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(54) Title: DIALKYL QUATERNARY AMMONIUM DERIVATIVES OF OILS, FATTY ACIDS, TRIGLYCERIDES AND THEIR USE IN PERSONAL CARE PRODUCTS		
(57) Abstract Dialkyl quats useful in personal care products are described. These quats are produced from fatty acids at least 30 % by weight of which are C-20 in length or longer.		

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DIALKYL QUATERNARY AMMONIUM DERIVATIVES OF OILS, FATTY ACIDS, TRIGLYCERIDES AND THEIR USE
IN PERSONAL CARE PRODUCTSTECHNICAL FIELD

The present invention relates to novel dialkyl quaternary fatty ammonium derivatives of natural and synthetic oils, fatty acids and/or triglycerides and to their use in personal care products.

BACKGROUND ART

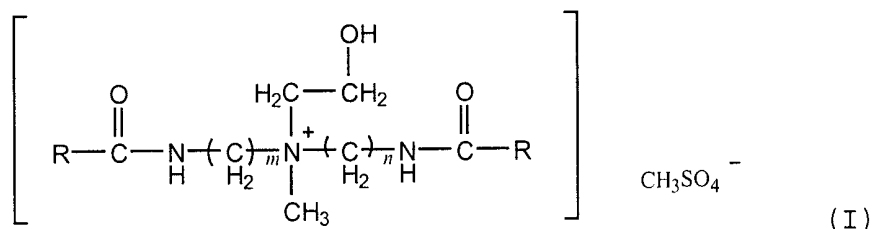
Dialkyl quaternary fatty ammonium derivatives of relatively long chain fatty acid components are known. For example, a dibehenyl dimethyl ammonium quat has been sold under the trade name INCROQUAT DBM-90 from Croda Inc., 7 Century Drive, Parsippany, New Jersey 07054. Similar ammonium based quat compounds have been described in U.S. Patent No. 4,954,335 to Ben Janchipiaponvej. However, the '335 patent describes such dialkyl quats as being selected from ammonium compounds having one or two long chain alkyl groups including from about 14 to about 22 carbon atoms. These compounds are said to be used as conditioning agents primarily for hair conditioners. It should be noted however that the '335 patent, and in addition, Noe U.S. Patent 4,976,956 appear to only disclose the production of conditioning agents, not shampoos or conditioning shampoos. In addition, it has been recognized that the solubility or, more correctly, the compatibility of these compounds with anionic surfactants is limited. Indeed, in the '335 patent, even in conditioning compounds a "solubilizing" nonionic surfactant was necessary. While of course, such compounds could be used in shampoos, they can often have detrimental effects. They can reduce the foaming which is important to the action and feel of a shampoo, they add cost because of the need for an additional ingredient, present additional formulation obstacles and, in addition, add unnecessary surfactant to the shampoo, potentially increasing irritation. Dialkyl quats of compounds such as tallow are also known. However, these compounds are generally made from shorter chain fatty acid constituents, i. e. C-16 and C-18

fatty acids. Therefore, there remains a need for the production of conditioning agents which are compatible in shampoos which will not further complicate an already complicated formulation process.

5 SUMMARY OF THE INVENTION

The present invention relates to the dialkyl quats of fatty acid materials having at least about 30% of at least a C-20 fatty acid component by weight and preferably having a target melting point of about 100°C or less and more preferably
10 about 85°C or less.

The quats in accordance with the present invention, unlike the dialkyl quats of the prior art, include an amidoamine group produced by the reaction of the carboxylic acid portion of the fatty acids with at least 2 of the
15 nitrogens contained within a bridging molecule such as, for example, DETA.



In the above formula I, R is the carbon chain of the fatty acid constituent and m and n are as described herein.

