

Description**BACKGROUND OF THE INVENTION****Field of the Invention:**

This invention relates to a water-soluble viscosity increasing agent and a liquid detergent composition containing the same and, more particularly, to a water-soluble viscosity increasing agent having excellent stability and solubility in a solution of various surface active agents and to a liquid detergent composition possessing a proper viscosity and homogeneousness containing said water-soluble viscosity increasing agent.

Description of the Background:

Viscosity increasing agents are used in order to impart an appropriate viscosity to solutions of various surface active agents such as, for example, anionic, cationic and nonionic surface active agents, and have a wide variety of applications, e.g., for liquid detergents, cosmetics, paints, adhesives and dyestuff. As viscosity increasing agents to be used with said solutions of a surface active agent, polyoxyethylene (hereinafter abbreviated to "POE") linear fatty acid ester type compounds, including POE linear fatty acid esters and POE methylglucoside linear fatty acid esters, and water-soluble polymers such as hydroxyethyl cellulose, methyl cellulose and polyvinyl pyrrolidone are known in the art.

The viscosity increasing agents of the POE linear fatty acid ester type, however, tend to hydrolyze in an aqueous system and have a poor viscosity stability. On the other hand, the viscosity increasing agents of the water-soluble polymer type tend to salt out in a strong electrolyte solution containing a certain kind of an anionic surface active agent or inorganic salt, and thus have a poor solubility to such electrolyte. This imposes a serious limitation to the formulation, for example, of shampoos, when one intends to increase their viscosity.

FR-A-2 534 923 discloses a water-soluble viscosity increasing agent consisting of an ester of a 55 moles ethylene oxide adduct of glycerol and isostearic fatty acid.

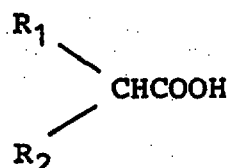
There have been, therefore, strong demands for the development of a viscosity increasing agent possessing a good viscosity stability and an abundant solubility to solutions of various surface active agents, including anionic, cationic and nonionic surface active agents.

SUMMARY OF THE INVENTION

In these situations, the present inventors have made extensive studies, and found that ethylene oxide adducts of a polyhydric alcohol, esters of branched fatty acid and ethylene glycol and ethylene oxide adducts of branched fatty acid esters of polyhydric alcohol are capable of enhancing viscosity of solutions of surface active agents, while maintaining stability of the solutions and giving a good solubility of surface active agents in the solutions. The effects are such that one can never anticipate with conventional linear fatty acid esters. Such findings have led to the completion of this invention.

Accordingly, an object of this invention is to provide a water-soluble viscosity increasing agent consisting essentially of one or more branched fatty acid esters selected from the group consisting of the following (i) to (iii):

- (i) an ester of a 40 to 400 moles ethylene oxide adduct of polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content,
- (ii) an ester of polyethylene glycol having average molecular weight of 2,000 to 20,000 and branched fatty acid of 8 to 36 carbon atom content, and
- (iii) a 40 to 400 mole ethylene oxide adduct of an ester of a polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content; wherein the branched fatty acid is an α -position branched fatty acid represented by the following formula (I):



(I)

in which R_1 represents a linear or branched alkyl or alkenyl group of 4 to 18 carbon atom content and R_2 represents a linear or branched alkyl or alkenyl group of 2 to 16 carbon atom content.

The second object of this invention is to provide a liquid detergent composition comprising 5 to 40% by weight of a surface active agent having a detergency and 0.1 to 10% by weight of the above water-soluble viscosity increasing agent.

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

The ethylene oxide adducts of a polyhydric alcohol, esters of a branched fatty acid and ethylene glycol, and ethylene oxide adducts of branched fatty acid ester of polyhydric alcohol to be employed in this invention may be prepared according to the methods known in the art, with no special limitation being imposed to the processes and their conditions. Examples of these methods include a method of reacting a polyhydric alcohol with a branched fatty acid in the presence of an alkali catalyst or an acid catalyst to afford a polyhydric alcohol branched fatty acid ester and then adding ethylene oxide to the polyhydric alcohol branched fatty acid ester in the presence of an alkali catalyst, a method of adding ethylene oxide to a polyhydric alcohol in the presence of an alkali catalyst and then esterifying the thus-obtained ethylene oxide adduct with a branched fatty acid, a method of reacting polyethylene glycol with a branched fatty acid in the presence of an alkali catalyst or an acid catalyst, and a method of effecting an addition reaction of a branched fatty acid and ethylene oxide (for preparing a branched fatty acid ester of polyethylene glycol).

Specific branched fatty acids of formula I are 2-ethylhexanoic acid, 2-ethyl-iso-hexanoic acid, 2-propylheptanoic acid, 2-propyl-iso-heptanoic acid, 2-butyloctanoic acid, 2-iso-butyloctanoic acid, 2-pentyl-nonanoic acid, 2-iso-pentyl-nonanoic acid, 2-hexyldecanoic acid, 2-hexyl-iso-decanoic acid, 2-butyl-dodecanoic acid, 2-iso-butyl-dodecanoic acid, 2-heptylundecanoic acid, 2-iso-heptylundecanoic acid, 2-iso-heptyl-iso-undecanoic acid, 2-dodecylhexanoic acid, 2-iso-dodecylhexanoic acid, 2-octyldodecanoic acid, 2-iso-octyldodecanoic acid, 2-octyl-iso-dodecanoic acid, 2-nonyltridecanoic acid, 2-iso-nonyl-iso-tridecanoic acid, 2-decyl-dodecanoic acid, 2-iso-decyl-dodecanoic acid, 2-decyl-iso-dodecanoic acid, 2-decyl-tetradecanoic acid, 2-octylhexadecanoic acid, 2-iso-octylhexadecanoic acid, 2-undecylpentadecanoic acid, 2-iso-undecylpentadecanoic acid, 2-dodecylheptadecanoic acid, 2-iso-dodecyl-iso-heptadecanoic acid, 2-decyl-octadecanoic acid, 2-decyl-iso-octadecanoic acid, 2-tridecylheptadecanoic acid, 2-iso-tridecyl-iso-heptadecanoic acid, 2-tetradecyloctadecanoic acid, 2-iso-tetradecyloctadecanoic acid, 2-hexadecylhexadecanoic acid, 2-hexadecyltetradecanoic acid, 2-hexadecyl-iso-hexadecanoic acid, 2-iso-hexadecyl-iso-hexadecanoic acid, 2-pentadecyl-nonadecanoic acid, 2-iso-pentadecyl-iso-nonadecanoic acid, 2-tetradecyl-behenic acid, 2-iso-tetradecyl-behenic acid, 2-iso-tetradecyl-behenic acid, 2-tetradecyl-iso-behenic acid and 2-iso-tetradecyl-iso-behenic acid.

