Slight discoloration in comparison with the sample just after produced

3: Some discoloration in comparison with the sample just after produced

35 4: Serious discoloration in comparison with the sample just after produced.

Table 3

Exp. No		1	2	3	4	5	6*	7	8	9
Component ** (%)	C ₁₈ F ₀	59.9	59.8	59.6	59.1	58	56.8	71.6	48.6	9.6
	C ₁₈ F ₁	40	40	40	40	40	40	28	51	90
	C ₁₈ F ₂	0.1	0.2	0.4	0.9	2.0	3.2	0.4	0.4	0.4
	C ₁₈ F ₃	trace	trace	trace	trace	trace	trace	trace	trace	trace
Effect	Scent	A	A	A	A	A'	B	A	A	A'
	Color	0	0	0	1	2	3	0	0	1

* Comparative Example

** Content based on the whole C_{18} fatty acid sodium salts

Example 2

5 The same palm oil as shown in Example 1 was used as the starting palm oil.

The palm oil was subjected to a transesterification reaction with methanol conducted at a temperature of 60°C under pressure of 2 atm. in the presence of sodium hydroxide catalyst. Next, glycerol was removed from the resultant ester mixture according to a usual stationary separation method. The resultant mixture was subjected to a fractional distillation treatment to separate a fraction of C₁₈-esters and a fraction of C₁₄- and C₁₆-esters. The C₁₈-fraction was subjected to a hydrogenation treatment at a temperature of 160°C under hydrogen pressure of 1.5 atm. in the presence of a nickel catalyst by varying the reaction time and the stirring condition.

20 The resultant hydrogenated product was mixed with the C₁₄- and C₁₆-fraction in a ratio of 1:1 and the mixture was reacted with sodium hydroxide to obtain palm oil fatty acid sodium salts.

25 The moisture content of the resultant palm oil fatty acid sodium salts was adjusted at 12% by weight and used as a soap base. This soap base was incorporated with 1.5% by weight of perfume identical with that shown in Table 2 and then with 0.15% by weight of EDTA and 0.3% by weight of titanium dioxide, and kneaded in a usual manner to prepare a sample.

30 The soap composition thus obtained was examined and evaluated for its perfume scent and color in the same manner as described in Example 1 and also examined for its crack and disintegration on dissolving in the following manner: A result of the examination and evaluation is shown in Table 4 below.
(Crack)

35 After dipping the sample in water maintained at 30°C for 30 minutes, the sample was washed with running water for 30 seconds and dried for one hour at 30°C. After this step was repeated for 5 times, the sample was allowed to stand at room temperature to check whether cracks were formed or not. The

evaluation of cracks was carried out according to the following basis by way of the four reference numerals 0-3:

- 0: No cracks
 1: Slight cracks
 5 2: Some cracks
 4: Serious cracks

A product given the evaluation 0 or 1 has a commercial value while that given the evaluation 2 or 3 has no commercial value.

10 (Disintegration on dissoving)

After dipping the sample in water kept at 30°C for one hour, the sample was dried for one hour. The sample thus treated was compared with that just after produced (control) and evaluated according to the following basis by way of the
 15 four reference numerals 0-3:

- 0: No difference as compared with the control sample
 1: Slight disintegration as compared with the control sample
 20 2: Some disintegration as compared with the control sample
 3: Serious disintegration as compared with the control sample

A product given the evaluation 0 or 1 has a commercial
 25 value while that given the evaluation 2 or 3 has no commercial value.

Table 4

-Exp.	No	10	11	12	13	14*	15	
30	Component	F ₀	9.9	9.8	9.6	9.0	6.5	35.6
		F ₁	40	40	40	40	40	14
		F ₂	0.1	0.2	0.4	1.0	3.5	0.4
		F ₃	trace	trace	trace	trace	trace	trace
35	Component**	C _{1s}	48.4	48.4	48.4	48.4	48.4	48.4
		C ₁₄	1.6	1.6	1.6	1.6	1.6	1.6
	Effect	Scent	A	A	A	A'	B'	A
		Color	0	0	0	1	2	0
		Cracks	0	0	0	0	1	0
		Disinte-gration	0	0	0	0	2	0

* Comparative Example

** Content based on the whole fatty acid sodium salts

5 Example 3

The following 3 kinds of fatty acid sodium salts were mixed in a usual manner:

- 10 (a) Palm oil fatty acid sodium salt obtained in No. 3 of Example 1 (F_0 : 59.6%, F_1 : 40%, F_3 : trace) or palm oil fatty acid sodium salt obtained in No. 9 thereof (F_0 : 9.6%, F_1 : 90%, F_2 : 0.4%, F_3 : trace),
- (b) Saturated C_{16} fatty acid sodium salt derived from palm oil,
- 15 (c) Saturated C_{10-14} saturated fatty acid sodium salts derived from coconut oil or palm kernel oil.

