



(51) International Patent Classification:

C11D 1/62 (2006.01) *C11D 3/37* (2006.01)
C11D 3/00 (2006.01) *C11D 3/50* (2006.01)

(21) International Application Number:

PCT/US2016/036307

(22) International Filing Date:

8 June 2016 (08.06.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

15290164.1 23 June 2015 (23.06.2015) EP
15181595.8 15 September 2015 (15.09.2015) EP

(71) Applicant: **ROHM AND HAAS COMPANY** [US/US];
100 Independence Mall West, Philadelphia, PA 19106
(US).

(72) Inventors: **PERDIGON, Valerie**; Les Lacs D Aron,
83840 Comps Sur Artuby (FR). **OBERLIN, Anne**; 897
chemin des Ames du Purgatoire, Résidence Anais, 06600
Antibes (FR). **GAELLE, Della Noce**; 371 rue LV Beeth-
oven, BP 249 Sophia Antipolis, 06565 Valbonne (FR).

(74) Agent: **DEIBERT, Thomas**; The Dow Chemical Com-
pany, P. O. Box 1967, Intellectual Property, Midland,
Michigan 48641-1967 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: FABRIC SOFTENER COMPOSITIONS AND METHODS OF USE

(57) Abstract: Provided is a fabric softener composition and its use in laundry applications. The composition comprises: a poly(ethylene oxide) polymer with a molecular weight of at least 80,000 Da; a fabric softening agent that is a cationic compound; a solvent; and a fragrance.



WO 2016/209617 A1

FABRIC SOFTENER COMPOSITIONS AND METHODS OF USE

Field

This invention relates generally to fabric softener compositions and their use in laundry applications.

5 Background

Modern fabric softener compositions, such as those delivered in the rinse cycle of a washing machine, contain a variety of functional actives. One of the most important actives in such compositions is the fabric softening agent, which provides the desirable sensorial softness to the treated fabric. Typical fabric softening agents are cationic materials, such as quaternary ammonium compounds.

The cost of the fabric softening agent represents a significant portion of both the cost and the quantity of ingredients of the overall composition. Consequently, increasing the efficacy of the softening agent would allow for less material to be used to achieve the same result, thereby providing economic advantages to the formulator. Increasing efficacy can also provide performance advantages such as boosting of softening benefits and providing higher fragrance retention characteristics to the fabrics.

While certain cationic materials, such as quaternary ammonium compounds, are very effective at softening fabrics, they are also known to render the fabrics less water absorbent. This is an issue for various laundry items, such as towels and diapers. Thus, a further benefit of increasing the efficacy of cationic softeners, and thus permitting use of smaller amounts, is the potential for improving the water absorption characteristics of the fabric.

The problem addressed by this invention is the provision of new technologies that enhance the efficacy of fabric softening agents in fabric softener compositions.

25 Statement of Invention

We have now found that inclusion of a high molecular weight poly(ethylene oxide) polymer in a fabric softener composition can enhance the efficacy of cationic fabric softening agents. Consequently, reduced amounts of the softening agents may be used, sometimes by a factor of two or greater, without detrimental effect on the softening effect of the composition. In addition, in some cases, the composition of the invention also provides higher fragrance retention in the fabric. Moreover, the compositions of the invention may allow for greater water absorption by fabrics to which the softener composition has been

applied. Advantageously, therefore, the compositions of the invention provide various economic and performance benefits to producers and consumers of fabric softener compositions.

In one aspect, there is provided a fabric softener composition. The composition
5 comprises: a poly(ethylene oxide) polymer with a molecular weight of at least 80,000 Da; a fabric softening agent that is a cationic compound; a solvent; and a fragrance.

In another aspect, there is provided a method for softening a fabric, a method for increasing fragrance retention in a fabric, a method for increasing water retention in a fabric, or a combination of the foregoing, the method comprising: contacting the fabric with
10 the fabric softener composition as described herein.

Detailed Description

Unless otherwise indicated, numeric ranges, for instance as in "from 2 to 10" or "between 2 and 10," are inclusive of the numbers defining the range (e.g., 2 and 10).

