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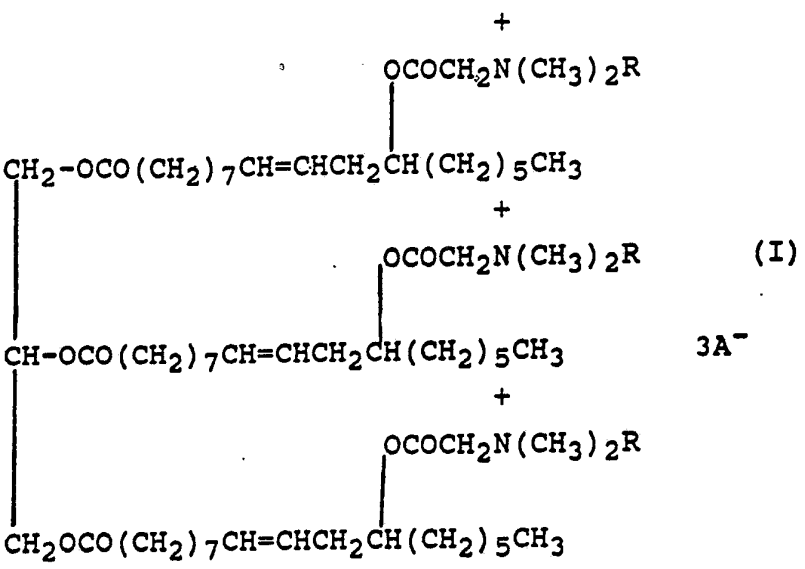
(54) Title: TRIGLYCERIDE QUATERNARY AMMONIUM COMPOUNDS, THEIR PREPARATION ANDUSE



(I)

(57) Abstract

The invention provides novel triglyceride quaternary ammonium compounds of formula (I), in which R is an alkyl group having 10 to 20 carbon atoms, preferably n-dodecyl or n-octadecyl, and A^- is a physiologically acceptable anion, preferably chloride. These compounds are prepared by a process which essentially comprises reacting triglyceryl ricinoleate with chloroacetyl chloride to esterify the hydroxyl groupes of the triglyceride and then reacting the product obtained with an alkyldimethylamine of the formula $N(CH_3)_2R$. The compounds of formula (I) are useful as additives to skin moisturizing compositions and hair conditioners.

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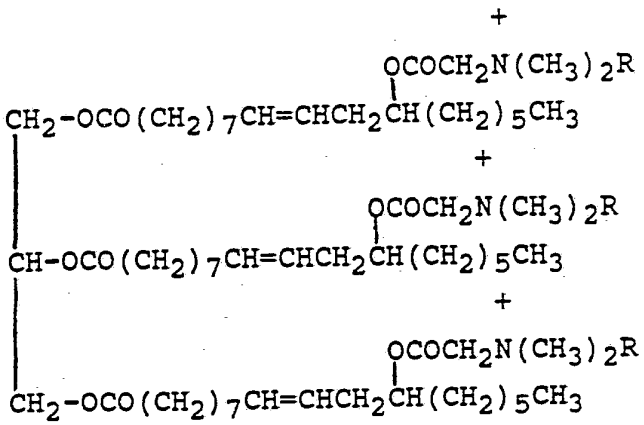
TRIGLYCERIDE QUATERNARY AMMONIUM COMPOUNDS, THEIR PREPARATION AND USE

This invention is concerned with certain novel triglyceride quaternary ammonium compounds, with a process for their preparation, and with their use in cosmetic and toiletry compositions.

Many cosmetic and toiletry compositions contain natural triglyceride oils, that is the glyceryl esters of naturally occurring long chain fatty acids, but in certain types of composition, such as moisturising compositions, it is found that certain triglyceride oils are not readily absorbed by the skin. Such slow or reduced absorption of triglyceride oils may reduce the acceptability of cosmetic or toiletry compositions containing them even though the other properties and characteristics of the compositions are favourable.

It would, therefore, be desirable to have available an additive which rendered natural triglyceride oils more readily absorbed by the skin and which was completely compatible with such triglycerides. An object of the invention is to provide a range of such additives.