As a polyhydric alcohol, alcohols of more than trivalent are desirably used. Examples of these polyhydric alcohols are glycerol, trimethylolpropane, pentaerythritol, arabinitol, xylitol, sorbitol, mannitol, galactitol, heptytol, inositol, sorbitan, sorbide, glucose, galactose, mannose, maltose, fructose, sucrose, lactose, maltitol, lactitol, methylglucoside, methylgalactoside, methylmannoside and methylmaltoside. Among these, preferred polyhydric alcohols are glycerol, trimethylolpropane, pentaerythritol, sorbitol, mannitol, sorbitan, sorbide, inositol and methylglucoside in view of the thermal stability, economy and viscosity increasing effects.

Moles of ethylene oxide to be added may be 40 to 400, preferably 80 to 300, per 1 mole of the raw material, i.e. the polyhydric alcohol branched fatty acid ester or polyhydric alcohol.

Polyethylene glycol to be used may be that having a molecular weight of 2,000 to 20,000, preferably 3,500 to 15,000.

The branched fatty acid is used from 1 to 8 moles per 1 mole of the raw material, i.e. the polyoxyethylene polyhydric alcohol ether or polyhydric alcohol.

The esterification degree of the branched fatty acid ester to be employed in this invention may be 1 to 8, preferably 1.0 to 5.0. The branched fatty acid esters may be used either singly or mixed with one or more others at an arbitrary ratio.

In case where the branched fatty acid esters are used as the component (B) of the liquid detergent composition of the second invention, the amount of these compounds to be formulated may be 0.1 to 10% by weight, preferably 0.4 to 4% by weight per total amount of the liquid detergent composition.

Following compounds are given as examples of surface active agents having a detergency to be employed for the component (A) of the second invention:

(1) Linear or branched alkylbenzenesulfonates having an alkyl group with an average carbon atom content of 10 to 16.

(2) Alkyl- or alkenylether sulfates added with 0.5 to 8 moles, per molecule in average, of ethylene oxide, propylene oxide, butylene oxide, ethylene oxide/propylene oxide at a ratio of 0.1/9.9 to 9.9/0.1 and ethylene oxide/butylene oxide at a ratio of 0.1/9.9 to 9.9/0.1, and having an alkyl- or alkenyl group with an average carbon atom content of 10 to 20.

(3) Alkyl- or alkenyl sulfates having an alkyl- or alkenyl group with an average carbon atom content of 10 to 20.

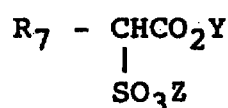
(4) Olefin sulfonates having an average carbon atom content of 10 to 20 per molecule.

(5) Alkane sulfonates having an average carbon atom content of 10 to 20 per molecule.

(6) Salts of a saturated or unsaturated fatty acid having an average carbon atom content of 10 to 24 per molecule.

(7) Alkyl- or alkenylether carboxylates added with, per molecule, 0.5 to 8 moles in average of ethylene oxide, propylene oxide, butylene oxide, ethylene oxide/propylene oxide at a ratio of 0.1/9.9 to 9.9/0.1 and ethylene oxide/butylene oxide at a ratio of 0.1/9.9 to 9.9/0.1, and having an alkyl- or alkenyl group with an average carbon atom content of 10 to 20.

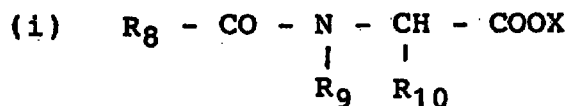
(8) Salts of α -sulfofatty acid represented by the following formula:



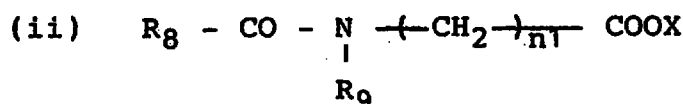
in which Y represents an alkyl group of from 1 to 3 carbon atom content or a counter ion, Z represents a counter ion and R_7 represents an alkyl or alkenyl group of from 10 to 20 carbon atom content; or esters thereof.

A counter ion of an anionic surface active agent to be used in the present invention may include alkali metal ions such as sodium and potassium ions, alkaline earth metal ions such as calcium and magnesium ions, ammonium ion, alkanol amines having from 1 to 3 alkanol groups of a 2 or 3 carbon atom content such as monoethanol amine, diethanol amine, triethanol amine and isopropanol amine.

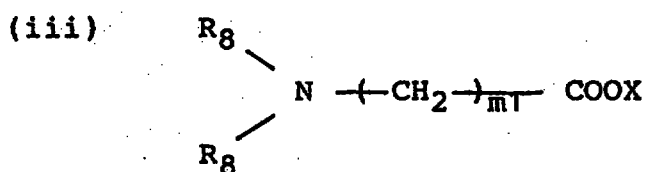
(9) Amino acid type surface active agents represented by the following formulae:



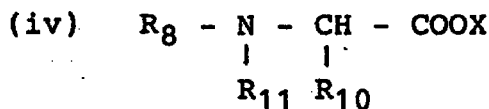
in which R_8 represents an alkyl- or alkenyl group of from 8 to 24 carbon atom content, R_9 represents hydrogen atom or an alkyl group of 1 or 2 carbon atom content, R_{10} represents an amino acid group residue and X represents an alkali or alkaline earth metal ion.



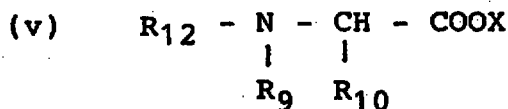
in which R_8 , R_9 and X have the same meanings as defined above, and n represents an integer of 1 to 5.