Unless otherwise indicated, ratios, percentages, parts, and the like are by weight.
15 Weight percentages (or wt%) in the compositions are percentages of the referenced active ingredient in the composition. Molecular weights of poly(ethylene oxide) polymers may be determined by aqueous solution viscometry. The aqueous Brookfield solution viscosities of various High MW poly(ethylene oxide) samples at various polymer concentrations are correlated to polymers with known molecular weight, with the original molecular weights
20 being determined by capillary viscometry using the Mark-Houwink equation established by Allen and coworkers (G. Allen, C. Booth, S. J. Hurst, M. N. Jones, and C. Price, *Polymer*, 8(8), 391-397 (1967)). Additional details are provided in the Examples. Molecular weights are reported in units of Daltons and represent weight average molecular weights.

As noted above, in one aspect the invention provides a fabric softener composition.
25 The composition comprises: a poly(ethylene oxide) polymer with a molecular weight of at least 80,000 Da; a fabric softening agent that is a cationic compound; a solvent; and a fragrance.

Poly(ethylene oxide) ("PEO") polymers used in the invention comprise polymerized units of ethylene oxide of the general formula $\text{HO}-(\text{-CH}_2\text{CH}_2\text{O-})_n\text{-H}$, wherein n is such that
30 the polymer has a molecular weight of at least 80,000 Da. In some embodiments, the molecular weight of the PEO polymer is at least 90,000 Da, alternatively at least 100,000 Da, alternatively at least 150,000 Da, alternatively at least 200,000 Da, alternatively at least

250,000 Da, alternatively at least 300,000 Da, or alternatively at least 350,000 Da. In some embodiments, the molecular weight of the PEO polymer is up to 4,250,000 Da, alternatively up to 4,000,000 Da, alternatively up to 3,000,000 Da, alternatively up to 2,000,000 Da, alternatively up to 1,000,000 Da, alternatively up to 700,000 Da, alternatively up to 650,000 Da, alternatively up to 600,000 Da, alternatively up to 550,000 Da, alternatively up to 500,000 Da, or alternatively up to 450,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 90,000 Da to 4,250,000 Da, alternatively from 90,000 Da to 610,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 90,000 Da to 110,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 190,000 Da to 210,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 390,000 Da to 410,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 590,000 Da to 610,000 Da. In some embodiments, the molecular weight of the PEO polymer is from 3,900,000 Da to 4,100,000 Da.

In some embodiments, the composition of the invention contains at least 0.01 weight percent, alternatively at least 0.1 weight percent, alternatively at least 0.4 weight percent of the PEO polymer, based on the total weight of composition. In some embodiments, the composition contains up to 3 weight percent, alternatively up to 2 weight percent, alternatively up to 1 weight percent of the PEO polymer, based on the total weight of the composition.

Poly(ethylene oxide) polymers suitable for use in the invention may be readily prepared using known methods. In addition, they are also commercially available.

The fabric softening agent of the composition is a cationic compound, preferably a quaternary ammonium compound, more preferably a fatty ester quaternary ammonium compound. Examples of suitable fabric softening agents include, without limitation, dihydrogenated tallowylethyl hydroxyethylmonium methosulfate (CAS Reg. No. 91995-81-2); dipalmitoylethyl hydroxyethylmonium methosulfate (CAS Reg. No. 157905-74-3), methyl bis(ethyl (tallowate))-2-hydroxyethyl ammonium methyl sulfate (CAS Reg. No. 157905-74-3), or mixtures thereof. Preferably, the fabric softening agent is methyl bis(ethyl (tallowate))-2-hydroxyethyl ammonium methyl sulfate.

In some embodiments, the composition of the invention contains at least 0.5 weight percent, alternatively at least 1 weight percent, alternatively at least 2 weight percent, alternatively at least 3 weight percent, or alternatively at least 4 weight percent of the fabric softening agent, based on the total weight of the composition. In some embodiments, the

composition contains up to 15 weight percent, alternatively up to 12 weight percent, alternatively up to 10 weight percent, alternatively up to 8 weight percent, or alternatively up to 6 weight percent of the fabric softening agent, based on the total weight of the composition.