20 In addition, the dialkyl quats of the present invention are generally made from fatty acids having an iodine value of 200 or less, more preferably 150 or less and even more preferably 100 or less. The resulting quats can include, for example, compounds made exclusively from, for example, erucic
25 acid (C22:1-22 carbon atoms with one double bond) or high erucic rapeseed oil ("HEAR oil"). HEAR oil has a fatty acid content of 46% by weight erucic acid (C22:1), 1.5% behemic acid (C22:0), and 11% gadoleic acid (C20:1) by weight. HEAR oil has an iodine value ranging from between about 90 to about 120
30 depending upon grade and actual fatty acid content. Erucic

acid, by comparison, has an iodine value of about 74. Erucic acid, which makes up the major portion of HEAR oil has a target melting point of about 33.5°C.

The dialkyl quats in the present invention can also include such long chain fatty acid constituents as montan acid wax which contains, as its major constituent, a C36:0 fatty acid. Surprisingly, the compounds in accordance with the present invention have excellent anionic surfactant compatibility when compared to, for example, non-amidoamine based dialkyl quats such as those previously known. This allows them to be formulated into surfactant systems such as, for example, those present in shampoos, without the need for separate compatibilizers. Personal care products comprising a base of a shampoo, conditioner, liquid soap, facial/body wash or hair color and 0.1-10% cationic activity of the quats of the invention are also contemplated.

BEST MODE OF CARRYING OUT INVENTION

Oils in accordance with the present invention include, without limitation, HEAR oil, as well as cod liver oil, herring oil, menhaden oil, mustard seed oil, pilchard oil, hear oil, salmon oil, sardine oil, meadowfoam oil and shark liver oil. The C-20+ components of some of these oils are as follows: Cod liver oil - 8.8-14.6% Eicosenoic acid (C20:1), 2.6-9% Eicosapentaenoic acid (C20:5), 4.6-13.3% Docosenoic (Erucic) acid (C22:1), 1-2% Docosapentaenoic acid (C22:5) and 8.6-19% Docosaheptaenoic acid (C22:6); Herring oil - 1.5-19.2% Eicosenoic acid (C20:1), 4.6-10.2% Eicosapentaenoic acid (C20:5), 2.8-19.9% Docosenoic (Erucic) acid (C22:1), 1-3.7% Docosapentaenoic acid (C22:5) and 3.8-24.1% Docosaheptaenoic acid (C22:6); Menhaden oil - 0.9-2.7% Eicosenoic acid (C20:1), 0.6-1.2% Eicosatetraenoic acid (C20:4), 10.2-13.5% Eicosapentaenoic acid (C20:5), 0.7-1.7% Docosenoic (Erucic) acid (C22:1), 1.1-2.3% Docosapentaenoic acid (C22:5) and 3.3-14% Docosaheptaenoic acid (C22:6); Pilchard (Sardine) oil - 3.2% Eicosenoic acid (C20:1), 1.6% Eicosatetraenoic acid (C20:4), 16.9% Eicosapentaenoic acid (C20:5), 3.6% Docosenoic (Erucic)

acid (C22:1), 2.5% Docosapentaenoic acid (C22:5) and 12.9% Docosaheptaenoic acid (C22:6); HEAR oil - 0.8-13.5% Eicosenoic acid (C20:1), 20.1-59.4% Docosenoic (Erucic) acid (C22:1), 0.1-1.4% Tetracosanoic (C24:0); Mustard Seed oil - 7% Eicosenoic acid (C20:1), 44.2% Docosenoic (Erucic) acid (C22:1). Oils rich in Tetracosanoic (Nervonic) acid (C24:1) such as genetically altered HEAR oil also work well. Of course, variations in content can occur. See generally 1 "Bailey's Industrial Oil and Fat Products" (Daniel Swern, John Wiley & Sons, 4th Ed. 1979) pg. 416, 417, 447, 449, 450 and 452, all of which are attached and hereby incorporated by reference. Each of the foregoing oils has a distribution of fatty acids (usually in the form of triglycerides) which includes at least 30% of a C-20 or greater component.

