

(19)



(11)

EP 1 935 971 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

25.06.2008 Bulletin 2008/26

(51) Int Cl.:

C11C 5/02 (2006.01)

C11C 3/02 (2006.01)

(21) Application number: **06126298.6**

(22) Date of filing: **18.12.2006**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

Designated Extension States:

AL BA HR MK RS

(71) Applicant: **Chant Oil Co., Ltd.**

Shu-Lin City

Taipei Hsien (TW)

(72) Inventor: **Lee, Yi-Fa**

TAIPEI Hsien (TW)

(74) Representative: **Collin, Jérôme**

Cabinet Régimbeau

20, rue de Chazelles

75847 Paris Cedex 17 (FR)

(54) **Partial acyl glyceride based biowaxes, biocandles prepared therefrom and their preparation methods**

(57) The present invention relates to a biowax comprising a partial acyl glyceride selected from the group consisting of a monoacylglyceride, a diacylglyceride and the combination thereof. The present invention also re-

lates to a biocandle comprising a biowax and a wick, and to a method of producing the same.

EP 1 935 971 A1

Description**BACKGROUND OF THE INVENTION**

1. Field of the Invention

[0001] The present invention relates to a biowax comprising partial acyl glycerides (PAG). The present invention also relates to biocandles formed from said biowax, and to a method for the production of the same.

2. Description of Related Arts

[0002] Many types of candles have already been developed on the market. Conventionally, candles are made by paraffin and/or natural waxes. Some typical candles prepared by conventional methods can be formed as container candles, votive candles, pillar candles, taper candles, tea-light candles and hurricane candles.

[0003] For a long time, it has been known that biowaxes, such as beeswax (myricyl palmitate) and spermaceti wax (cetyl palmitate), etc., can be used as natural waxes for the preparation of candles. Later, fossil waxes, such as paraffin, etc., are used as raw materials of candle waxes for the preparation of candles, in parallel with the development of the petroleum refining industry.

[0004] Today, paraffin-based waxes are major raw materials for the production of candles. The paraffin is produced from the residue left after refinement of fossil oils. It was found that paraffin can be completely burned, but it typically emits a smoke and produces an unpleasant odor when burning.

[0005] Palm stearin is a byproduct from palm oil refinery industry. The yield of palm stearin every year is huge and the price thereof is more inexpensive than paraffin. It has attempted to apply palm stearin as an ingredient of candle wax. However, due to the lower melting point property of the palm stearin, the compounding percentage in candle wax is limited and difficultly controlled. Even though the palm stearin may be hydrogenated to be one having a higher melting point, candles made therefrom are brittle and lack malleability. Thus, the application of palm stearin as an ingredient of candle wax is still limited.

[0006] To provide the candles having clean burning characteristics, extensive researches on candle waxes having low paraffin content have been conducted. For example, U.S Patent Nos. 6,503,285; 6,645,261; 6,770,104; 6,773,469; 6,797,020; and 5,824,572 disclose triacylglycerol based candle waxes, particularly those derived from various animal and/or plant sources, such as vegetable oil-source.

[0007] However, candle waxes formulated from vegetable oil-based materials often result in a variety of problems. It was found that vegetable oil-based candles have many disadvantages, such as cracking, air pocket formation and a natural product odor associated with soybean materials, as compared with paraffin-based candles. In addition, the soybean-based waxes have performance problems relating to optimum flame size, effective wax and wick performance matching for an even burn, maximum burning time, product color integration and/or product shelf life. Hence, to have the aesthetic and functional product surface and quality required by consumers, it is necessary to develop new substitutive vegetable oil-based waxes.

[0008] Accordingly, there exists a need to develop substitutive wax materials. Said substitutive wax materials have clean burning property when being used for forming candles. Preferably, such materials are biodegradable and derived from renewable raw materials. More preferably, the candle base wax materials have physical characteristics, such as melting point, hardness and/or malleability, etc., that permit the materials to be readily formed into candles having a pleasing appearance and/or feel to the touch, as well as having desirable olfactory properties.

[0009] Further, the Kyoto Protocol establishes the agreements of green issues in every aspect on the earth and its objective is "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". As fossil fuel resources are scarce and the oil prices are soaring up, biomass fuels play a vital role on renewable energy supply chain. In the fast developing biodiesel supply chain, the oversupply of glycerol becomes an urgent problem to be solved.

SUMMARY OF THE INVENTION

[0010] The present invention provides partial acyl glycerides (PAG)-based biowaxes. Such PAG-based biowax consumes majority of glycerol, thus ramify the biodiesel supply chain to solve the excess production of glycerol. In this invention, consuming the glycerol to produce PAG-based biowax and using the biowax in formation of green candle can facilitate the healthy developing of Carbon Cycle on Earth. Eventually it redirect the fossil energy to most valuable and feasible agricultural energy policy.

[0011] The present invention provides PAG-based biowax useful as candle wax. PAG-based biocandle has comparable burning characteristic with commercial candles made from paraffin wax in terms of flame length and is free of unpleasant

odor. It has superior characteristics than paraffin wax which include low soot emission and high additives compatibility. It would be advantageous to use PAG-based biowax to replace paraffin wax.