5 In some embodiments, the weight ratio of poly(ethylene oxide) polymer to fabric softening agent in the compositions of the invention is from 1:1 to 1:10, alternatively from 1:1.5 to 1:10, alternatively from 1:1.5 to 1:6, alternatively from 1:1.5 to 1:4, alternatively from 1:1.5 to 1:3, or alternatively from 1:1.5 to 1:2.

10 The solvent of the composition preferably comprises water. Other suitable solvents that may be used include, without limitation, isopropanol, polypropylene glycol, glycol ethers (for instance, dipropylene glycol n-butyl ether, ethylene glycol monohexyl ether, dipropylene glycol methyl ether, ethylene glycol monobutyl ether, or ethylene glycol phenyl ether), or mixtures of any of the foregoing, including with water. The amount of solvent in the composition is not critical and generally provides the balance of the composition. In
15 some embodiments, the composition of the invention contains at least 60 weight percent, alternatively at least 80 weight percent, or alternatively at least 95 weight percent of the solvent, based on the total weight of the composition. In some embodiments, the composition contains up to 99 weight percent, alternatively up to 96 weight percent of the solvent, based on the total weight of the composition.

20 Fragrances that may be present in the composition of the invention may be any such material that is generally known for use in fabric softening. A wide variety of chemicals are known for fragrance uses, including materials such as aldehydes, ketones, and esters. More commonly, naturally occurring plant and animal oils and exudates comprising complex mixtures of various chemical components are known for use as fragrances. The fragrances
25 herein can be relatively simple in their compositions or can comprise more complex mixtures of natural and synthetic chemical components, all chosen to provide the desired odor. Examples of fragrances are described, for example, in US 2005/0202990A1.

 By way of non-limiting illustration only, a specific example of a fragrance may, for instance, contain: 5-10% of Terpineol, dihydro-, acetate (CAS# 58985-18-5), 5-10%
30 tetrahydrolinalool (CAS# 78-69-3), 1-5% limonenes (CAS# 138-86-3), 1-5% Heliotropine (CAS# 120-57-0), 1-5% Butylphenylmethylpropional (CAS# 80-54-6), 1-5% Vanillin (CAS# 121-33-5), 1-5% octahydro tetramethyl acetone (CAS# 54464-57-2), 1-5% Geraniol (CAS# 106-24-1), 0.1-1% Hexyl acetate (CAS# 142-92-7), 0.1-1% Gamma-

undecalactone (CAS# 104-67-6), 0.1-1% Citronellol (CAS# 106-22-9), 0.1-1% Nerol (CAS# 106-25-2), 0.1-1% Verdyl propionate (CAS# 17511-60-3), 0.1-1% Cyclamen aldehyde (CAS# 103-95-7), 0.1-1% Beta pinene (CAS# 127-91-3), 0.1-1% Isoeugenol (CAS# 97-54-1), 0.1-1% Isobornyl acetate (CAS# 125-12-2), and 0.1-1% Lorenox (CAS# 900779-74-0).

In some embodiments, the composition of the invention contains at least 0.1 weight percent, preferably at least 1 weight percent of the fragrance, based on the total weight of the composition. In some embodiments, the composition contains up to 3 weight percent, alternatively up to 2 weight percent of the fragrance, based on the total weight of the composition.

The composition of the invention may contain various optional ingredients such as, for instance, one or more of an emulsion stabilizer (e.g. cellulose gum, glycol stearate, ethylhexyl stearate, hydrophobically modified urethane, nonionic surfactant such as alcohol alkoxylate), a preservative (e.g., benzisothiazolinone), a sequestrant (e.g., etidronic acid or monosodium etidronate), a bulking agent (e.g., calcium chloride), an anti-foaming agent (e.g., dimethicone and/or phenyl methicone), a skin or fiber conditioning agent (e.g., hydrogenated vegetable glycerides, or a material from the silicone family such as dimethyl siloxane), a pH adjuster (e.g., hydrochloric acid, citric acid, sodium hydroxide, or amine based neutralizers), a colorant, or an opacifier (for instance styrene/acrylates copolymer).