Of course, it is possible in accordance with the present invention to use pure fatty acids and/or artificially created mixtures including, without limitation arachidic (C20:0) behenic (C22:0), gadoleic (C20:1), erucic (C22:1), arachadonic (C20:4) and culpodonic (C22:5). Mixtures of fatty acids are also possible which include fatty acid constituents of lower carbon chain lengths. Fatty acids may be provided from fatty acid containing oils, triglycerides and from fatty acids or salts. Indeed, fatty acid materials useful for production of dialkyl quats in accordance with the present invention can come from natural or synthetic sources and include pure fatty acids, fatty acid mixtures, triglycerides, oils, and waxes such as, for example, jojoba oil (fatty acids and fatty alcohols) or montan wax.

Reference is made herein to the use of fatty acids, or materials containing fatty acids, having a chain length of at least 20 carbon or more. If 100% erucic acid is used, then 100% of the fatty acid constituents of the quats is C-22. If HEAR oil is used, then at least 30% of the fatty acids and therefore, at least 30% of the resulting quats, will have a C-20 or higher chain length constituent. As should be clear, this means that the fatty acid component can be made up of one

or more C-20 or greater fatty acids totaling at least 30% by weight of the fatty acids.

The oils or any of the pure acids contained in them should have, most preferably, but not absolutely necessary, a
5 melt point of 100°C or less and more preferably 85°C or less.

The fatty acids should also be limited in terms of the degree of saturation. Preferably the majority of the fatty acid materials will either be completely saturated or mono-unsaturated. One way of measuring the degree of saturation of
10 fatty acid is the well known iodine value used in the trade. Odor and color problems can develop as the iodine value of a fatty acid or oil containing fatty acid increases due to the products being more prone to oxidation. The odor and very dark colors obtained render the quats unacceptable for use as
15 cosmetic ingredients. They may also render the compounds difficult to work with and compatibilize. This is particularly true when it is desired to include these ingredients in, for example, conditioning shampoos. Therefore, esters, triglycerides, acids or any combinations thereof and/or the
20 individual fatty acids should preferably have an iodine value of 200 or less, more preferably 150 or less, and even more preferably 100 or less. Of course, if the individual fatty acid or the mixture of fatty acids has an iodine value of greater than the desired target, it may be possible to include
25 same by hydrogenating or partially hydrogenating the material until the iodine value falls within the desired limits.

The dialkyl mono quats in accordance with the present invention can be made by taking one of the fatty acids described above such as, a triglyceride, and reacting same with
30 a compound which can form a dialkyl amidoamine. For example, when a triglyceride is used, 2 moles of triglyceride will be reacted with 3 moles of, for example, diethylene triamine (DETA) to form 3 moles of the fatty amidoamine. The resulting secondary amidoamine can then be reacted with, for example, on
35 alkylene oxide such as ethylene oxide to convert the secondary amine into a tertiary amine containing a alcohol group. This

material can then be quaternized by a reaction with, for example $(\text{CH}_3)_2\text{SO}_4$ to form the quat. Any known technique for forming quaternary amine compounds can be used. Quats so formed generally include counter ions such as halides, sulfates, phosphates and the like.

The amidoamine forming component in accordance with the present invention can be, for example, DETA as previously discussed. The amidoamine forming constituent will have the formula $\text{N1}-(\text{C})_m-\text{N2}-(\text{C})_n-\text{N3}$. m and n can be an integer from 1 to 6 and more preferably 1 to 4 and most preferably 1 to 3. If more than 1 carbon atom is present, the bonds between them can be saturated or unsaturated. In addition, any carbon atoms present can be substituted with, for example, one or more alkyl groups of 1 to 4 carbons, a hydroxyl containing group, an alkoxy group and the like. However, any other amidoamine forming compounds are also contemplated. For example, triethylene tetraamine (TETA), may also be used.

It should also be understood that either the nitrogen in the first, second or third position can be quaternized (amine nitrogen). The remaining 2 nitrogens would be bound to the alkyl chains (amido nitrogens). Therefore, it is possible to produce a dialkyl quat which is symmetric about the second nitrogen quat or one of the terminal nitrogens can be quaternized with the remaining 2 nitrogens bound to the alkyl groups.