The moisture content of the mixture was adjusted to 12% by weight to prepare a soap base. This soap base was incorporated with 1.5% by weight of a perfume shown in Table 2 and then with 0.15% by weight of EDTA and 0.3% by weight of titanium dioxide, kneaded in a usual manner and molded to prepare a sample. The sample was subjected to the same experiment as shown in Example 2 and the following experiment for foaming: The result of these experiments is given in Table 5 below.

(Foaming)

25 The sample was subjected to a functional test wherein the level of foaming was evaluated by a hand-washing test with 30 persons (panellers), making the the sample of Experiment No. 17 as standard and evaluating the level of foaming according to the following test basis using the four reference numerals 0-3:

- 30 3: Very good foaming in comparison with the standard sample
 - 2: Slightly better foaming in comparison with the standard sample
 - 35 1: Almost same in the level of foaming in comparison with the standard sample
 - 0: Poor foaming in comparison with the standard sample
- From a result of the above test, an average value for each

sample evaluated by 30 persons was obtained and the level of foaming was finally evaluated according to the following test basis:

- ⊙: Above 2.5
 ○: $2.5 \geq \text{the level} \geq 2.0$
 Δ: $2 \geq \text{the level} \geq 1$
 X: Less than 1.

Table 5

Exp. No.		16****	17*	18****	19***
Component ** (%)	C ₁₈ (Exp. No.)	70 (No.3)	70 (No.3)	45 (No.9)	45 (No.9)
	C ₁₆	10	30	29	29
	C ₁₄	-	-	6	6
	C ₁₂	20	-	20	20
	C ₁₀	trace	-	trace	trace
Effect	Odor	A	A	A	A
	Color	0	0	0	0
	Cracks	0	0	0	0
	Disintegration	0	0	0	0
	Foaming	⊙	Δ	⊙	⊙

* Comparative Example

** Content based on the whole fatty acid sodium salts

*** Fatty acid sodium salts derived from palm kernel oil

**** Fatty acid sodium salts derived from coconut oil

Example 4

The same palm oil as shown in Example 1 was used as the starting palm oil.

The palm oil was subjected to a transesterification reaction under the same condition as described in Example 1 and glycerol was removed from the reaction mixture according to a usual stationary separation method. The resultant ester mixture was subjected to a fractional distillation to obtain a C₁₈ fraction and a C₁₄- and C₁₆-fraction. The C₁₈-fraction was subjected to a hydrogenation treatment at a temperature of 140-200°C under hydrogen pressure of 1-6 atm. in the presence of a nickel catalyst by varying the reaction time and the stirring

condition. The resultant C_{18} hydrogenation product was reacted with sodium hydroxide to prepare various C_{18} palm oil fatty acid sodium salts among which sodium elaidate-enriched component is selected and mixed with the C_{16} fatty acid sodium salts derived from palm oil and the C_{10-14} fatty acid sodium salts derived from coconut oil in a ratio of C_{18} :45% by weight, C_{16} :29% by weight, C_{14} :6% by weight and C_{12} :20% by weight. The moisture content of the mixture is then adjusted to 12% by weight to prepare a soap base. This soap base was incorporated with 1.5% by weight of a perfume as shown in Table 2 and then with 0.15% by weight of EDTA and 0.3% by weight of titanium dioxide, kneaded in a usual manner and molded to prepare a sample.

The sample was then examined for its durability of foam in the following manner: The result of the examination is shown in Table 6 below.

(Durability of foam)

The sample was subjected to a functional test wherein the durability of foam was evaluated by a hand-washing test with 30 persons (panellers), making the sample of Experiment No. 23 as standard and evaluating the durability of foam according to the following test scale using the four reference numerals 0-3:

- 3: Very good durability in comparison with the standard sample
- 2: Slightly better durability in comparison with the standard sample
- 1: Almost same in durability in comparison with the standard sample
- 0: Poor durability in comparison with the standard sample.