[0012] In accordance with the present invention, the present invention further provides a biocandle comprising a biowax and a wick, wherein the biowax comprises partial acyl glycerides. Further, the candles may also be formed from PAG-based biowaxes containing paraffin and/or stearin as additional ingredients. The candles prepared therefrom exhibit uniform texture, translucent and fine grain crystalline structure. The candles are generally clean burning and emit very little soot. Due to the combination of low soot emission and biodegradability, the production of candles from renewable raw materials makes the present candles a particularly environmentally friendly product.

[0013] In accordance with the present invention, it provides a method for preparing biocandles. With the method of the present invention, various types of biocandles, such as container candles, candle beads, etc. may be formed.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

Figure 1 shows the gas chromatographic analysis result of GMP.

Figure 2 shows the gas chromatographic analysis result of partial acyl glycerids of Example 8 (defined as $GMS_{IV=1.0}$).

Figure 3 shows the gas chromatographic analysis result of partial acyl glycerides (defined as $GMS_{IV=15}$).

Figure 4 shows the gas chromatographic analysis result of partial acyl glycerides of Example 11 (defined as $GMS_{IV=20}$).

Figure 5 shows the gas chromatographic analysis result of partial acyl glycerides of Example 12 (defined as $GMS_{IV=30}$).

DETAILED DESCRIPTION OF THE INVENTION

[0015] According to the present invention, the biowax comprises partial acyl glycerides (PAG). Preferably, the biowax according to the present invention comprises about 20 wt.% to 100 wt.%, preferably 30 wt.% to 100 wt.%, of PAG, based on the total weight of the biowax.

[0016] As used herein, the term "biowax" refers to waxes produced from the raw materials derived from the biodiesel supply chain. As used herein, the term "partial acyl glyceride" refers to a glyceride selected from the group consisting of a monoacylglyceride (MAG), a diacylglyceride (DAG) and the combination thereof. The partial acyl glyceride may be obtained by the esterification of glycerol molecules with one or two medium or long fatty acids chain. As used herein, the term "medium chain fatty acid" refers to a saturated or unsaturated fatty acid having 6 to 10 carbons, or a mixture thereof. Further, the term "long chain fatty acid" refers to a saturated or unsaturated fatty acid having 14 to 24 carbons, or a mixture thereof. More preferably, the acyl group has straight chains of C16, C18, C18:1, C18:2. According to the present invention, the partial acyl glyceride can be used alone, or in combination with triacylglycerides and/or other ingredients. The term "biocandle" used herein refers to candles produced from biowaxes.

[0017] According to the present invention, the biowax may further comprise triacylglyceride (TAG), stearin, or paraffin or a combination thereof as an additional ingredient. In one preferred embodiment of the present invention, the biowax comprises a monoacylglyceride (MAG), a diacylglyceride (DAG) and a triacylglyceride (TAG). The monoacylglyceride is used preferably in an amount of about 10 to 75 wt. %, more preferably in an amount of about 40 to 70 wt. %, based on the weight of the biowax. The diacylglyceride (DAG) is preferably used in amount of about 10 to 50 wt. %, more preferably in an amount of about 10 to 35 wt. %, based on the weight of the biowax. The triacylglyceride (TAG) is optionally used in an amount of about 5 to 50 wt. %, preferably in an amount of 10 to 40 wt. %, based on the weight of the biowax.

[0018] In the present invention, the biowax may optionally include minor amounts of other additives to modify the properties of the waxy materials. Examples of the additives incorporated into the biowax of the present invention include colorants, fragrances (e.g., fragrance oils), antioxidants, UV light absorber and migration inhibitors, and the like. Preferably, the biowax is blended with natural colorants to provide an even solid color distribution.

[0019] Biowax has a melting point of about 40 to 62°C. In one embodiment, the biowax has an Iodine Value of about 0.2 to 35.

[0020] In the present invention, the biowax can be formed into a desired shape. According to one preferred embodiment, the biowax may be formed into powdered or ground particles. Preferably, the biowax can be formed into beads by heating the biowax to a molten state and then spray cooling the molten biowax, or by means of a bead-manufacturing device commercially available from Chant Oil Co., Ltd. (Taiwan, R.O.C.). According to the present invention, the biowax may be shaped into beads having a diameter of about 0.5 to 1.2 mm.

[0021] In the present invention, the biowaxes are suitable as raw materials for the manufacture of biocandles.

[0022] According to the present invention, it provides a biocandle comprising a biowax and a wick, wherein the biowax comprises partial acyl glycerides (PAG). The biocandle is typically solid, firm but not brittle, generally somewhat malleable,

with no free oil visible. In the present invention, the biocandles may be prepared by means of melt-processing to form the desired shape of candles, such as pillar candles, tea light candles, etc.

[0023] In the present invention, in order to fully benefit from the environmentally-safe aspect of said PAG-based biowax, it is desirable to use a wick which does not have a metal core, such as a lead or zinc core. One example of a suitable wick material is a braided cotton wick. The wick may apply standard wicks employed with other waxes (e.g., paraffin and/or beeswax).

[0024] According to the present invention, it further provides a method of preparing a biocandle, comprises the steps of: 1) heating the PAG-based biowax to a molten state, 2) introducing the molten biowax into a mold, wherein the mold includes a wick disposed therein, 3) cooling the molten biowax in the mold, and 4) solidifying the biowax, and then removing the solidified biowax from the mold.