In some embodiments, the optional ingredients, when present, may typically amount to between 0 and 5 weight percent, based on the total weight of the composition.

In some embodiments, compositions of the invention may have a pH ranging from 1 to 7, preferably from 2.5 to 5.

Compositions of the inventions are generally in the form of liquids that may be prepared by mixing the various components, for instance under stirring, such as mechanical stirring. Elevated temperature, for instance 30 to 60 °C may be used to facilitate mixing and/or dissolution, for instance of the fabric softening agent.

In use, the fabric softener composition of the invention may be added to the washing machine, for instance, directly into the washing drum or into the fabric softener compartment of the machine. Generally, the composition may be added during one or more of the wash rinse cycles. The amount of the composition that may be used can be readily determined by a person of ordinary skill in the art. A typical effective amount is from 25 g to 150 g per wash.

Some embodiments of the invention will now be described in detail in the following Examples.

EXAMPLES

Example 1

5 Preparation of fabric softener compositions

The concentrations of the components are in weight percentage.

Abbreviated component have the following meanings: PEO= Poly(ethylene oxide) polymer

RT: Room temperature (typically about 20 °C).

10 PEO Molecular weight assessment: The approximate molecular weights are based on rheological measurements. PEO MW 200,000: viscosity range in mPa.s (Cp) using a Brookfield viscometer model RVT, spindle N° 1 @ 50rpm in 5% aqueous solution at 25°C= 65-115 Cp). PEO MW 4,000,000 : viscosity range in mPa.s (Cp) using a Brookfield viscometer model RVF, spindle N° 2 @ 2rpm in 1% aqueous solution at 25°C= 1650-5500 Cp).

15 The fabric softening agent ("esterquat") used in this example is methyl bis(ethyl (tallowate))-2-hydroxyethyl ammonium methyl sulfate. The material is first stored at 50 °C so it is in melted form before use.

A solution of 2 % weight of PEO is prepared in deionized (Di) water at room temperature using a Heidolph model RZR 2020 mechanical agitator with a four blades
20 screw until complete dissolution of the polyethylene oxide, when the solution becomes transparent.

This example studies two different molecular weight of PEO: 200,000 Da and 4,000,000 Da.

25 Under mechanical action using a Heidolph model RZR 2020 mechanical agitator with a four blades screw, the melted esterquat is added to a beaker containing deionized water at 50 °C. When the solution is homogeneous, the mixture is allowed to cool to room temperature. When the solution is at room temperature, a fragrance and the solution of 2 % weight of PEO previously prepared are added. The compositions are shown in Table 1.

Table 1.

	%weight of the total composition				
Fabric softeners base	3wt% esterquat + 0.25wt% active PEO	3wt% esterquat + 0.5wt% active PEO	11wt% esterquat	3wt% esterquat	no esterquat 0.5wt% PEO
	composition 1 (inventive)	composition 2 (inventive)	composition 3 (comparative)	composition 4 (comparative)	composition 5 (comparative)
DI Water	83.17	70.67	86.8	95.67	75
Esterquat* (90wt% active content)	3.33	3.33	12.2	3.33	
Fragrance***	1	1	1	1	1
PEO solution** (2%weight in DI water)	12.5	25			25
****Nonionic surfactant: alcohol ethoxylate	1	1	1	1	1

* Stepanex VK-90® from Stepan Company

** PEO with 200,000Da or PEO with 4 000,000Da

5 *****Happiness™ from Mane Company

**** Ecosurf™ SA9 from The Dow Chemical Company

Evaluation of care benefits

Pretreatment phase:

- 3.5 kg of ballast fabrics containing two terry towels are washed 2 times with 45 g
- 10 ECE-2 powder laundry detergent from Testgewebe GmbH at 95 °C with the cotton program in each Miele Novotronic W1614 washing machine and then washed one time with no detergent at 95 °C to strip the fabrics.