From a result of the above test, an average value for each sample evaluated by 30 persons was obtained and the durability of foam was finally evaluated according to the test scale:

- ⊙: Above 2.5
- : $2.5 \geq \text{durability} \geq 2$
- △: $2 \geq \text{durability} \geq 1$
- ×: Less than 1

Table 6

Exp. No			20	21	22	23*
Component ** (%)	C ₁₈	F ₀	3.0	4.3	6.5	4.5
		F ₁	41.8	40.5	38.3	40.5
		Oleic acid salt	(38.0)	(30.5)	(24.9)	(40.5)
		Elaidic acid salt	(3.8)	(10.4)	(13.4)	(-)
		F ₂	0.2	0.2	0.2	—
	F ₃	trace	trace	trace	—	
	C ₁₆	29	29	29	29	
	C ₁₄	6	6	6	6	
	C ₁₂	20	20	20	20	
	C ₁₀	trace	trace	trace	trace	
Durability of foam			○	◎	◎	△

* Comparative Example (purified sodium stearate and purified sodium oleate were used as C₁₈F₀ and C₁₈F₁, respectively)

** Content based on the whole fatty acid sodium salts

5

Example 5

The same palm oil as shown in Example 1 (Table 1) was used as the starting palm oil.

10

The palm oil was subjected to a transesterification reaction with methanol conducted at a temperature of 60°C under pressure of 2 atm. in the presence of sodium hydroxide. Glycerol was removed from the reaction mixture according to a usual stationary separation method and the resultant ester mixture was subjected to fractional distillation to separate a C₁₈ fraction. The composition of this fraction is shown in Table 7 below.

15

Table 7

Saturated moieties (% by weight)			Unsaturated moieties (% by weight)		
C ₁₆	C ₁₈	C ₂₀	C ₁₈ F ₁	C ₁₈ F ₂	C ₁₈ F ₃
1.8	7.8	0.8	72.5	16.7	0.4

This fraction was subjected to a hydrogenation treatment with stirring at a temperature of 160°C under hydrogen pressure of 1.5 atm. in the presence of a nickel catalyst whereby a sample A and a sample B having the compositions as shown in Table 8 were obtained.

Table 8

Hydrogenated product	Saturated moieties (% by weight)			Unsaturated moieties (% by weight)		
	C ₁₆	C ₁₈	C ₂₀	C ₁₈ F ₁	C ₁₈ F ₂	C ₁₈ F ₃
Sample A	1.8	9.0	0.8	88.2	0.2	trace
Sample B	1.8	8.3	0.8	80.5	8.6	trace

The sample A, the sample B shown in Table 8 and untreated product (the C₁₈ fraction in Table 1) were examined for their peroxide value (POV) and carbonyl value (COV). Further, these three samples were saponified with sodium hydroxide and any change in the color of these saponified products (fatty acid-Na) with the lapse of time was measured by every 2 weeks up to 8 weeks. The result of these tests is shown in Table 9 below.

Table 9

Test item	Sample	Lapse of time (week)				
		0	2	4	6	8
P O V (meq/kg)	Sample A	0.26	0.77	0.73	1.10	1.56
	Sample B	0.5	6.0	11.5	9.5	15.0
	Untreated product	1.1	7.2	11.2	50	110
	Sample A	1.8	2.0	2.0	2.2	2.4
C O V	Sample B	2.7	3.2	7.4	9.9	14.0
	Untreated product	2.6	3.1	5.9	9.0	16.9
	Sample A	1	1	1	1	1
Color	Sample B	1	1	2	2	3
	Untreated product	4	4	4	5	6

The test items POV and COV shown in Table 9 stand as general evaluation standards for odor, storage stability and color. The quality of the product becomes higher as the value for these test items becomes smaller. The test items POV and COV were measured according to the method defined in the standard methods for the analysis of fats and oils. The change in color was evaluated by allowing the samples to stand in a thermostat maintained at 50°C and comparing the color of the samples with the color of the samples before storage (control). The scale of the evaluation is represented by the following six reference numerals 1-6

- 1: No difference in comparison with control
- 2: Slightly colored in comparison with control
- 3: A little discolored in comparison with control
- 4: Medium discoloration in comparison with control
- 5: Significantly discolored in comparison with control
- 6: Seriously discolored in comparison with control

As shown in Table 9, it is understood that sample A is extremely superior in quality as compared with the sample B and the untreated product.

Example 6

An operation was carried out in the same manner as described in Example 5 except that the conditions for the hydrogenation treatment were varied whereby various hydrogenated products of the C₁₈ fraction were obtained.

The hydrogenated products were then examined for their POV, COV and color after allowing them to stand for 8 weeks. The result of the examination is shown in Table 10 below.

Sample No. 5 in Table 10 is a mixture of 100 parts by weight of a sample No. 1 and 50 parts by weight of fatty acid esters which were retained after separation of the C₁₈ fraction in fractional distillation.