[0025] The present invention further provides a method for preparing a biocandle comprising heating the PAG-based biowax to a molten state, spray cooling the biowax to form 0.5 to 1.2 mm beads and compressing the biowax beads into a mold to form as candles.

[0026] For preparation of biocandles, it is important that the colorants, if present, need be dissolved in the PAG-based biowax in order to prevent insoluble particles from blocking the biowax flow in the wick. Generally, the blocked biowax flow results in a poor candle bum. Further, the color of the biowax may also affect the dying performance. Most fragrances can be applied to the biowax to improve the performance of the resulting biocandles, such as stability, reactivity, color, etc.

[0027] According to the present invention, the resulting biocandles are clean burning and emit very little soot.

[0028] In the present invention, all numbers expressing quantities of ingredients, properties, etc. in the specification and claims are to be understood as being modified in all instances by the term "about", and all parts and percentages referred to in this specification and claims are by weight, unless otherwise specified.

[0029] The invention is illustrated in greater detail by the examples described below. The examples are not intended in any way to limit the scope of the invention. Notwithstanding that the numerical ranges and parameters setting forth the broad scope are approximations, the numerical values set forth in the specific example are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in its respective testing measurements.

Examples

A. Gas Chromatographic Analysis of PAG

[0030]

GC Model: YOUNGLIN ACME 6000M GC

GC Conditions:

1. Column: QUADREX fused silica capillary column; 007-65HT-25W-0.1F, 0.32mmID
2. Detector: FID
3. Carrier Gas: Nitrogen
4. Oven Temperature:
 - 1) 80°C (Hold 1 min), and to 240°C in a rate of 20°C/min;
 - 2) 240°C, and to 360°C in a rate of 4°C/min;
 - 3) 360°C (Hold 11 min)

5. Injector Temperature: 280°C
6. Detector Temperature: 360°C
7. Determination Range: 6x10³mV

Preparation of Samples:

Homogeneously mixing 0.2 gm of sample with 5cc chloroform.

Analysis Conditions:

1. Sample Content: 0.2 µl
2. Analysis Time: 50 mins

EP 1 935 971 A1

B. Components for the Preparation of waxes

[0031] Component 1: Paraffin wax, supplied by Taiwan Wax Co., Ltd., has the physical properties listed on Table 1.

Table 1

Physical Property	Test Method	Value
M.P., °C	ASTM D87	59.8
Needle Penetration at 25°C, mm	ASTM D 1321	15.5
Kinetic Viscosity at 100°C, cps	ASTM D445	4.382
Oil Content, wt. %	ASTM D721	0.116
Color	ASTM D156	30
Carbon Distribution	ASTM D5442	C ₂₀ ~ C ₄₆
<C ₂₆		16.48%
C ₂₆₋₂₉		23.78%
C ₂₉₋₃₂		23.05%
C ₃₂₋₄₄		36.69%
>C ₄₄		nil
n-Paraffin		51.05%

Component 2: Fatty acid S1801, supplied by P.T. MUSIM MAS., has the physical properties listed on Table 2.

Table 2

Physical Property	Test Method	Value
Acid Value, mg KOH/g	ASTM D 1980-87	210.2
Saponification Value, mg KOH/g	ASTMD1962-85	211.4
Iodine Value, g Iodine/100g	ASTM D 1959-97	0.13
M.P., °C	ASTM D 1982-85	55.4
Fatty Acid Carbon Chain Composition, %	ASTM D 1983-90	
C12+14		0.4
C16		57.67
C18		41.3
Others		0.5

Component 3: Fatty acid 1698, supplied by P.T. MUSIM MAS., has the physical properties listed on Table 3.

Table 3

Physical Property	Value
Acid Value, mg KOH/g	218.5
Saponification Value, mg KOH/g	220
Iodine Value, g Iodine/100g	0.1
M.P., °C	62.0
Fatty Acid Carbon Chain Composition, %	
C12+14	0.3

EP 1 935 971 A1

(continued)

Physical Property	Value
C16	98.6
C18	1.1
Others	0.5

Component 4: Two types of RBD Palm Stearin supplied by P.T. MUSIM MAS. having the physical properties listed Table 4.

Table 4

Physical Property	Type 1	Type 2
Free Fatty Acid, %	0.057	0.01
Iodine Value, g Iodine/ 1 00g	20.4	33.3
M.P., °C	56.5	51
Fatty Acid Carbon Chain Composition, %		
C16	72.00	59.8
C18	5.10	3.67
C18:1	16.22	29.7
C18:2	3.67	5.22

Component 5: Hardened Fat FO81, made by hydrogenation of RBD palm stearin (Type 2, Component 4) at a temperature of from 170 to 200°C and at a pressure of 3kg in the presence of Ni catalyst (0.2%) for 4 hours, has the physical properties listed on Table 5.

Table 5

Physical Property	Value
Acid Value, mg KOH/g	1.2
Saponification Value, mg KOH/g	196.8
Iodine Value, g Iodine/100g	0.4
M.P., °C	57
Color Gardner	1.3
Fatty Acid Carbon Chain Composition, %	
C16	59.8
C18	35.6

Component 6: Partial Acyl Glyceride defined as GMP, made by the reaction of 200 gm of Fatty Acid 1698 (Component 3) with 72 gm of glycerol at 250 °C for 5 hours, has the physical properties listed on Table 6a and GC analysis result and data respectively shown in Figure 1 and Table 6b.