In addition, the quaternized nitrogen can include a number of quaternizing groups as is known in the art. For example, as previously discussed, the quaternized nitrogen can include an ethoxy group and a methyl group as its substituents. See Formula I. Two ethoxy groups may also be used. Where it is important to render the resulting quat compatible with anionic surfactants, such as, for example, where the resulting material will be used in shampoo as opposed to a conditioner, it is important that at least one of the constituents contain, for example, a hydroxy, aldehyde, acid or other generally electro-negative group bound to the quaternized nitrogen i.e.,

the amine nitrogen. These can include ethoxy groups, propoxy groups, aldehydes, acids, polyethoxy groups (polyalkoxy groups) and the like. In fact, with reference to Formula I, the ethoxy group could be replaced with a polyethoxy group of
5 between 2 and 20 ethoxy units. Anionic surfactant compatibility can be measured by a clear solution without precipitation or turbidity once the quat is mixed with the surfactant. Of course, if anionic surfactant compatibility is not required, then for example, two alkyl groups may be used
10 instead, such as, for example, two methyl groups, one methyl and one ethyl group, etc.

Generally, quats in accordance with the present invention are not sold as individual compounds. Instead, they are dissolved or dispersed in a solvent or mixture of solvents.
15 Generally, solvents can include ethylene glycol, propylene glycol, butylene glycol, dipropylene glycol, alcohol such as ethanol, isopropyl alcohol and the like. Generally, the quats in accordance with the present invention are provided in an amount of between about 25 and 90% by weight relative to the
20 amount of solvent. More preferably between about 25 and 80% and even more preferably between 25 and 65% by weight. In addition, fatty acids or fatty alcohols can also be used resulting in a flakable material.

The formulations in accordance with the present invention are often referred to, when mixed with their solvent, as containing a certain amount of cationic activity. Therefore, a formulation including a 25% cationic activity consists of, amongst other things, 25 weight percent of a cationic quat in 75 weight percent of a solvent. Generally,
25 the quats of the present invention are formulated in shampoos in an amount of between about .1 and about 10 percent based on the amount of cationic activity. Therefore, in formulating a shampoo with, for example, 1% active or 1% cationic activity, 2% of a 50/50 quat/solvent formulation by weight of the shampoo
30 would be necessary for formulation. More preferably, the amount of activity ranges from between about .1% and about 5% and more preferably between about .5% and about 3%. On an actives

basis, generally the same amounts may be used in conditioners, shampoos, colorings, liquid hand or body soaps, facial or body washes, etc.

Synthesis example - These quats can generally be prepared in a stirred pressure vessel fitted with nitrogen, vacuum, heat and cooling, by adding 1 mole equivalent of the claimed acids and 1.5 mole equivalents of diethylenetriamine (DETA). The vessel is then heated to a temperature between 130-200°C for 3 to 6 hours. Sample should be taken during the course of the reaction and checked via FTIR for the disappearance of the ester peak as is known to those skilled in the art. Once a negligible ester peak is obtained, the product should be cooled to a temperature between 90-130°C and 1 or more mole equivalents of ethylene oxide added. The ethylene oxide should be allowed to react until the vessel pressure drops to its initial value. The product after the ethylene oxide addition should have a tertiary amine content of 90-100% and most preferably 95-100%. The batch should be cooled to 50-100°C and then quaternized in the presence of propylene glycol, butylene glycol, isopropyl alcohol and the like with dimethyl sulfate, methyl chloride, benzyl chloride and the like or any other quaternizing agent generally known to those skilled in the art.

Shampoo

	<u>Ingredient</u>	<u>% (W/W)</u>
25	ALS (30%	30.00
	Crosultaine C-50	3.00
	Crodasinic LS-30	4.00
	Dialkyl Quat	2.00
30	Deionized Water	61.00

Conditioner

	<u>Ingredient</u>	<u>% (W/W)</u>
	Dialkyl Quat	3.00
	Oleth-10	1.50
35	Crodacol S-70	4.00
	Deionized Water	91.50

Note that the Dialkyl Quat is provided as 3% based on the cationic activity of the Quat/solvent mixture.