Table 10

Sample	Fatty acid component (% by weight)			Properties just after produced			Properties after 8 weeks		
	C ₁₈ F ₁	C ₁₈ F ₂	C ₁₈ F ₃	POV	COV		POV	COV	
No									
1	88.2	0.2	trace	0.26	1.8	1	1.56	2.4	1
2	87.6	1.8	"	0.28	1.9	1	2.53	3.0	1
3	85.0	2.3	"	0.35	2.1	1	5.17	6.4	2
4	80.5	8.6	"	0.5	2.7	1	15.0	14.0	3
5	58.8	0.1	"	0.27	1.8	1	1.58	2.5	1

CLAIMS:

1. A fatty acid salt or ester product derived from palm oil and comprising fatty acid salts or esters of 18 carbon atoms, wherein the content of fatty acid salts or esters having at least two double bonds is 2% by weight or less.

2. A product according to Claim 1, wherein the content of said fatty acid salts or esters having at least two double bonds is 1% by weight or less.

3. A product according to Claim 1 or 2, wherein said fatty acid salts or esters of 18 carbon atoms contain fatty acid salts or esters having a single double bond in an amount of 10-95% by weight.

4. A product according to any preceding claim, wherein the content of C₁₈ fatty acid salts or esters having three double bonds is 0.05% by weight or less.

5. A product according to any preceding claim which is a salt product.

6. A soap composition comprising a fatty acid salt product according to Claim 5 together with one or more conventional soap ingredients.

7. A soap composition according to Claim 6, wherein said fatty acid salt product includes 5-50% by weight of fatty acid salts having at most 12 carbon atoms, 0-15% by weight of fatty acid salts having 14 carbon atoms, and 0-45% by weight of fatty acid salts having 16 carbon atoms, with the content of the fatty acid salts having 18 carbon atoms being 10-95% by weight, said composition being in the form of a solid.



8. A composition according to Claim 7, further comprising fatty acid salts derived from coconut oil and/or palm kernel oil and having 12 and 14 carbon atoms.

9. A composition according to any one of Claims 6-8 and containing elaidic acid salts.

10. A composition according to Claim 9, wherein the weight ratio of the elaidic acid salts to the content of oleic acid salts in the composition is from 5/95 to 70/30.

11. A process for the production of fatty acid salts, which comprises the steps of (a) subjecting palm oil to a transesterification reaction with a lower alcohol, (b) separating glycerol from the resultant product to obtain a mixture of fatty acid esters, (c) fractionating the mixture of fatty acid esters into a first fraction comprised predominantly of fatty acid esters having 18 carbon atoms and a second fraction comprised predominantly of other fatty acid esters, (d) subjecting said first fraction to a hydrogenation treatment, and (e) saponifying the hydrogenated product with an alkali.

12. A process according to Claim 11, wherein at least a part of said second fraction is mixed with said first fraction prior to step (e) and the resultant mixture is subjected to step (e).

13. A process according to Claim 11 or Claim 12, further comprising the steps of (f) saponifying at least a part of the second fraction and (g) mixing the saponified product from step (f) with the saponified product from step (e).



14. A process according to any one of Claims 11-13 which is carried out to obtain a product in which the content of fatty acid salt components having 18 carbon atoms and at least two double bonds is 2% by weight or less, while the content of fatty acid components having 18 carbon atoms and one double bond is 10-96% by weight.

15. A process for the production of fatty acid lower alkyl esters, which comprises the steps of (a) subjecting palm oil to a transesterification reaction with a lower alcohol, (b) separating glycerol from the resultant reaction product to obtain a mixture of fatty acid esters, (c) fractionating the mixture of fatty acid esters into a first fraction comprised predominantly of fatty acid esters having 18 carbon atoms and a second fraction comprised predominantly of other fatty acid esters, and (d) subjecting said first fraction to a hydrogenation treatment, whereby fatty acid lower alkyl esters are obtained which comprise 2% by weight or less of fatty acid components having 18 carbon atoms and at least two double bonds and at least 20% by weight of fatty acid esters having 18 carbon atoms and one double bond.

16. A process according to Claim 15, further comprising the step of mixing said second fraction with said hydrogenated product.

17. A fatty acid salt or ester product according to Claim 1 and substantially as described in any one of the Examples herein.

18. A soap composition according to Claim 6 and substantially as described in any one of the Examples herein.



19. A process for the production of fatty acid salts according to Claim 11 and substantially as described in any one of the Examples herein.

20. A process for the production of fatty acid lower alkyl esters according to Claim 15 and substantially as described in any one of the Examples herein.