We have now found that triglyceride quaternary ammonium compounds of formula I:



(I)

in which R is an alkyl group having 10 to 20 carbon atoms, and A^- is a physiologically acceptable anion, having a range of useful properties. Thus the compounds in which R is an alkyl group having 16 to 20 carbon atoms, when added to natural triglyceride oils, render the latter more readily absorbed by the skin and are completely compatible with such oils: those compounds also have useful hair conditioning properties. The compounds of formula I in which R is an alkyl group containing 10 to 12 carbon atoms have valuable bactericidal properties.

The triglyceride quaternary ammonium compounds of formula I are novel compounds and constitute one aspect of the present invention.

The anion A^- is preferably chloride, but may be any other physiologically acceptable anion which does not interfere with and is compatible with the composition in which the compound is used.

Particularly preferred compounds of formula I are those in which R is a linear alkyl group containing 12 or 18 carbon atoms, that is n-dodecyl or n-octadecyl (stearyl).

The compounds of formula I are not soluble in water, but are readily self emulsified in water. They are very soluble in ethanol and soluble in iso-propanol, propanol acetone and chloroform, and in hot ethyl acetate.

The compounds range from viscous oils to low

melting, waxing solids.

According to another aspect of the invention, there is provided a process for the preparation of a triglyceride quaternary ammonium compound of formula I, which comprises reacting triglyceryl ricinoleate with chloracetyl chloride to esterify the hydroxyl groups of the triglyceride, and reacting the product obtained with an alkyldimethylamine of the formula $N(CH_3)_2R$, where R has the above-stated meaning.

This process gives compounds of formula I in which A^- is chloride. These chlorides may be converted into salts having other anions, such as sulphate, by conventional procedures.

Triglyceryl ricinoleate is the major component of castor oil, the fatty acid content of which is typically as follows, by weight:

ricinoleic	87%
oleic	7%
linoleic	3%
palmitic	2%
stearic	1%

The process according to the invention is preferably carried out with castor oil, rather than with pure triglyceryl ricinoleate; the other triglycerides present in castor oil are unaffected by the reactions and are present with the desired quaternary ammonium compound in the product. Such an impure product is entirely suitable for use in the various applications, such as cosmetic and toiletry compositions, described herein.

The first stage of the process according to the invention may be carried out at room temperature or moderately elevated temperatures. Both the starting materials, that is triglyceryl ricinoleate (or castor oil) and chloroacetyl chloride are liquid and the reaction mixture may consist simply of the two

reactants. One or more organic solvents for the reactants may be present, if desired, suitable solvents being, for example, toluene, chloroform, or dichloromethane. It is generally preferred to use a stoichiometric excess of the chloroacetyl chloride, that is an excess over and above the 3 moles of chloroacetyl chloride required to react with 1 mole of triglyceryl ricinoleate; it is preferred to use an excess of 2 to 5 moles. Unreacted chloroacetyl chloride may be removed from the first stage product by repeated washings with and aqueous solution of an alkali, such as sodium bicarbonate.

The second stage of the process is generally carried out in the presence of a suitable organic solvent, such as ethanol, at an elevated temperature. It is preferred to use the stoichiometric quantity of the amine.

The triglyceride quaternary ammonium compounds of formula I in which R is C_{16}-C_{20} alkyl are valuable additives to a range of cosmetic and toiletry compositions. They are particularly useful in moisturizing compositions containing natural triglycerides which are not easily absorbed by the skin. Examples of such natural triglycerides are avocado oil and apricot kernel oil which are the major natural triglyceride oil components of certain commercially available moisturizing lotions and creams. By replacing 20% by weight of the avocado oil or apricot kernel oil in such compositions by the formula I compound in which R is stearyl, a significant improvement in the absorption of the composition by the skin is obtained.

The compounds of formula I in which R is C_{16}-C_{20} alkyl can also be used in hair conditioning compositions as the active hair conditioning component thereof. Their activity for this purpose is shown by conventional wet combing and fly-away tests and

measurement of combing work.