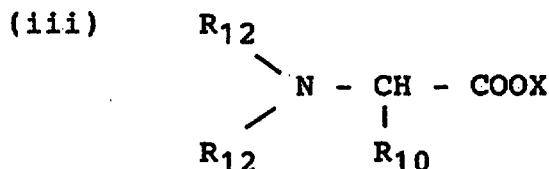
in which R_8 and X have the same meanings as defined above, and m1 represents an integer of 1 to 8.



in which R_8 , R_{10} and X have the same meanings as defined above and R_{11} represents hydrogen atom or an alkyl or hydroxyalkyl group of 1 or 2 carbon atom content.



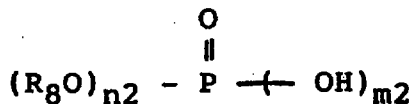
in which R_9 , R_{10} and X have the same meanings as defined above and R_{12} represents a β -hydroxyalkyl or β -hydroxyalkenyl group of from 6 to 28 carbon atom content.



in which R_{10} , R_{12} and X have the same meanings as defined above.

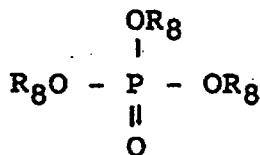
(10) Phosphoric acid ester type surface active agents

(i) Acidic alkyl- or alkenyl phosphoric acid esters represented by the following formula:



in which R_8 has the same meaning as defined above, and n2 and m2 are values satisfying the equation, $n2 + m2 = 3$, provided that n2 is a value of 1 to 2.

(ii) Alkyl- or alkenyl phosphoric acid esters represented by the following formula:



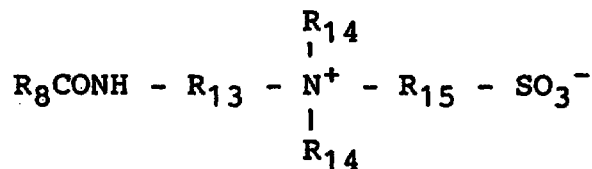
in which R_8 has the same meaning as defined above.

(iii) Salts of an alkyl- or alkenyl phosphoric acid ester represented by the following formula:



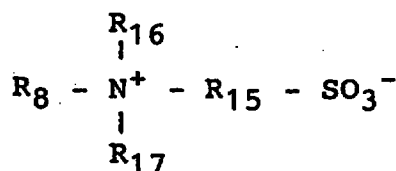
in which R_8 has the same meaning as defined above, M denotes sodium, potassium or calcium, and n_3 and m_3 are values satisfying the equation $n_3 + m_3 = 3$, provided that n_3 is a value of 1 to 3.
 (11) Sulfonic acid type amphoteric surface active agents represented by the following formulae:

(i)



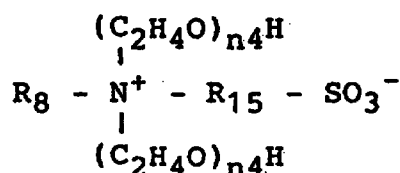
in which R_8 has the same meaning as defined above, R_{13} represents an alkylene group of 1 to 5 carbon atom content, R_{14} represents an alkyl group of 1 to 4 carbon atom content, and R_{15} represents an alkylene or hydroxyalkylene group of 1 to 4 carbon atom content.

(ii)



in which R_8 and R_{15} have the same meanings as defined above, R_{16} and R_{17} each represents independently an alkyl group of 8 to 24 carbon atom content or an alkenyl group of 1 to 5 carbon atom content.

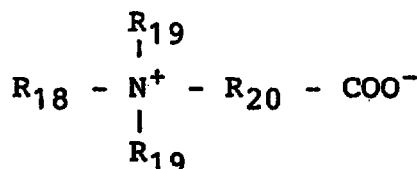
(iii)



in which R_8 and R_{15} have the same meanings as defined above and n_4 designates an integer of from 1 to 20.

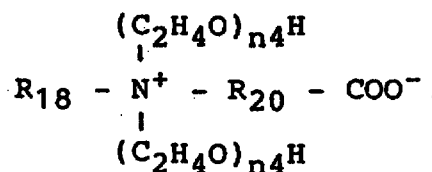
(12) Betaine type amphoteric surface active agents represented by the following formulae:

(i)



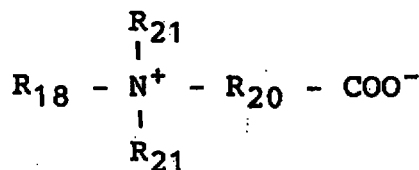
in which R_{18} represents an alkyl, alkenyl, β -hydroxyalkyl or β -hydroxyalkenyl group of from 8 to 24 carbon atom content and R_{20} represents an alkylene or hydroxyalkylene group of from 1 to 6 carbon atom content.

(ii)



in which R_{18} , R_{20} and $n4$ have the same meanings as defined above.

(iii)



in which R_{18} , R_{20} have the same meanings as defined above and R_{21} represents a carboxyalkyl or hydroxyalkyl group.

(13) Polyoxyethylenealkyl- or alkenyl ethers added with from 1 to 20 moles of ethylene oxide and having an alkyl or alkylene group of an average carbon atom content of from 10 to 20.

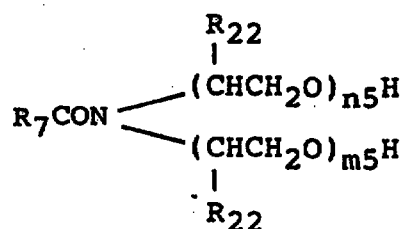
(14) Polyoxyethylenealkylphenylethers added with from 1 to 20 moles of ethylene oxide and having an alkyl group of an average carbon atom content of from 6 to 12.

(15) Polyoxypropylenealkyl- or alkenyl ethers added with from 1 to 20 moles of propylene oxide and having an alkyl or alkenyl group of an average carbon atom content of from 10 to 20.

(16) Polyoxybutylenealkyl- or alkenyl ethers added with from 1 to 20 moles of butylene oxide and having an alkyl or alkenyl group of an average carbon atom content of from 10 to 20.

(17) Nonionic surface active agents which are total 1 to 30 moles of ethylene oxide/propylene oxide or ethylene oxide/butylene oxide addition compounds, ratio of ethylene oxide/propylene oxide or ethylene oxide/butylene oxide being 0.1/9.9 to 9.9/0.1, and which have an alkyl or alkenyl group of an average carbon atom content of from 10 to 20.