INDUSTRIAL APPLICABILITY

The invention relates to the chemical cosmetic and personal care products in that it provides additives which impact desirable properties to personal care products such as
5 shampoos, conditioners, liquid soaps and the like.

CLAIMS:

1. A dialkyl quat material comprising a quaternized dialkyl amidoamine characterized by said dialkyl groups including at least about 30% of at least a C-20 fatty acid
5 component by weight.

2. A dialkyl quat material comprising a quaternized dialkyl amidoamine characterized by said dialkyl groups having an iodine value of 200 or less.

3. The dialkyl quat material of claim 2
10 characterized in that said dialkyl groups have an iodine value of 150 or less.

4. The dialkyl quat material of claims 1, 2 or 3 characterized in that said dialkyl groups are derived from the fatty acids contained in triglycerides, waxes or an oil
15 selected from the group consisting of HEAR oil, cod liver oil, herring oil, menhaden oil, mustard seed oil, pilchard oil, hear oil, salmon oil, sardine oil, meadowfoam oil and shark liver oil.

5. The dialkyl quat material of claims 1, 2 or 3
20 characterized in that said dialkyl groups are derived from the fatty acids selected from the group consisting of eicosenoic acid, eicosapentaenoic acid, erucic acid, docosapentaenoic acid, docosahexaenoic acid, eicosatetraenoic acid, tetracosanoic acid, arachidic acid, behemic acid, gadoleic acid, arachadonic acid and culpodonic acid.
25

6. The dialkyl quat material of claims 1, 2 or 3 further characterized by at least one generally electro-negative group bound to an amine nitrogen.

7. The dialkyl quat material of claim 6
30 characterized in that said at least one generally electro-negative group is selected from the group consisting of hydroxy, aldehyde, acid, alkoxy and polyalkoxy groups.

8. The dialkyl quat material of claims 1,2 or 3 further characterized by at least one solvent.

9. A personal care product comprising a base selected from the group consisting of a shampoo, a conditioner,
5 liquid soap, facial or body wash, or hair color and between about .1 to about 10% by activity of a quaternized dialkyl amidoamine said dialkyl groups characterized by including at least about 30% of a C-20 fatty acid component by weight.

10. The personal care product of claim 9 characterized in that said dialkyl groups have an iodine value of 200 or less.

11. The personal care product of claim 9 characterized in that said dialkyl groups are derived from the fatty acids contained in triglycerides, waxes or an oil
15 selected from the group consisting of HEAR oil, cod liver oil, herring oil, menhaden oil, mustard seed oil, pilchard oil, hear oil, salmon oil, sardine oil, meadowfoam oil and shark liver oil.

12. The personal care product of claim 9
20 characterized in that said dialkyl groups are derived from the fatty acids selected from the group consisting of eicosenoic acid, eicosapentaenoic acid, erucic acid, docosapentaenoic acid, docosahexaenoic acid, eicosatetraenoic acid, tetracosanoic acid, arachidic acid, behemic acid, gadoleic acid,
25 arachadonic acid and culpodonic acid.

13. The personal care product of claim 9 characterized in that said dialkyl quat includes at least one generally electro-negative group bound to an amine nitrogen.

14. The personal care product of claim 13
30 characterized in that said at least one generally electro-negative group is selected from the group consisting of hydroxy, aldehyde, acid, alkoxy and polyalkoxy groups.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/22916

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :C07C 233/00

US CL :Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 424/70.6; 510/119, 123, 125, 126; 554/52, 55, 56

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CAS ONLINE, USPATFUL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,525,245 A (GRANDMAIRE et al) 11 June 1996(11/06/96), see entire document.	1-14
X	US 4,923,642 A (RUTZEN et al) 08 May 1990(08/05/90), see entire document.	1-14
X	WO 98/17750 A1 (THE PROCTER AND GAMBLE COMPANY) 30 April 1998(30/04/98), see pages 3, 20-21, 23, 30.	1-14
E,X	US 5,977,055 A (TRINH et al) 02 November 1999(02/11/99), see entire document.	1-14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

424/70.6; 510/119, 123, 125, 126; 554/52, 55, 56