Washing phase:

- On each washing machine are added 3.5 kg of ballast fabrics containing two terry
- 15 towels, one SBL2004 swatch from Testgewebe GmbH containing 8 g of soil ballast load; 60 g of model high duty laundry detergent (see composition in Table 2) and 30 g of either composition 1, 2, 3, 4 or 5 in the fabric softener compartment of the washing machine. The wash temperature is tuned at 40 °C.

Table 2. High Duty Liquid laundry formulation composition

Model High duty Liquid laundry composition	% Active(in finished product)
Deionised Water	50
Linear Alkyl Benzene Sulfonate*	19
Alcohol ethoxylate- 7EO**	11
Trisodium Citrate 2H ₂ O	2
Propylene Glycol	5
Fatty acid soap***	8.5
Ethanol	2
Sodium xylene sulfonate ****	2
NaOH (32%)	to pH 8.5
Deionised Water	balance to 100

*For instance, Nansa®SS80 from Huntsman

** For instance, Neodol® 25-7 from Shell

*** For instance, Prifac® 7908 from KLK

**** For instance, Eltesol® SX-30 from Huntsman

A) Evaluation of Fragrance retention: Wet fabrics fragrance intensity assessment

The evaluation of fragrance is run by a panel of experts.

- 10 The fragrance intensity is assessed directly when opening the washing machines after 1 cycle set at 40 °C with all the wet ballast inside the drum of the machine. Results are shown in Table 3, with the following ratings: 1: poor fragrance intensity and 10: high fragrance intensity.

Table 3

	Fragrance intensity ratings
No fabric softener(as control)	1
Composition 3 (11 wt% Esterquat)	8
Composition 4 (3 wt% Esterquat)	5
Composition 5 with PEO MW: 200,000 Da	8
Composition 1 PEO MW: 200,000 Da	7
Composition 2 with PEO MW: 200,000 Da	7
Composition 1 with PEO MW: 4,000,000 Da	5

15

- The composition 5 with PEO of 200,000 Da ; the Composition 1 with PEO of 200,000 Da and the Composition 2 with PEO of 200,000 Da show similar or slightly lower fragrance intensity rating than the composition 3, containing 11 wt% esterquat and higher
20 fragrance intensity than the composition 4 containing 3 wt% esterquat.

This example shows that intensity of fragrance can be maintained while decreasing the level of esterquat from 11wt% to 3 wt% content if we add either 0.25 wt% or 0.5 wt% of

PEO MW: 200,000 Da. This example also shows that esterquat can be completely removed without compromise on fragrance intensity if we have 0.5 wt% PEO MW: 200,000 Da.

B) Measurements of softening

5 The evaluation of softening is run by a panel of experts. Each panelist compares one terry towel against the terry towels washed without fabric softeners (considered as control). Data are shown in Table 4, with the following ratings: 1 poor softening effect and 10: excellent softening effect

Table 4.

	softening ratings (average)
No fabric softener(as control)	1.0
Composition 3 (11wt% Esterquat)	8.0
Composition 4 (3wt% Esterquat)	2.6
Composition 5 with PEO:MW:200,000 Da	2.2
Composition 1 with PEO MW:200,000 Da	2.6
Composition 2 with PEO MW:200,000 Da	8.0
Composition 1 with PEO MW:4,000,000 Da	7.2

10

The composition 2 with PEO of 200,000 Da, with 3 wt% Esterquat showed similar softening effect rating to the composition 3, containing 11 wt% esterquat and superior softening effect than composition 4.

15 Composition 1 with PEO MW: 4, 000, 000 Da shows slightly lower softening effect rating than the composition 3, containing 11 wt% esterquat and superior softening effect than composition 4 containing 3 wt% esterquat.

This example shows that softening benefits can be maintained while decreasing the level of esterquat from 11 wt% to 3 wt% content if we add 0.5 wt% of PEO MW: 200,000 Da.

20 Example 2:

The fabric softening agent (esterquat) used in this example is methyl bis(ethyl (tallowate)) -2- hydroxyethyl ammonium methyl sulfate. The material is first stored at 50 °C so it is in melted form before use.