The compounds of formula I in which R is C_{12} alkyl also have useful anti-microbial activity, particularly against Gram positive bacteria. The compound, propane-1,2,3-tri[octadec-9-en-12(oxycarbonyl-N-methylene, N,N,dimethyl,N-dodecyl-ammonium chloride)oate], formula I, R=n-dodecyl, A^-=chloride (see Example 2 below), was subjected to the standard minimum inhibitory concentration (MIC) tests against a range of common microorganisms. The results obtained are as follows (MIC values in ppm/μg)

	MIC
Staphylococcus aureus	60
Candida albicans	250
Aspergillus wentii	500
Pseudomonas putida	2000
Proteus rettgeri	2000

The first two of these organisms are Gram positive bacteria, the third is a fungus, and the fourth and fifth are Gram negative bacteria.

In order that the invention mey be more fully understood, the following examples are given by way of illustration only.

Example 1

(i) Preparation of propane-1,2,3-tri[octadec-9-en 12(-oxycarbonylchloromethane)oate]

Castor oil (20g) was stirred at room temperature for 12 hours with chloroacetyl chloride (45ml). The reaction mixture was taken up in ether, the ethereal solution was washed with aqueous sodium bicarbonate (x8), water (x2), and then dried. The solvent was removed under reduced pressure to yield propane-1,2,3-[trioctadec-9-en-12(oxycarbonylchloromethane)oate] as a viscous orange oil (21.2g).

3g of the oil was purified by column chromatography using silica gel and ethyl acetate

(10%) and 60-80 petroleum ether (90%) as eluant. The pure chloro derivative was dried in a vacuum oven at 100°C for 24 hours.

Ir: 1740(C=O), 1725 (C=O) cm^{-1}

Nmr: δ5.41-5.56 (m, 3H, CH=), 5.23-5.39 (m, 3H, CH=) 5.26-5.33 (m, 1H, CH-O), 4.90-4.97 (pentet, 3H, CH-OCO), 4.31 (pseudo d, 2H, CH_2-O), 4.19 (pseudo d, 2H, CH_2-O), 4.03 (s, 6H, OCH_2Cl), 2.26-2.39 (m, 12H, $6XCH_2$-C=C) 2.03-2.09 (m, 6H, $3XCH_2C$=O), 1.2-1.6 (m, 60H, $30XCH_2$) 0.94 (t, 9H, Me) ppm.
(s=singlet, d=doublet, t=triplet, m=multiplet, br=broad)

Analysis:	Required	Found
%C	65.05	65.16
%H	9.29	9.38
%Cl	9.15	8.68

(ii) Preparation of propane-1,2,3-tri[octadec-9-en-12(oxycarbonyl-N-methylene, N,N, dimethyl, N-octadecyl-ammonium chloride)oate]

The crude chloro derivative from (i) (11.6g, 0.01M) and stearyl dimethylamine (8.94g,0.03M) were refluxed in 100 ml of ethanol for 90 hours. The solvent was removed under reduced pressure and the residue was dried under vacuum at 80°C to give a viscous oil which solidified into a wax on standing (yield: 18.9g). This product was 88% quaternary ammonium salt, that is propane-1,2,3-tri[octadec-9-en-12(oxycarbonyl-N-methylene, N,N,-dimethyl, N-octadecylammonium chloride)oate], the remainder being the triglycerides of fatty acids other than ricinoleic acid present in castor oil.

The pure chloro derivative as obtained by chromatography, see (i), (1.16g, 0.001M) and stearyl-dimethylamine (0.894g, 0.003M) were refluxed in 20 ml of ethanol for 90 hours. The product was worked up as

for the crude derivative.

Yield: 2.01 g (98%)

Ir: 1740(C=O), 1640(C=C) cm^{-1}

Nmr: δ5.4-5.6(m, 3H, CH=), 5.34-5.38 (m, 3H, CH=), 5.12 (m, 1H, CHO), 4.97 (m, 3H, CHO-OCO), 4.2-4.4 (pseudo d, 4H, CH_2-O), 3.5 + (s, 6H, O-CH_2-N), 2.15-2.4 (m, 12H, 6XCH_2-C=C), 2.0 (m, 6H, 3X CH_2C=O), 1.1-1-9 (brs, 189H), 0.95(t,9H, 3xMe).