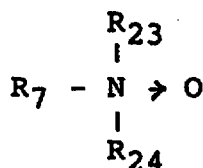
(18) Higher fatty acid alkanol amides represented by the following formula:



in which R_7 has the same meaning as defined above, R_{22} represents hydrogen atom or methyl group, $n5$ designates an integer of from 1 to 3, and $m5$ designates an integer of from 0 to 3; or alkylene oxide adducts thereof.

(19) Glycerol monoesters of a fatty acid having an average carbon atom content of from 10 to 20.

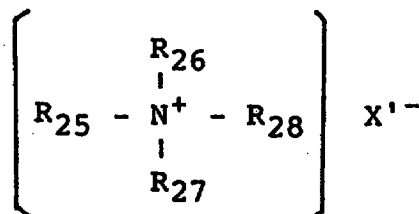
(20) Alkylamine oxides represented by the following formula:



in which R_7 has the same meaning as defined above, R_{23} and R_{24} each represents independently an alkylene group of from 1 to 3 carbon atom content.

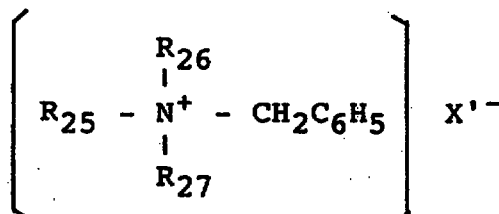
(21) Cationic surface active agents represented by the following formula:

(i)



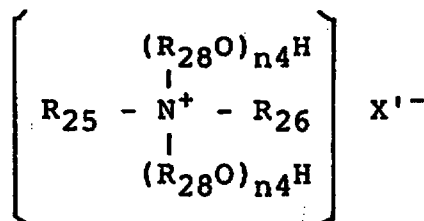
in which at least one of R_{25} , R_{26} , R_{27} and R_{28} is an alkyl- or alkenyl group of from 8 to 24 carbon atom content and others designate an alkyl group of from 1 to 5 carbon atom content, and X' represents a halogen atom.

(ii)



in which R_{25} , R_{26} , R_{27} and X' have the same meanings as defined above.

(iii)



in which R_{25} , R_{26} , X' and $n4$ have the same meanings as defined above, and R_{28} represents an alkylene group of from 2 or 3 carbon atom content.

Among the surface active agents illustrated above, particularly preferred are anionic surface active agents such as linear or branched alkyl sulfates having an average carbon atom content of from 10 to 16, polyoxyethylene alkyl sulfates with 0.5 to 8 moles of POE added per molecule and the alkyl group having an average carbon atom content of from 8 to 20, alkyl phosphates having an average carbon atom content of from 8 to 16, olefin sulfonates having an average carbon atom content of from 10 to 16; nonionic surface active agents such as higher fatty acid mono- or dialkanol amide having an average carbon atom content of from 10 to 14; amphoteric surface active agents of alkylamine oxide, alkyl betaine and imidazoline type, all having an average carbon atom content of from 10 to 14. These surface active agents may be formulated either singly or in combination with others to the liquid detergent composition in an amount ranging from 5 to 40% by weight, preferably 10 to 25% by weight.

Branched fatty acid esters to be employed in this invention is insusceptible of hydrolysis due to their branched structure of the long chained alkyl group. Because of this, it is presumed that a solution containing these esters and surface active agents is not liable to the change in viscosity upon lapse of time.

The viscosity increasing agent according to the first invention of this application is capable of increasing the viscosity of solutions of various surface active agents, inclusive of anionic, nonionic and cationic surface

active agents, while maintaining the stability and solubility of these surface active agents in solutions. It can be, therefore, advantageously formulated to various detergents, especially those used for washing textiles, tablewares, human skins and hairs. In particular, according to the first invention in which the viscosity increasing agent is employed in combination with a surface active agent having a detergency, the composition with a proper viscosity as well as a good detergency can be obtained, which can be advantageously used as a skin detergent and a hair detergent.

Other features of the invention will become apparent in the course of the following description of the exemplary embodiments which are given for illustration of the invention and are not intended to be limiting thereof.

EXAMPLES

Synthetic Example 1

A four necked flask was charged with 345 g of 70% sorbitol and 1147 g of 2-heptylundecanoic acid, to which 1.49 g of sodium hydroxide, 1.15 g of 85% phosphoric acid and 5.69 g of active carbon were added to effect esterification reaction in an nitrogen gas atmosphere at 250 °C for 10 hours. After the reaction, the reaction mixture was filtered to obtain 1205 g of an yellowish oily liquid containing as a major component sorbitan 2-heptylundecanoic acid ester (the average esterification degree: 2.85).

The sorbitan ester thus prepared was reacted with ethylene oxide by bubbling ethylene oxide gas into 100 g of the sorbitan ester in the presence of sodium hydroxide catalyst until 160 moles of ethylene oxide were added per 1 mole of the ester. The reaction mixture was neutralized with phosphoric acid, decolorized with an aqueous hydrogen peroxide solution and filtered to obtain 905 g of pale yellowish solid containing as a major component POE (160) sorbitan 2-heptylundecanoic acid ester (Viscosity Increasing Agent No. 1).

Synthetic Examples 2 - 7

Viscosity Increasing Agents No. 2 - 7 listed in the following table were prepared according to the same manner as in Synthetic Example 1.

Viscosity Increasing Agents	Compounds	Average Degree of Esterification
No.2	POE(120) sorbitan 2-heptyl-undecanoic acid ester	2.0
No.3	POE(200) sorbitan 2-decyl-dodecanoic acid ester	2.9
No.4	POE(160) sorbitan 2-ethyl-hexanoic acid ester	2.4
No.5	POE(150) glycerol 2-heptyl-undecanoic acid ester	2.0
No.6	POE(240) trimethylolpropane 2-heptylundecanoic acid ester	2.0
No.7	POE(250) pentaerythritol 2-heptylundecanoic acid ester	4.0

Synthetic Example 8

Ethylene oxide was bubbled into 91 g of powdery sorbitol in the presence of potassium hydroxide catalyst until 200 moles of ethylene oxide were added per 1 mole of sorbitol, thus obtaining 4450 g of pale yellowish solid containing POE(200) sorbitol ether as a major component.