25 Under mechanical action using a Heidolph model RZR 2020 mechanical agitator with a four blades screw, the melted esterquat is added to a beaker containing deionized water at 50 °C. When the solution is homogeneous, the solution is cooled to room temperature.

When the solution is at RT, the PEO MW 200,000 is added in concentrations as described in Table 5.

Table 5

	% of the total composition					
Fabric softeners base	4wt% esterquat + 1wt% PEO:MW:200,000 Da + 1wt% fragrance	4wt% esterquat + 2wt% PEO:MW:200,000 Da + 1wt% fragrance	4wt% esterquat + 1wt% fragrance	6wt% esterquat + 1wt% PEO:MW:200,000 Da + 1wt% fragrance	6wt% esterquat + 2wt% PEO:MW:200,000 Da + 1wt% fragrance	6wt% esterquat + 1wt% fragrance
	comp A (inventive)	comp B (inventive)	comp C (comparative)	comp D (inventive)	comp E (inventive)	comp F (comparative)

Comp = composition

5 **Evaluation of care benefits**

Pretreatment phase:

Twenty terry towels are washed 3 times with 50 g ECE-2 powder laundry detergent from Testgewebe GmbH at 60 °C with the cotton program, Hydroplus option, 800 rpm in each Miele Novotronic W1614 washing machine to strip the fabrics. The washing machines are washed empty during two short cycles to remove any residual detergent.

Washing phase:

On each Miele Novotronic W1614 washing machine, twenty stripped terry towels are added, with 50 g ECE-2 powder laundry detergent from Testgewebe GmbH, directly on the drum, and the cotton program is run with Hydroplus option at 800 rpm. 50 g of composition A, B, C, D, E or F are added in the fabric softener compartment of the washing machine.

The wash temperature is tuned at 60 °C.

The terry towels are washed 5 consecutive times in different washing machines to remove the washing machine influence. Between each cycle, the washing machines are washed empty during two short cycles to remove any residual detergent.

Measurements of softening

The panelists are asked to rank three terry towels, based on the softness aspect, washed with three different compositions: Composition A, B and C and separately, composition D, E and F.

The softening benefits are assessed using the Friedman test described in ISO 8587 after one cycle and five cumulative washes. Composition A, B and C are ranked using Friedman test, after 1 cycle by 28 panelists and after 5 cycles by 29 panelists as described above. Composition D, E and F are ranked using Friedman test, after 1 cycle by 28 panelists and after 5 cycles by 29 panelists, as described above.

Rank 1 is the composition which provides the softest terry towels while rank 3 is the composition which provides the less soft terry towels.

NA means that there is no statistical difference to determine a rank.

Each terry towel is assessed by maximum 3 panelists as the softening feeling can change after several touching. Results are shown in Table 6.

Table 6.

	After cycle 1	After cycle 5
Rank composition A	NA	1
Rank composition B	NA	NA
Rank composition C	NA	NA

	After cycle 1	After cycle 5
Rank composition D	NA	1
Rank composition E	NA	2
Rank composition F	3	3

PEO: MW: 200,000 Da boosts the softening property when added on top of a fabric softener. There is no linear performance and as it appears that 1 wt % PEO: MW: 200,000 Da provide higher softening property than 2 wt% PEO:MW:200,000 Da. The 5th cycle presents stronger difference comparative to results with the first cycle.

Example 3:

PEO Molecular weight assessment: the approximate molecular weight are based on rheological measurements. PEO MW 600,000 Da: viscosity range in mPa.s (Cp) using a Brookfield viscometer model RVF, spindle N° 2 @ 2rpm in 5% aqueous solution @25°C= 4500-8800 Cp).

The fabric softening agent (esterquat) used in this example is methyl bis(ethyl (tallowate)) -2- hydroxyethyl ammonium methyl sulfate. The material is first stored at 50 °C so it is in melted form before use.

Under mechanical action using a Heidolph model RZR 2020 mechanical agitator with a four blades screw, the melted esterquat is added to a beaker containing deionized water at 50°C. When the solution is homogeneous, it is allowed to cool to room temperature.