Table 6a

Physical Property	Value
Free Fatty Acid, %	1.2
M.P., °C	56
MAG %	64.0
DAG, %	25.5

EP 1 935 971 A1

(continued)

Physical Property	Value
TAG, %	9.3
MAG: Monoacylglyceride DAG: Diacylglyceride TAG: Triacylglyceride	

Table 6b

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
1	FFA	8.813	146.88	1.20
2	GMP	14.424	7845.39	63.98
3	GDP	31.754	3132.86	25.54
4	GTP	48.118	1137.85	9.28
FFA: Free Fatty Acid GMP: Glycerol Monopalmitate GDP: Glycerol Dipalmitate GTP: Glycerol Tripalmitate				

Component 7: Partial Acyl Glyceride defined as $\text{GMS}_{\text{IV}=1.0}$, made by the reaction of 200 gm of Fatty Acid S1801 (Component 2) with 72 gm of glycerol at 250 °C for 5 hours, has the physical properties listed on Table 7a and GC analysis result and data respectively shown in Figure 2 and Table 7b.

Table 7a

Physical Property	Value
Acid Value, mg KOH/g	0.4
Iodine Value, mg KOH/g	0.2
Color, APHA	140
M.P., °C	56
MAG, %	62.6
DAG, %	28.8
TAG, %	7.6

Table 7b

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
1	G	3.539	519.91	0.65
2	FFA	6.525	233.16	0.29
3	FFA	7.350	46.61	0.06
4	Mono-Glyceride	10.453	48623.36	60.90
5	Di-Glyceride	16.861	215.56	0.27
6	Di-glyceride	23.320	24237.86	30.36

EP 1 935 971 A1

(continued)

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
7	Tri-Glyceride	36.047	5964.83	7.47
G: Glycerol				

Component 8: Partial Acyl Glyceride defined as $\text{GMS}_{\text{IV}=15}$, made by a 200gm of mixture of equal amount of FO81 (Component 5) and RBD palm stearin (Type 2, Component 4) with 40 gm of glycerol at 250 °C for 8 hours, has the physical properties listed on Table 8a and GC analysis result and data respectively shown in Figure 3 and Table 8b.

Table 8a

Physical Property	Value
M.P., °C	46
MAG, %	68.35
DAG, %	15.69
TAG, %	11.72

Table 8b

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
1	G	2.572	83.89	0.62
2	FFA	6.424	487.76	3.6
3	FFA	7.287	558.61	4.14
4	Mono-Glyceride	9.360	8665.79	64.21
5	Di-Glyceride	15.445	10.99	0.08
6	Di-glyceride	19.710	2106.60	15.61
7	Tri-Glyceride	27.898	6.40	0.05
8	Tri-Glyceride	29.627	42.31	0.31
9	Tri-Glyceide	31.626	1532.99	11.36

Component 9: Partial Acyl Glyceride defined as $\text{GMS}_{\text{IV}=20}$, made by the reaction of 200 gm of RBD palm stearin (Type 1, Component 4) with 40 gm of glycerol at 250 °C for 8 hours, has the physical properties listed on Table 9a and GC analysis result and data respectively shown in Figure 4 and Table 9b.

Table 9a

Physical Property	Value
Color	1.4
M.P., °C	46
MAG %	49.6
DAG,%	11.1
TAG, %	33.1

EP 1 935 971 A1

Table 9b

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
1	FFA	6.499	989.15	5.25
2	Mono-Glyceride	9.405	8776.13	46.60
3	Di-Glyceride	19.948	2471.18	13.12
4	Tri-Glyceride	27.846	16.10	0.09
5	Tri-Glyceride	32.31	6582.08	34.95

Component 10: Partial Acyl Glyceride designed as $\text{GMS}_{\text{IV}=30}$, made by the reaction of 200 gm of RBD palm stearin (Type 2, from Component 4) with 40 gm of glycerol at 250 °C for 8 hours, has the physical properties listed on Table 10a and GC analysis result and data respectively shown in Figure 5 and Table 10b.

Table 10a

Physical Property	Value
M.P., °C	42
MAG, %	66.2
DAG, %	13.4
TAG, %	13.3

Table 10b

Peak No.	Component	Retention Time (second)	Area	Percentage (%)
1	G	2.489	49.89	0.18
2	FFA	6.511	1933.86	6.93
3	Mono-Glyceride	9.507	18463.30	66.20
4	Di-Glyceride	13.502	14.22	0.05
5	Di-Glyceride	15.504	20.38	0.07
6	Di-Glyceride	20.023	3715.59	13.32
7	Tri-Glyceride	27.924	18.28	0.07
8	Tri-glyceride	33.699	3674.74	13.18

C. Preparation of container candle (as listed in Table 11) to be tested:

[0032] Various components were mixed in an equal weight amount and molten. The molten waxes were poured into an aluminum cup having 15mm height x 37.5mm diameter with a 23mm length of braided cotton wick disposed in the middle of the cup. The resulting candles were cooled and solidified for the burning test.