A four necked flask was charged with 900 g of the thus-obtained sorbitol ether and 115 g of 2-heptylundecanoic acid, to which 1.0 g of sodium hydroxide and 0.77 g of 85% phosphoric acid were added to effect esterification reaction at 245 °C for 20 hours. After the reaction, the mixture was neutralized with phosphoric acid and filtered to obtain 1002 g of pale yellowish solid containing as a major component POE-(200) sorbitol 2-heptylundecanoic acid with a degree of esterification of 3.8 (Viscosity Increasing Agent No. 8).

Synthetic Examples 9 and 10

Viscosity Increasing Agents Nos. 9 and 10 below were prepared according to the same manner as in Synthetic Example 8.

Viscosity Increasing Agents	Compounds	Average Degree of Esterification
No.9	POE(240) glycerol 2-heptyl-undecanoic acid ester	2.0
No.10	POE(300) pentaerythritol 2-decyldodecanoic acid ester	4.0

Synthetic Example 11

Ethylene oxide was bubbled into 140 g of 2-heptylundecanoic acid in the presence of sodium hydroxide catalyst until 200 moles of ethylene oxide were added per 1 mole of the fatty acid, thus obtaining 4412 g of pale yellowish solid containing POE(200) mono-2-heptylundecanoic acid ester as a major component (Viscosity Increasing Agent No. 11).

Synthetic Example 12

A four necked flask was charged with 1000 g of polyethylene glycol having an average molecular weight of 10,000 and 58 g of 2-heptylundecanoic acid, to which 1.02 g of sodium hydroxide was added to effect esterification reaction at 255 °C for 24 hours. The product thus obtained was neutralized with phosphoric acid to obtain 1052 g of pale yellowish solid containing as a major component ethylene glycol di-2-heptylundecanoic acid ester (Viscosity Increasing Agent No. 12).

Experiment 1

Saponification values of viscosity increasing agents prepared in Synthetic Examples 1 - 12 were measured at different hydrolysis time (1 - 3 hours) to determine the rates of hydrolysis for theoretical saponification values.

Saponification Value Measurement Method

About 3 g of samples were precisely weighed, to which 20 ml of 0.5 N - KOH (alcoholic) was added to effect saponification at 50 °C for 1 - 3 hours. After saponification, the reaction mixture was reverse-titrated with 0.5 N - HCl to obtain the saponification values of the samples and determine rates of hydrolysis for theoretical saponification values. The results are shown in Table 1.

For comparison, saponification values (at saponification time: 1 - 3 hours) and rates of saponification are given for POE(120) sorbitan dioleic acid ester, POE(120) methylglucoside dioleic acid ester and polyethylene glycol (molecular weight: about 10,000) distearic acid ester.

In the table, "S.V." designates saponification value.

Table 1

Viscosity Increasing Agents	S.V. and Rate of Hydrogenation for Theoretical S.V. (% in parentheses)			Theoretical S.V.
	1 Hr	2 Hrs	3 Hrs	
<u>Inventive Agents</u>				
No. 1	1.1 (4.8)	2.7 (9.6)	3.1 (13.7)	22.9
No. 2	1.7 (4.9)	3.3 (9.5)	4.8 (14.0)	34.6
No. 12	0.6 (5.2)	1.2 (10.3)	1.7 (14.7)	11.6
<u>Comparative compounds</u>				
POE(120) sorbitan dioleic acid ester	4.8 (23.2)	8.6 (41.5)	11.5 (55.6)	21.0
POE(120) methyl- glucoside dioleic acid ester	4.6 (24.5)	8.1 (43.1)	10.8 (57.4)	18.8
Polyethylene glycol (10,000) distearic acid ester	3.5 (28.9)	5.9 (48.8)	8.0 (66.1)	12.1

Example 1

Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 25 °C using a B-type viscometer. Results are shown in Table 2.

Triethanolamine salt
of monolauryl phosphate

20% by weight

Viscosity increasing agent

0 - 5% by weight

Purified water

balance

Total

100% by weight

(pH 7.5)

Table 2
(viscosities are expressed by mPa.s)

Viscosity Increasing Agents	Concentration of viscosity increasing agent			
	0	1 wt%	3 wt%	5 wt%
<u>Inventive Agents</u>				
No. 1	7	9	56	7460
No. 2	7	8	45	1875
No. 3	7	9	52	3480
No. 4	7	8	45	2600
No. 5	7	8	15	1125
No. 6	7	8	40	1850
No. 7	7	8	40	1700
No. 8	7	8	40	1360
No. 9	7	8	25	1200
No. 10	7	8	10	860
No. 11	7	8	25	700
No. 12	7	8	32	840
<u>Comparative compound</u>				
Polyethylene glycol (10,000) distearic acid ester	7	8	30	800

Example 2

Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 25 °C using a B-type viscometer. Results are shown in Table 3.

Triethanolamine salt of monolauryl sulfate	20% by weight
Viscosity increasing agent	0 - 5% by weight
Purified water	balance
Total	100% by weight
	(pH 7.5)

Table 3
(viscosities are expressed by mPa.s)

Viscosity Increasing Agents	Concentration of viscosity increasing agent			
	0	1 wt%	3 wt%	5 wt%
<u>Inventive Agents</u>				
No. 1	6	8	30	300
No. 2	6	7	25	260
No. 3	6	8	30	280
No. 4	6	8	31	350
No. 5	6	7	20	280
No. 6	6	7	25	300
No. 7	6	7	26	320
No. 8	6	7	28	250
No. 9	6	8	32	360
No. 10	6	8	30	320
No. 11	6	7	26	265
No. 12	6	7	24	240
<u>Comparative compound</u>				
Polyethylene glycol (10,000) distearic acid ester	6	8	40	400

Example 3

Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 25 °C using a B-type viscometer. Results are shown in Table 4.

Sodium salt of POE(2.5)
lauryl ether sulfate

20% by weight

Viscosity increasing agent

0 - 5% by weight

Purified water

balance

Total

100% by weight

(pH 7.5)

Table 4

(viscosities are expressed by mPa.s)

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Viscosity
Increasing
Agents

Concentration of viscosity increasing agent

0

1 wt%

3 wt%

5 wt%

Inventive
Agents

No. 1

7

10

90

1860

No. 2

7

8

82

1500

No. 3

7

9

95

2020

No. 4

7

8

60

1430

No. 5

7

8

20

200

No. 6

7

8

25

300

No. 7

7

8

24

285

No. 8

7

8

54

1260

No. 9

7

9

62

1850

No. 10

7

8

30

600

No. 11

7

8

22

270

No. 12

7

8

25

285

Comparative
compoundPolyethylene glycol
(10,000) distearic
acid ester

7

8

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350

Example 4

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Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 25 °C using a B-type viscometer. Results are shown in Table 5.