When the solution is at RT, the PEOs are added in the concentration described in the Table 7.

Table 7

	% of the total composition			
Fabric softeners base	4wt% esterquat + 1wt% fragrance	4wt% esterquat + 0.4wt% PEO:MW:200,000 Da + 1wt% fragrance	4wt% esterquat + 0.4wt% PEO:MW:600,000 Da + 1wt% fragrance	8wt% esterquat + 1wt% fragrance
	composition a (comparative)	composition b (inventive)	composition c (inventive)	composition d (comparative)

5 Evaluation of care benefits

Pretreatment phase:

Twenty terry towels are washed 3 times with 50 g ECE-2 powder laundry detergent from Testgewebe GmbH at 60 °C with the cotton program, Hydroplus option, 800 rpm in each Miele Novotronic W1614 washing machine to strip the fabrics. The washing machines are washed empty during two short cycles to remove any residual detergent.

Washing phase:

To each washing machine are added the twenty stripped terry towels, with 50 g ECE-2 powder laundry detergent from Testgewebe GmbH, directly to the drum, and the cotton program run with Hydroplus option at 800 rpm. 50 g of composition a, b, c or d are added in the fabric softener compartment of the washing machine. The wash temperature is tuned at 60 °C.

The terry towels are washed 5 consecutive times in different washing machine to remove the washing machine influence. Between each cycle, the washing machines are washed empty during two short cycles to remove any residual detergent.

Measurements of softening

The panelists are asked to test the softness of terry towels washed with different compositions by pair, in order to obtain a softness comparison of each fabric softeners compositions.

The softening benefits are determined using the Pair comparison method ISO 5495, bilateral test after one cycle and five cumulative washes. Each terry towel is assessed by maximum 3 panelists as the softening feeling can change after several touching.

Panel test after 1 cycle

24 panelists participated in the test.

According to the ISO method, a difference between two answers needs to be minimum 18 to have a significant softening difference.

5 *Panel test after 5 cycles*

23 panelists participated in the test.

According to the ISO method, a difference between two answers needs to be minimum 17 to have a significant softening difference.

Results are shown in Table 8.

10 Table 8:

Towels treated with different fabric softeners	Answer (number of panelists who choose this formulation as softer)-CYCLE 1	Answer (number of panelists who choose this formulation as softer)-CYCLE 5
composition a	3	4
composition b	51	42
composition c	43	57
composition d	47	35

After the first cycle:

The panelists could not distinguish softening difference between 8 wt% esterquat and 4 wt% esterquat + 0.4 wt% PEO: MW: 200,000Da or 4 wt% esterquat + 0.4 wt% PEO: MW: 600,000 Da.

15

The 4 wt% esterquat formulation is the formulation evaluated to be the worst.

The Example shows that after the first cycle, the softening benefits can be maintained while decreasing the level of esterquat from 8 wt% to 4 wt% content if we add 0.4 wt% of PEO MW: 200,000 Da or 0.4 wt% PEO:MW:600,000Da.

20 Adding 0.4 wt% of PEO MW: 200,000 Da or 0.4 wt% of PEO MW:600,000 Da on top of a 4 wt% esterquat fabric softener significantly boosts the softening benefits.

After the 5th cycle:

The panelists chose the formulations 4 wt% esterquat + 0.4 wt% PEO: MW: 200,000 Da or 4 wt% esterquat + 0.4 wt% PEO: MW: 600,000 Da as the two softest, better
5 than the 8 wt% esterquat.

The 4 wt% esterquat formulation is clearly the formulation evaluated to be the worst.

The softening measurement described in this example shows that fabric washed with compositions of the invention provide equal or higher softening performance versus fabric
10 washed with composition d.

Example 4. Water absorption measurement

Background: The class of materials known as quaternary ammonium compounds, or esterquats, provides the softening feeling to the fabric, but they also make the fabric less absorbent. This can be an issue with terry towels, for instance because they can lose the
15 ability to absorb water from consumer body effectively.