Analysis:	Required	Found
%C	71.85	71.89
%H	11.6	11.83
%N	2.05	1.96

Example 2

Preparation of propane-1,2,3-tri[octadec-9-en-12(oxycarbonyl-N-methylene, N,N, dimethyl, N-dodecyl-ammonium chloride)oate]

The pure chloro derivative from Example 1(i) (11.6g, 0.01M) and N,N,-dimethyldodecylamine (6.39g, 0.03M) were refluxed in 100 ml of ethanol for 72 hours. The solvent was removed under reduced pressure and the residue was dried under vacuum at 80°C to give propane-1,2,3-tri[octadec-9-en-12(oxycarbonyl-N-methylene, N,N-dimethyl, N-dodecyl-ammonium chloride)oate] as a viscous oil.

Yield: 17.1g (95%)

Ir: 330-2500 (br), 1730(C=0),1200 cm^{-1}

Nmr: δ5.43-5.55 (m, 3H, CH=), 5.38-5.40 (m, 3H, CH=), 5.18-5.23 (m, 1H, CH-O), 4.96 (p, 3H, CH-OCO), 4.2-4.35 (pseudo d, 4H, CH_2-O), 3.53 + (s,6H, O-CH_2N), 2.15-2.32 (m,12H, 6X CH_2-C=C), 1.95-2.01 (m, 6H,

3X CH_2 C=O), 1.2-1.6 (m, 153H),0.92 (t,9H,Me).

Analysis:	Required	Found
%C	69.94	69.97
%H	11.11	11.37
%N	2.3	2.36

Example 3

Moisturizing lotion

A moisturizing lotion consisting of an oil-in-water emulsion of the following composition (all percentages on a weight/weight basis) was made up

	%
Aqueous phase	
Deionized water	85.2
Propylene glycol	2.0
Carbopol 941	0.2
Triethanolamine	0.6
Methyl paraben	0.15
Oil phase	
Avocado oil	2.0
Quat. amm. salt	0.4
Polyoxyethylene 21-stearyl ether	2.0
Stearyl alcohol	1.0
Isopropyl palmitate	1.25
Mineral oil (liquid paraffin)	4.0
Polypropyleneglycol-lanolin-5-ether	0.75
Stearic acid	0.25
Propyl paraben	0.1
Vitamin E	0.1

"Quat. Amm. Salt" = Quaternary ammonium salt derived from castor oil as described in Example 1.

The oil phase and the aqueous phase were formed separately by mixing the ingredients thereof, both phases were then warmed to 70°C and the oil phase was added to the aqueous phase with intensive mixing. The resulting emulsion was cooled to 30°C.

Samples of the moisturizing lotion were

stored at, respectively room temperature, 35°C, and 45°C; all the samples were stable and showed no change in appearance (i.e. there was no phase separation) after two months.

In user tests, it was found that the lotion could be readily rubbed into the skin.

The specific compounds of formula I, and the intermediate, referred to above can equally and, indeed, more correctly, be named as follows:

Example 1 (i) - title compound

propane-1,2,3-triyltris [carbonyloxy (heptadec-8-ene-1,11-diyl) oxycarbonyl-chloromethane]