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POE(30) lauryl ether	10% by weight
Viscosity increasing agent	0 - 5% by weight
Purified water	balance
Total	100% by weight
	(pH 7.5)

Table 5
(viscosities are expressed by mPa.s)

Viscosity Increasing Agents	Concentration of viscosity increasing agent			
	0	1 wt%	3 wt%	5 wt%
<u>Inventive Agents</u>				
No. 1	6	9	60	2100
No. 2	6	8	45	1200
No. 3	6	9	58	1850
No. 4	6	8	30	860
No. 5	6	8	35	1250
No. 6	6	8	35	1200
No. 7	6	8	32	1000
No. 8	6	8	32	1020
No. 9	6	9	40	1460
No. 10	6	9	35	1220
No. 11	6	9	40	950
No. 12	6	10	62	2780
<u>Comparative compound</u>				
Polyethylene glycol (10,000) distearic acid ester	6	10	70	3500

Example 5

Liquid detergent compositions having the following formulations were prepared according to the conventional method and, after having been stored for 0 - 20 days at 50 °C, their viscosities were measured at 25 °C using a B-type viscometer. Results are shown in Table 6.

Triethanolamine salt of monolauryl phosphate	20% by weight
Viscosity increasing agent	5% by weight
Purified water	75% by weight
Total	100% by weight
	(pH 7.5)

Table 6

(viscosities are expressed by mPa.s)

Viscosity Increasing Agents	Number of Days Stored		
	0	10	20
<u>Inventive Agents</u>			
No. 1	7460	7480	7520
No. 2	1875	1780	1800
No. 3	3480	3450	3500
No. 4	2600	2420	2580
No. 5	1125	1100	1100
No. 6	1850	1840	1820
No. 7	1700	1720	1650
No. 8	1360	1385	1370
No. 9	1650	1600	1650
No. 10	860	880	860
No. 11	700	660	650
No. 12	840	820	860
<u>Comparative compounds</u>			
Polyethylene glycol (10,000) distearic acid ester	800	40	15
POE(120) methyl- glucoside dioleic acid ester	1075	40	18

Example 6

Liquid detergent compositions were prepared by adding 3% by weight of the viscosity increasing agent to each of an aqueous solution of 15% by weight of triethanolamine salt of monolauryl sulfate (AS/TEA), an aqueous solution of 15% by weight of sodium salt of POE(2.5) laurylether sulfate (ES/Na), and an aqueous solution 15% by weight of triethanolamine salt of monolauryl sulfate plus 1% by weight of NaCl (AS/TEA + NaCl). Transparency of each composition thus prepared are shown in Table 7, in which "TRP" means that

the composition is transparent and "TUB" means that the composition is turbid.

The table also shows, for comparison, the transparency of aqueous liquid detergent compositions containing 3% by weight of hydroxyethyl cellulose with molecular weight of about 100,000 (HEC), 3% by weight of methyl cellulose with molecular weight of about 90,000 (MC) and 3% by weight of polyvinyl pyrrolidone of approximate molecular weight of 100,000 (PVP).

Table 7

Viscosity Increasing Agents	Detergent		
	AS/TEA	ES/Na	AS/TEA + NaCl
<u>Inventive Agents</u>			
No. 1	TRP	TRP	TRP
No. 2	TRP	TRP	TRP
No. 3	TRP	TRP	TRP
No. 4	TRP	TRP	TRP
No. 5	TRP	TRP	TRP
No. 6	TRP	TRP	TRP
No. 7	TRP	TRP	TRP
No. 8	TRP	TRP	TRP
No. 9	TRP	TRP	TRP
No. 10	TRP	TRP	TRP
No. 11	TRP	TRP	TRP
No. 12	TRP	TRP	TRP
<u>Comparative compounds</u>			
HEC	TRP	TUB	TUB
MC	TRP	TUB	TUB
PVP	TRP	TUB	TUB

Example 7

Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 30 °C using a BM-type viscometer. Results are shown in Table 8.

2-alkyl-N-carboxymethyl-
N-hydroxyethylimidazolinium
betaine *

10% by weight

Viscosity increasing
agent No. 4

0 - 3% by weight

Purified water

balance

Total

100% by weight

(pH 7.0)

* Milanol C2M CONC (product of Milanol Co.)

Table 8

(viscosities are expressed by mPa.s)

Viscosity Increasing Agents	Concentration of viscosity increasing agent				
	0	0.5 wt%	1 wt%	2 wt%	3 wt%
<u>Inventive Agent</u>					
No. 4	6	420	1836	3800	4660
<u>Comparative compound</u>					
Polyethylene glycol (10,000) distearic acid ester	6	196	1400	2520	3540

Example 8

Liquid detergent compositions having the following formulations were prepared according to the conventional method and their viscosities were measured at 30 °C using a BM-type viscometer. Results are shown in Table 9.

Sodium sulfate of POE (2.5) lauryl ether *	10% by weight
Lauric acid diethanol amide	0 - 3% by weight
Viscosity increasing agent No. 4	0.5% by weight
Purified water	balance
Total	100% by weight (pH 7.0)

* Emal 20C (product of Kao Corp.)

Table 9

(viscosities are expressed by mPa.s)

Viscosity Increasing Agent	Concentration of lauric acid diethanol amide			
	0	1 wt%	2 wt%	3 wt%
<u>Inventive Agent</u>				
No. 4 (0.5 wt%)	7	460	1820	3640

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

Claims

Claims for the following Contracting States : CH, DE, FR, GB, IT, LI, NL

1. A water-soluble viscosity increasing agent consisting essentially of one or more branched fatty acid esters selected from the group consisting of the following (i) to (iii):

- (i) an ester of a 80 to 400 moles ethylene oxide adduct of polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content,
- (ii) an ester of polyethylene glycol having average molecular weight of 2,000 to 20,000 and branched fatty acid of 8 to 36 carbon atom content, and
- (iii) a 80 to 400 mole ethylene oxide adduct of an ester of a polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content;

said branched fatty acid being a fatty acid branched at α -position, represented by the following formula (I):



Sodium sulfate of POE (2.5) lauryl ether *	10% by weight
Lauric acid diethanol amide	0 - 3% by weight
Viscosity increasing agent No. 4	0.5% by weight
Purified water	balance
Total	100% by weight (pH 7.0)

* Emal 20C (product of Kao Corp.)