In a fabric softener composition, the addition of the High MW PEO together with a lower dosage of the esterquat is a solution to limit this low water absorption issue, while keeping the same or even higher softening feeling.

20 Water absorption procedure:

Terry towels washed under the condition described in Example 3 are cut under the same dimension to have terry towel swatches.

The terry towels swatches are marked with a permanent pen at 1 cm from the bottom of the terry towel. One terry towel swatch is vertically suspended with a clamp on top of a
25 colored aqueous solution. The terry towel swatch is then dipped in the colored aqueous solution up to the mark. The system is left for 6 minutes.

After the 6 minutes, the terry towel swatch is raised and the maximum point reached by the colored aqueous is marked.

The distance between the bottom line and the maximum point is measured in cm.
30 Three replicates are run for each fabric softening formulations. The softener compositions are the same as described in Example 3.

Results are shown in Table 9.

Table 9:

Fabric softener composition	Water absorption in cm - Average of 3 measures	Standard deviation
Composition d	1.3	0.15
water	2.5	0.05
Composition b	2.3	0.11
Composition c	2.4	0.11
Composition a	2.4	0.11

Conclusion:

The compositions b and c , with 4 wt% esterquat + 0.4 wt% PEO: MW: 200,000 Da
 5 or 4 wt% esterquat + 0.4 wt% PEO: MW: 600,000 Da have similar water absorption profile
 than towel washed with no fabric softener and higher and better water absorption than the
 composition d containing 8 wt% esterquat.

The softening measurement described in this example shows that fabric washed with
 compositions of the invention provide equal or higher softening performance versus fabric
 10 washed with composition d while maintaining a water absorption similar to fabric washed
 with no fabric softening agent.

WHAT IS CLAIMED IS:

1. A fabric softener composition comprising:
 - a poly(ethylene oxide) polymer with a molecular weight of at least 80,000 Da;
 - a fabric softening agent that is a cationic compound;
 - a solvent; and
 - a fragrance.
2. The fabric softener composition of claim 1 wherein the poly(ethylene oxide) polymer has a molecular weight of at least 90,000 Da and up to 4,250,000 Da.
3. The fabric softener composition of any one of claims 1-2 wherein the solvent comprises water.
4. The fabric softener composition of any one of claims 1-3 further comprising one or more of: of an emulsion stabilizer, a preservative, a sequestrant, a bulking agent, an anti-foaming agent, a skin or fiber conditioning agent, a pH adjuster, a colorant, or an opacifier.
5. The fabric softener composition of any one of claims 1-4 comprising from 0.01 to 3 weight percent of the poly(ethylene oxide) polymer, from 0.5 to 15 weight percent of the fabric softening agent, from 0.1 to 3 weight percent of the fragrance, from 0 to 5 weight percent of optional ingredients, and balance solvent, each based on the total weight of the composition.
6. The fabric softener composition of any one of claims 1-5 wherein the composition comprises up to 8 weight percent of the fabric softening agent based on the total weight of the composition.
7. The fabric softener composition of claim 1 wherein the weight ratio of poly(ethylene oxide) to fabric softening agent is from 1:1 to 1:10.
8. A method of treating a fabric, the method comprising: contacting the fabric with the fabric softener composition of any one of claims 1-7.

9. The method of claim 8 wherein the treating of the fabric provides one or more of softening, fragrance retention, and water absorption characteristics to the fabric.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/036307

A. CLASSIFICATION OF SUBJECT MATTER

INV. C11D1/62 C11D3/00 C11D3/37 C11D3/50
ADD.

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)

C11D

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 551 778 A1 (CAUBET FILS SARL ETS A [FR]) 15 March 1985 (1985-03-15) the whole document	1-9
Y	----- EP 0 839 899 A1 (PROCTER & GAMBLE [US]) 6 May 1998 (1998-05-06) page 6, lines 50-57; claims; examples -----	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

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

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"O" document referring to an oral disclosure, use, exhibition or other means

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

"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

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

31 August 2016

Date of mailing of the international search report

08/09/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Pfannenstein, Heide

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/036307

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