Example 1 (ii) - title compound

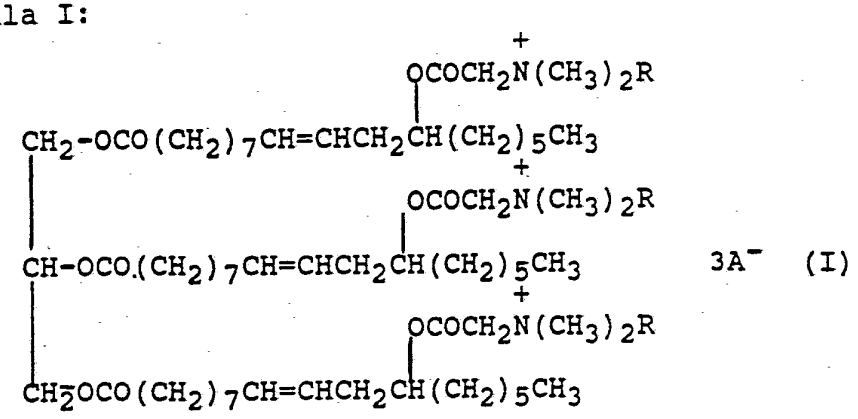
propane-1,2,3-triyltris [carbonyloxy (heptadec-8-ene-1,11-diyl) oxycarbonylmethylene-N,N-dimethyl-N-octadecylammonium chloride]

Example 2 - title compound

propane-1,2,3-triyltris [carbonyloxy (heptadec-8-ene-1,11-diyl) oxycarbonylmethylene-N,N-dimethyl-N-dodecylammonium chloride]

C L A I M S

1. Triglyceride quaternary ammonium compounds of formula I:



(I)

in which R is an alkyl group having 10 to 20 carbon atoms, and A^- is a physiologically acceptable anion.

2. Compounds according to claim 1, in which R is n-dodecyl or n-octadecyl.

3. Compounds according to claim 1 or 2, in which A^- is chloride.

4. A process for the preparation of a compound of formula I specified in claim 1, which comprises reacting triglyceryl ricinoleate with chloroacetyl chloride to esterify the hydroxyl groups of the triglyceride, and reacting the product obtained with an alkyldimethylamine of the formula $N(CH_3)_2R$, where R has the meaning specified in claim 1, and thereafter, if desired, replacing the chloride anion in the product obtained with another anion A^-.

5. A process according to claim 4, in which chloroacetyl chloride is reacted with castor oil as the source of triglyceryl ricinoleate and the product obtained is not separated from the other constituents of the castor oil.

6. A process according to claim 4 or 5, in which a stoichiometric excess of chloroacetyl chloride is used.

7. A moisturizing lotion or cream which comprises a compound of formula I specified in claim 1 in which R is an alkyl group having 16 to 20 carbon atoms.

8. A hair conditioning composition which comprises a

compound of formula I specified in claim 1 in which R is an alkyl group having 16 to 20 carbon atoms.

9. An anti-microbial composition which comprises a compound of formula I specified in claim 1 in which R is an alkyl group having 10 to 12 carbon atoms.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US88/00972

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4) C09F 5/00 A61K 7/06 A61K 31/225 A61K 47/00
U.S.Cl. 260/404.5 424/70 514/547 514/786

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	260/404.5 424/70 514/597 514/786

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Roberts and Caserio, Organic Chemistry, published 1965 (W.A. BENJAMIN, INC., NEW YORK, U.S.A)

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 3,873,583 (WALZ ET. AL.) published 25 March 1975.	1-6
X	Roberts and Caserio, Organic Chemistry, published 1965 (W.A. BENJAMIN, INC., New York, U.S.A.) pages 560, 653.	4-6
E, A	US, A, 4,743,621 (CAVAZZA) published 10 May 1988.	9
E, A	US, A, 4,721,728 (BRUZZESE ET AL) published 26 January 1988.	9
A	US, A, 4,552,754 (MURAMATSU ET AL) published 12 November 1985.	7-8
A	US, A, 4,464,400 (KIMURA ET AL) published 7 August 1984.	7

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

08 JUNE 1988

Date of Mailing of this International Search Report

19 JUL 1988

International Searching Authority

ISA/US

Signature of Authorized Officer

ALAN SIEGEL

Form PCT/ISA/210 (second sheet) (Rev.11-87)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers . because they relate to subject matter [2] not required to be searched by this Authority, namely:

2. ☐ Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [3], specifically:

3. ☐ Claim numbers_____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

I. Claims 1-6 drawn to a compound and method of preparing the compound.
II. Claim 7 drawn to a lotion.
III. Claim 8 drawn to a hair conditioning composition.
IV. Claim 9 drawn to an antimicrobial composition.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.