Table 9

(viscosities are expressed by mPa.s)

Viscosity Increasing Agent	Concentration of lauric acid diethanol amide			
	0	1 wt%	2 wt%	3 wt%
<u>Inventive Agent</u>				
No. 4 (0.5 wt%)	7	460	1820	3640

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

Claims

Claims for the following Contracting States : CH, DE, FR, GB, IT, LI, NL

1. A water-soluble viscosity increasing agent consisting essentially of one or more branched fatty acid esters selected from the group consisting of the following (i) to (iii):
 - (i) an ester of a 80 to 400 moles ethylene oxide adduct of polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content,
 - (ii) an ester of polyethylene glycol having average molecular weight of 2,000 to 20,000 and branched fatty acid of 8 to 36 carbon atom content, and
 - (iii) a 80 to 400 mole ethylene oxide adduct of an ester of a polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content;
 said branched fatty acid being a fatty acid branched at α -position, represented by the following formula (I):



in which R_1 represents a linear or branched alkyl or alkenyl group of 4 to 18 carbon atom content and R_2 represents a linear or branched alkyl or alkenyl group of 2 to 16 carbon atom content.

2. A water-soluble viscosity increasing agent as claimed in Claim 1 wherein said polyhydric alcohol is an alcohol being more than trivalent.

3. A liquid detergent composition comprising the following components (A) and (B):

(A) 5 to 40% by weight of a surface active agent having a detergency, and

(B) 0.1 to 10% by weight of one or more branched fatty acid esters selected from the group consisting of the following (i) to (iii):

(i) an ester of a 80 to 400 moles ethylene oxide adduct of polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content,

(ii) an ester of polyethylene glycol having average molecular weight of 2,000 to 20,000 and branched fatty acid of 8 to 36 carbon atom content, and

(iii) a 80 to 400 mole ethylene oxide adduct of an ester of a polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content;

wherein the branched fatty acid is a fatty acid branched at α -position, represented by the following formula (I):



in which R_1 represents a linear or branched alkyl or alkenyl group of 4 to 18 carbon atom content and R_2 represents a linear or branched alkyl or alkenyl group of 2 to 16 carbon atom content.

4. A liquid detergent composition as claimed in Claim 3 wherein the polyhydric alcohol is an alcohol being more than trivalent.

Claims for the following Contracting States : AT, ES

1. A liquid detergent composition comprising the following components (A) and (B):

(A) 5 to 40% by weight of a surface active agent having a detergency, and

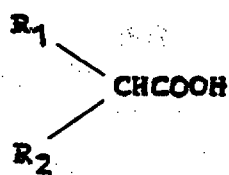
(B) 0.1 to 10% by weight of one or more branched fatty acid esters selected from the group consisting of the following (i) to (iii):

(i) an ester of a 80 to 400 moles ethylene oxide adduct of polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content,

(ii) an ester of polyethylene glycol having average molecular weight of 2,000 to 20,000 and branched fatty acid of 8 to 36 carbon atom content, and

(iii) a 80 to 400 mole ethylene oxide adduct of an ester of a polyhydric alcohol and a branched fatty acid of 8 to 36 carbon atom content;

wherein the branched fatty acid is a fatty acid branched at α -position, represented by the following formula (I):



(I)

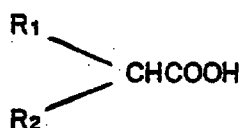
10 in which R_1 represents a linear or branched alkyl or alkenyl group of 4 to 18 carbon atom content and R_2 represents a linear or branched alkyl or alkenyl group of 2 to 16 carbon atom content.

2. A liquid detergent composition as claimed in Claim 1 wherein the polyhydric alcohol is an alcohol being more than trivalent.

15 Patentansprüche

Patentansprüche für folgende Vertragsstaaten : CH, DE, FR, GB, IT, LI, NL

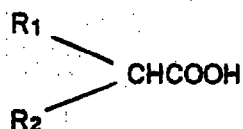
1. Wasserlösliches, die Viskosität steigerndes Mittel, bestehend im wesentlichen aus ein oder mehreren verzweigten Fettsäureestern, ausgewählt aus der Gruppe, bestehend aus den folgenden (i) bis (iii):
- (i) ein Ester eines 80 bis 400 Mol-Ethylenoxidaddukts von mehrwertigem Alkohol und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält,
 - (ii) ein Ester von Polyethylenglycol mit durchschnittlichem Molekulargewicht von 2000 bis 20 000 und verzweigter Fettsäure, die 8 bis 36 Kohlenstoffatome enthält, und
 - (iii) ein 80 bis 400 Mol-Ethylenoxidaddukt von einem Ester eines mehrwertigen Alkohols und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält;
- wobei die verzweigte Fettsäure eine an der α -Position verzweigte Fettsäure der folgenden Formel (I) ist:



(I)

35 wobei R_1 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 4 bis 18 Kohlenstoffatomen bedeutet und R_2 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 2 bis 16 Kohlenstoffatomen bedeutet.

2. Wasserlösliches, die Viskosität steigerndes Mittel gemäß Anspruch 1, wobei der mehrwertige Alkohol ein Alkohol ist, der mehr als dreiwertig ist.
3. Flüssige Detergensenzusammensetzung, umfassend die folgenden Komponenten (A) und (B):
- (A) 5 bis 40 Gew.-% eines oberflächenaktiven Mittels mit Waschwirkung, und
 - (B) 0,1 bis 10 Gew.-% eines oder mehrerer verzweigter Fettsäureester, ausgewählt aus der Gruppe, bestehend aus den folgenden (i) bis (iii):
- (i) ein Ester eines 80 bis 400 Mol-Ethylenoxidaddukts von mehrwertigem Alkohol und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält,
 - (ii) ein Ester von Polyethylenglycol mit durchschnittlichem Molekulargewicht von 2000 bis 20 000 und verzweigter Fettsäure, die 8 bis 36 Kohlenstoffatome enthält, und
 - (iii) ein 80 bis 400 Mol-Ethylenoxidaddukt von einem Ester eines mehrwertigen Alkohols und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält;
- wobei die verzweigte Fettsäure eine an der α -Position verzweigte Fettsäure der folgenden Formel (I) ist:



(I)



wobei R_1 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 4 bis 18 Kohlenstoffatomen bedeutet und R_2 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 2 bis 16 Kohlenstoffatomen bedeutet.