Examples 1 to 13

[0033] The container candles were prepared according to the components and contents listed on Table 11.

D. Burning Test

[0034] The burning performances of biocandles prepared from partial acyl glyceride (PAG) based biowaxes were carried out by following the steps below:

1. numbering and weighing each of container candles having various amounts of components;

EP 1 935 971 A1

2. placing the container candle separated by a distance of 100 mm on the experimental table;
3. placing a plaster slab 75 mm above the table, to observe the smoke emitting from the candles, when burning;
4. igniting the container candles and starting timing; measuring the flame heights of each container candles as soon as possible, when the wax is molten around each of the wick (about 5-6 minutes);
5. measuring the flame heights at an interval of one hour;
6. measuring the temperatures at the highest point of inside flame for each container candle after 60 minutes;
7. weighing each container candle after one of them burned out; and then calculating its burning rates of each container candle.

[0035] The burning test results of the container candles are shown on Table 11.

Table 11

Example No.	1	2	3	4	5	6	7	8	9 _{Comparative}	10	11	12	13
Component 1: Paraffin wax (weight, g)	3.91	4.94	5.23				7.78		7.49				
Component 2: S1801 (weight, g)	3.91	4.94		5.49	7.99				7.49				
Component 5: FO81 (weight, g)	3.91		5.23	5.49		7.78							
Component 6: GMP (weight, g)													21.59
Component 7: GMS _{IV=1.0} (weight, g)	3.91	4.94	5.23	5.49	7.99	7.78	7.78	15.32					
Component 8: GMS _{IV=15} (weight, g)										23.26			
Component 9: GMS _{IV=20} (weight, g)											22.87		
Component 10: GMS _{IV=30} (weight, g)												22.04	
Properties													
MP(°C)	50.5	52	52	51.5	52	53	57.5	54	52		46	46	52
Initial weight (g)	15.64	14.82	15.69	16.47	15.98	15.56	15.56	15.32	14.98	23.26	22.87	22.04	21.59
Remain weight (g), after 132 min.	4.77	3.10	3.64	6.76	7.37	5.60	2.78	3.62	3.88	14.24	14.00	15.11	10.60
Bum rate (g/hr)	4.94	5.32	5.48	4.42	3.91	4.53	5.80	5.32	5.04	4.10	4.03	3.15	5.00
Flame Temperature (°C)	731	768	757	711	729	777	839	881	806	835	740	668	820
Flame Height (mm), after 6 min.	26	27	25	23	24	24	27	22	33	15	25	20	25
Flame Height (mm), after 70 min.	26	26	26	22	15	25	30	22	28	18	18	10	18
Flame Height (mm), after 132 min.	21	24	30	20	15	23	23	21	27	15	17	6	24

[0036] As shown on Table 11, the biocandles made by the biowaxes of the present invention, together with a balanced amount of paraffin and/or stearin, exhibit excellent wax flow through wicks by visual appearance. Meanwhile, the biocandles of the present invention show steady burn rate and good appearances, such as color, fragrance and clarity, and also emit low soot when burning and good smell.

[0037] While the embodiments of the present invention described herein are presently preferred, various modifications and improvements can be made without departing from the spirit and scope of the present invention. The scope of the present invention is indicated by the appended claims, and all changes that fall within the meaning and range of equivalents are intended to be embraced therein.

Claims

1. A biowax, comprising a partial acyl glyceride selected from the group consisting of monoacylglycerides and diacylglycerides, and the combination thereof.
2. The biowax of claim 1, wherein the partial acyl glyceride is present in an amount of 20 wt.% to 100 wt.%, based on the total weight of the biowax.
3. The biowax of claim 1, wherein the partial acyl glyceride is present in an amount of 30 wt.% to 100 wt.%, based on the total weight of the biowax.
4. The biowax of claim 1, further comprising triacylglycerides.
5. The biowax of claim 4, wherein the monoacylglycerides are in an amount of about 10 to 75 wt. % and the diacylglycerides are in an amount of about 10 to 50 wt. %, and the triacylglycerides are in an amount of about 5 to 50 wt. %, based on the weight of the biowax.
6. The biowax of claim 5, wherein the triacylglycerides are in an amount of about 10 to 40 wt. %, based on the weight of the mixture.
7. The biowax of any one of claim 1 to 6, which further comprises a colorant, antioxidant or fragrance oil.
8. The biowax of claim 7, which is formed into beads having a diameter of about 0.5 to 1.2 mm.
9. The biowax of any one of claims 1 to 6, which has a melting point of about 40 to 62°C .
10. The biowax of any one of claims 1 to 6, which has an Iodine Value of about 0.2 to 35.
11. A biocandle comprising a biowax according to any one of claims 1 to 6 and a wick.
12. A method of producing a biocandle, comprising the steps of:
 - 1) heating the PAG-based biowax to a molten state;
 - 2) introducing the molten biowax into a mold, wherein the mold includes a wick disposed therein;
 - 3) cooling the molten biowax in the mold; and
 - 4) solidifying the biowax, and then removing the solidified biowax from the mold;

wherein the biowax comprises a partial acyl glyceride selected from the group consisting of monoacylglycerides, diacylglycerides and the combination thereof.
13. A method of producing a biocandle, comprising the steps of
 - 1) heating the PAG-based biowax to a molten state;
 - 2) spray cooling the molten biowax to form 0.5 to 1.2 mm beads; and
 - 3) compressing the biowax beads into a mold to form as candles.