4. Flüssige Detergenezusammensetzung gemäß Anspruch 3, wobei der mehrwertige Alkohol ein Alkohol ist, der mehr als dreiwertig ist.

Patentansprüche für folgende Vertragsstaaten : AT, ES

1. Flüssige Detergenezusammensetzung, umfassend die folgenden Komponenten (A) und (B):

(A) 5 bis 40 Gew.-% eines oberflächenaktiven Mittels mit Waschwirkung, und

(B) 0,1 bis 10 Gew.-% eines oder mehrerer verzweigter Fettsäureester, ausgewählt aus der Gruppe, bestehend aus den folgenden (i) bis (iii) :

(i) ein Ester eines 80 bis 400 Mol-Ethylenoxidaddukts von mehrwertigem Alkohol und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält,

(ii) ein Ester von Polyethylenglycol mit durchschnittlichem Molekulargewicht von 2000 bis 20 000 und verzweigter Fettsäure, die 8 bis 36 Kohlenstoffatome enthält, und

(iii) ein 80 bis 400 Mol-Ethylenoxidaddukt von einem Ester eines mehrwertigen Alkohols und einer verzweigten Fettsäure, die 8 bis 36 Kohlenstoffatome enthält;

wobei die verzweigte Fettsäure eine an der α -Position verzweigte Fettsäure der folgenden Formel (I) ist:



wobei R_1 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 4 bis 18 Kohlenstoffatomen bedeutet und R_2 eine lineare oder verzweigte Alkyl- oder Alkenylgruppe mit einem Gehalt von 2 bis 16 Kohlenstoffatomen bedeutet.

2. Flüssige Detergenezusammensetzung gemäß Anspruch 1, wobei der mehrwertige Alkohol ein Alkohol ist, der mehr als dreiwertig ist.

Revendications

Revendications pour les Etats contractants suivants : CH, DE, FR, GB, IT, LI, NL

1. Agent soluble dans l'eau augmentant la viscosité, constitué essentiellement d'un ou de plusieurs esters d'acides gras ramifiés choisis dans le groupe comprenant les composés suivants (i) à (iii) :

(i) un ester d'un produit d'addition d'oxyde d'éthylène à raison de 90 à 400 moles d'alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone,

(ii) un ester de polyéthylèneglycol ayant un poids moléculaire moyen de 2.000 à 20.000 et un acide gras ramifié ayant de 8 à 36 atomes de carbone, et

(iii) produit d'addition d'oxyde d'éthylène à raison de 40 à 400 moles d'un ester d'alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone ;

ledit acide gras ramifié étant un acide gras ramifié en position alpha représenté par la formule générale (I) suivante :



dans laquelle R_1 représente un groupe alkyle ou alcényle linéaire ou ramifié contenant 4 à 18 atomes de carbone et R_2 représente un groupe alkyle ou alcényle linéaire ou ramifié ayant de 2 à 16 atomes



de carbone.

2. Agent soluble dans l'eau augmentant la viscosité selon la revendication 1, dans lequel ledit alcool polyhydrique est un alcool qui est plus que trivalent.

3. Composition détergente liquide comprenant les composants suivants (A) et (B) :

(A) 5 à 40 % en poids d'un agent tensio-actif présentant un pouvoir détergent, et

(B) 0,1 à 10 % en poids d'un ou de plusieurs esters d'acides gras ramifiés choisis dans le groupe comprenant les composés (i) à (iii) suivants :

(i) un ester d'un produit d'addition d'oxyde d'éthylène à raison de 80 à 400 moles d'un alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone,

(ii) un ester de polyéthylèneglycol ayant un poids moléculaire moyen de 2.000 à 20.000 et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone, et

(iii) un produit d'addition d'oxyde d'éthylène à raison de 80 à 400 moles d'un ester d'un alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone ;

dans lequel l'acide gras ramifié est un acide gras ramifié en position alpha, représenté par la formule (I) suivante:



dans laquelle R_1 représente un groupe alkyle ou alcényle linéaire ou ramifié ayant de 4 à 18 atomes de carbone et R_2 représente un groupe alkyle ou alcényle linéaire ou ramifié ayant de 2 à 16 atomes de carbone.

4. Composition détergente liquide selon la revendication 3 dans laquelle l'alcool polyhydrique est un alcool qui est plus que trivalent.

Revendications pour les Etats contractants suivants : AT, ES

1. Composition détergente liquide comprenant les composants suivants (A) et (B) :

(A) 5 à 40 % en poids d'un agent tensio-actif présentant un pouvoir détergent, et

(B) 0,1 à 10 % en poids d'un ou de plusieurs esters d'acides gras ramifiés choisis dans le groupe comprenant les composés (i) à (iii) suivants :

(i) un ester d'un produit d'addition d'oxyde d'éthylène à raison de 80 à 400 moles d'un alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone,

(ii) un ester de polyéthylèneglycol ayant un poids moléculaire moyen de 2.000 à 20.000 et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone, et

(iii) un produit d'addition d'oxyde d'éthylène à raison de 80 à 400 moles d'un ester d'un alcool polyhydrique et d'un acide gras ramifié ayant de 8 à 36 atomes de carbone ;

dans lequel l'acide gras ramifié est un acide gras ramifié en position alpha, représenté par la formule (I) suivante:



dans laquelle R_1 représente un groupe alkyle ou alcényle linéaire ou ramifié ayant de 4 à 18 atomes de carbone et R_2 représente un groupe alkyle ou alcényle linéaire ou ramifié ayant de 2 à 16 atomes de carbone.



2. Composition détergente liquide selon la revendication 1 dans laquelle l'alcool polyhydrique est un alcool qui est plus que trivalent.

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