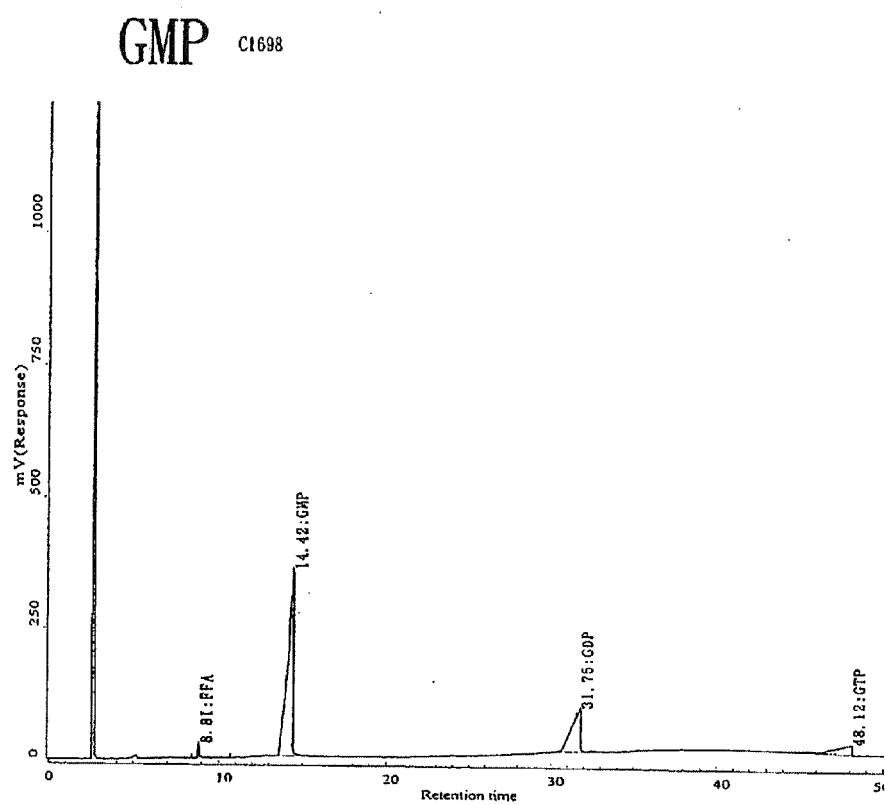


Fig. 1

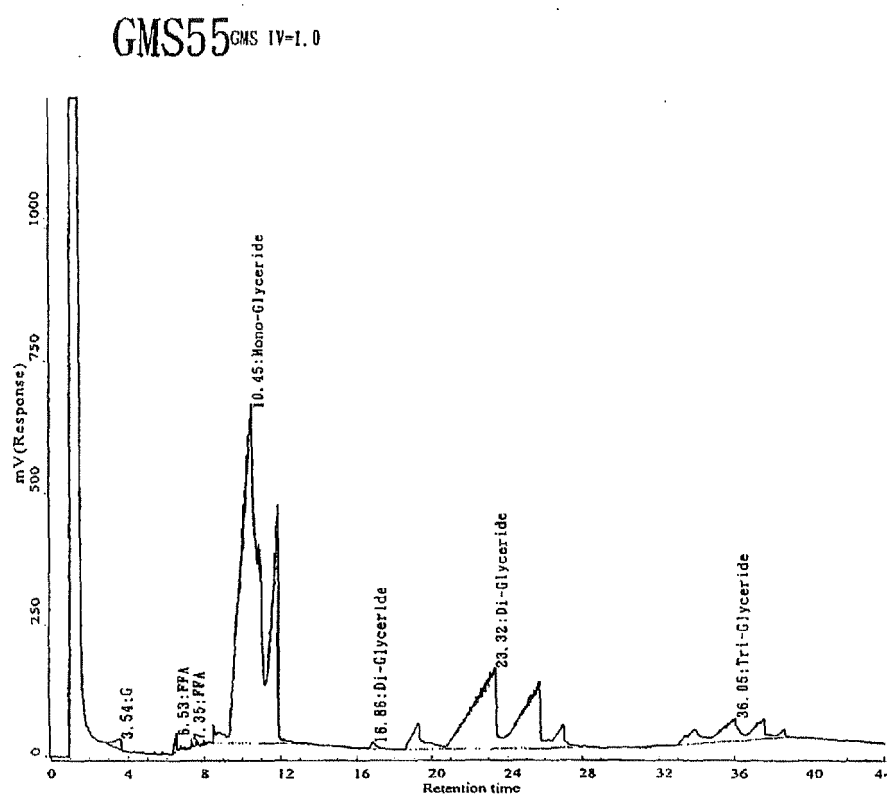


Fig. 2

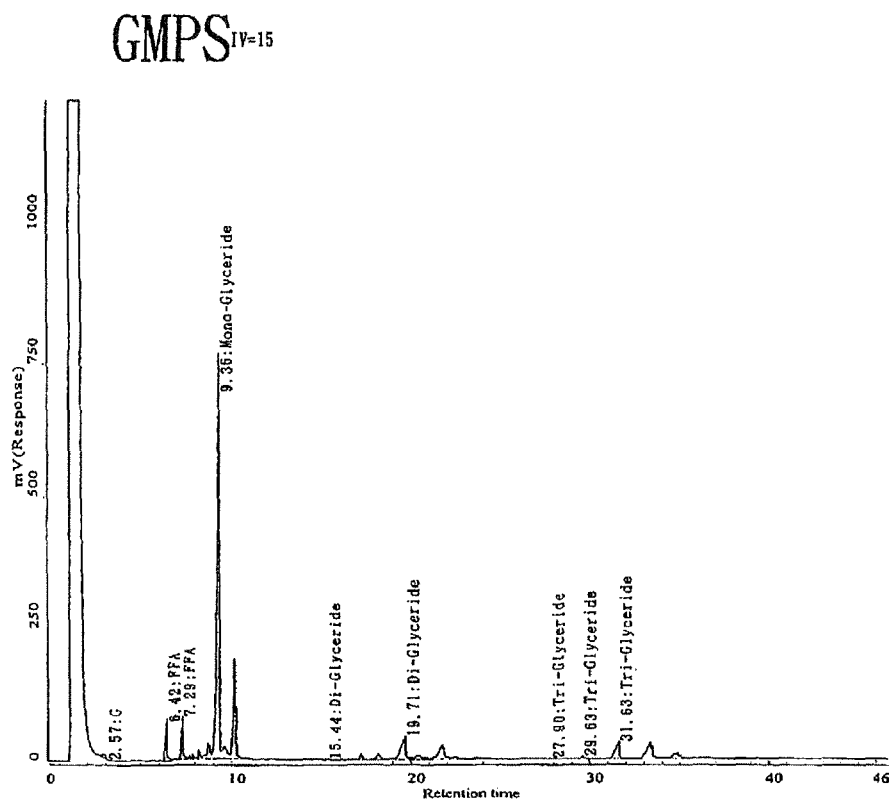


Fig. 3

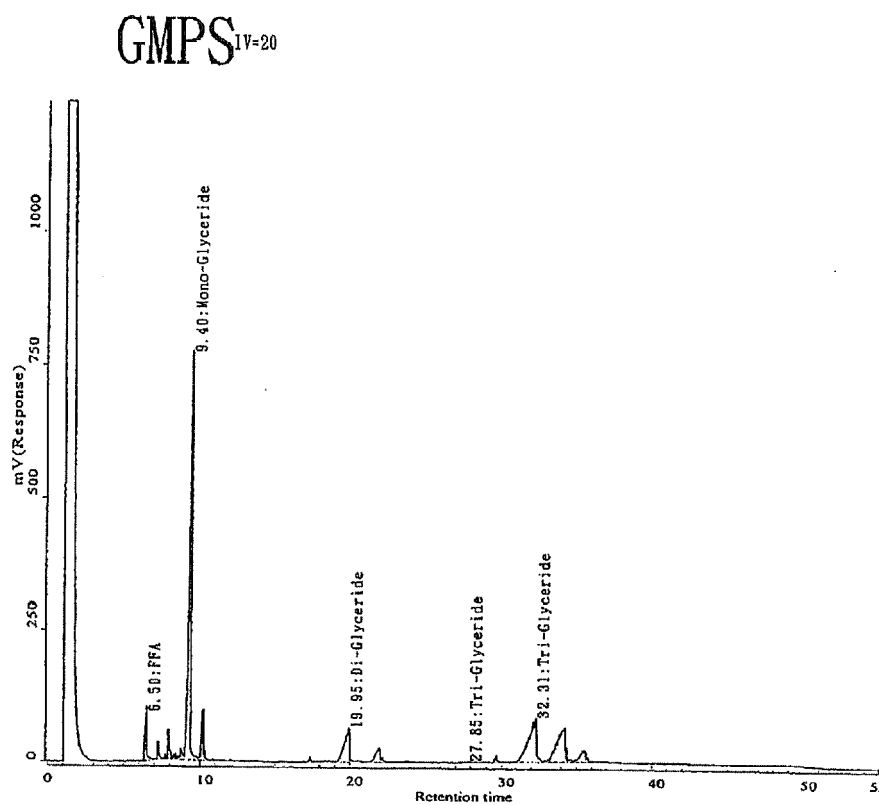


Fig. 4

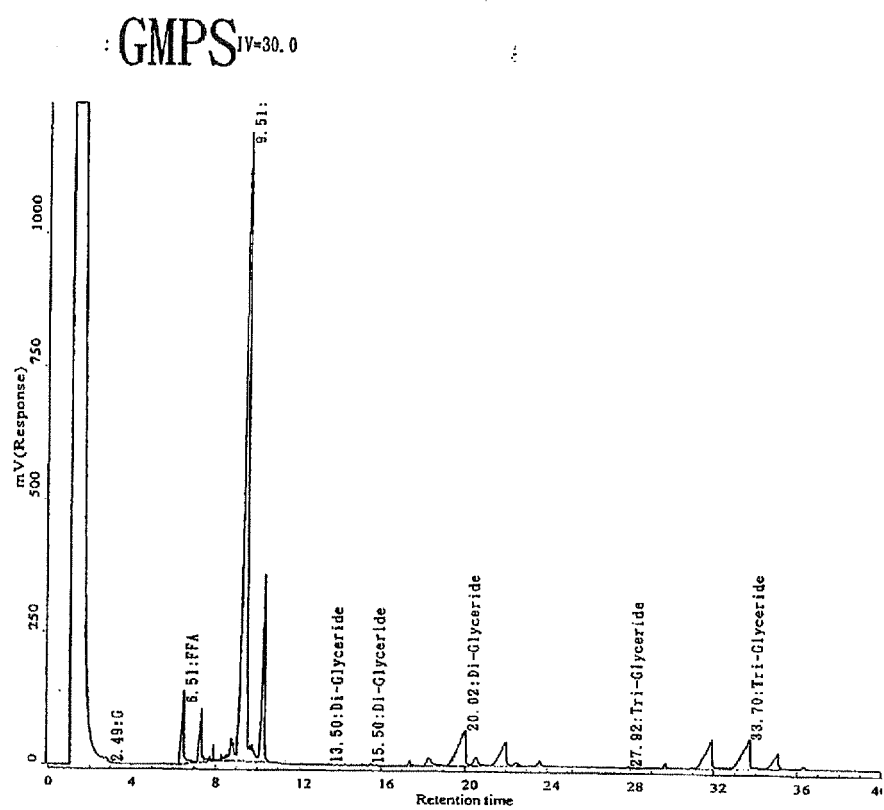


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 12 6298

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	MCNEILL G P ET AL: "SELECTIVE DISTRIBUTION OF SATURATED FATTY ACIDS INTO THE MONOGLYCERIDE FRACTION DURING ENZYMATIC GLYCEROLYSIS" 1 November 1992 (1992-11-01), JOURNAL OF THE AMERICAN OIL CHEMISTS' SOCIETY, AOCs PRESS, CHAMPAIGN, IL, US, PAGE(S) 1098-1103, XP000324893 ISSN: 0003-021X * the whole document *	1-10	INV. C11C5/02 C11C3/02
X	US 3 012 047 A (WOODS GEORGE E) 5 December 1961 (1961-12-05) * examples 1-3 *	1-6,9,10	
X	GUIMARAES AGUIAR, L.M., AND MATHEUS VARGAS, R.: "Preparation of monoglycerides by guanidine-catalyzed processes" JOURNAL OF THE AMERICAN OIL CHEMISTS' SOCIETY., vol. 75, no. 6, 1998, pages 755-756, XP002432189 USAMERICAN OIL CHEMISTS' SOCIETY. CHAMPAIGN. * page 755, column 2 - page 756, column 1 *	1-4,9,10	TECHNICAL FIELDS SEARCHED (IPC) C11C
X	EP 0 191 217 A1 (AMANO PHARMA CO LTD [JP]) 20 August 1986 (1986-08-20) * examples 5-7 *	1-4,9,10	
X	EP 1 693 436 A (CARGILL INC [US]) 23 August 2006 (2006-08-23) * paragraphs [0016], [0034]; claims 1,7,11,14 *	1-4,7,9-11	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 May 2007	Examiner Rooney, Kevin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 12 6298

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 844 706 A (TSARAS E) 29 October 1974 (1974-10-29) * the whole document *	1-13	
X	US 2004/088907 A1 (MURPHY TIMOTHY A [US]) 13 May 2004 (2004-05-13) * paragraphs [0040], [0056] - [0061] *	1,4,7,9-12	
X	US 2004/088908 A1 (MURPHY TIMOTHY A [US]) 13 May 2004 (2004-05-13) * the whole document *	1,2,4,6-13	
X	EP 0 041 204 A1 (HENKEL KGAA [DE]) 9 December 1981 (1981-12-09) * example 1 *	1-4,7,9,10	
X	US 2003/057599 A1 (MURPHY TIMOTHY A [US] ET AL) 27 March 2003 (2003-03-27) * the whole document *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 May 2007	Examiner Rooney, Kevin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 12 6298

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-05-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3012047	A	05-12-1961	NONE	
EP 0191217	A1	20-08-1986	DE 3561892 D1	21-04-1988
			ES 8701832 A1	01-03-1987
			JP 1724053 C	24-12-1992
			JP 4012112 B	03-03-1992
			JP 61181390 A	14-08-1986
			NL 8600148 A	01-09-1986
EP 1693436	A	23-08-2006	WO 2006087234 A1	24-08-2006
US 3844706	A	29-10-1974	NONE	
US 2004088907	A1	13-05-2004	US 2005060927 A1	24-03-2005
US 2004088908	A1	13-05-2004	NONE	
EP 0041204	A1	09-12-1981	DE 3020566 A1	10-12-1981
			JP 1014901 B	14-03-1989
			JP 1531665 C	24-11-1989
			JP 57024327 A	08-02-1982
US 2003057599	A1	27-03-2003	US 2007039237 A1	22-02-2007

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 6503285 B [0006]
- US 6645261 B [0006]
- US 6770104 B [0006]
- US 6773469 B [0006]
- US 6797020 B [0006]
- US 5824572 A [0006]