SILSOFT* AX conditioning agent

SPECIALTY FLUIDS - PERSONAL CARE

Silsoft AX conditioning agent, an alkyl modified amino fluid, can help consumers achieve superior smoothness and shine for dry hair. The combination of both pendant amino and terminal alkyl groups on the silicone structure help provide enhanced smoothness, softness and manageability.

Key Features and Typical Benefits

- outstanding smoothness
  - – not sticky or greasy
- shine without greasiness
- superior conditioning and manageability
  - – excellent for straight, sleek look
- color retention

Potential Applications

Hair Care

- products to smooth hair:
  - – leave-on conditioners
  - – shampoos
  - – rinse-off conditioners
  - – serum
- shine spray
- ethnic hair care
- products for color protection

Other

- body wash
- liquid hand soap
- bar soap

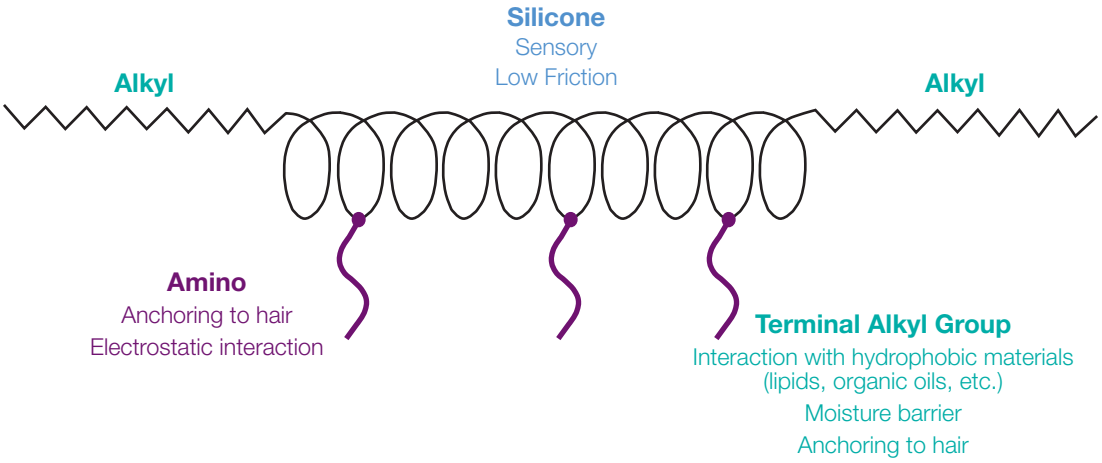
Typical Physical Properties[1]	
Appearance	Translucent, pale yellow
Active Content, %	100
Viscosity, mPa•s	5,000 - 20,000
Amino Content Nwt %	0.1 - 0.3

(1) Typical data are average data. The actual data may vary.
Product specifications for specific applications need to be agreed upon individually.

INCI Designation: *Bis-Cetearyl Amodimethicone*

Chemistry

Silsoft AX conditioning agent is an alkyl modified amino silicone fluid.



The combination of both pendant amino and terminal alkyl groups on the silicone structure help provide enhanced smoothness, softness and manageability.

Performance Data

Evaluations were conducted on undamaged and damaged hair.

Preparation of Damaged Hair: Undamaged hair was immersed twice in a 6% hydrogen peroxide solution at pH 9.5 (pH adjusted with ammonia) for 2 hours each time, followed by washing and drying.

Products Tested	Modification	Viscosity	% Active
Silsoft AX conditioning agent	Alkyl and amino	5,000-20,000 mPas	100%
XF42-B1989	Low vis. high amino	600-1,400 mPas	100%
Silicone Wax A(1)	C18 Alkyl dimethicone	(Softening point: 40°C)	100%
SME 253 silicone	High amino	1250-2500 mPas	20%(2)

(1) Silicone Wax A: MD500DR500M where M = $(CH_3)_3Si$-O1/2, D = $(CH_3)_2Si$-O-, DR = (CH_3) $(C_{18}H_{37})Si$-O-
(2) Micro-emulsion in water

Performance Data (continued)

1. Controlled Deposition

Dry Combing

Test Method

(1) Prepared D_5 solution containing 0.5 wt% of tested product. Use Isoparaffin for Silicone Wax A

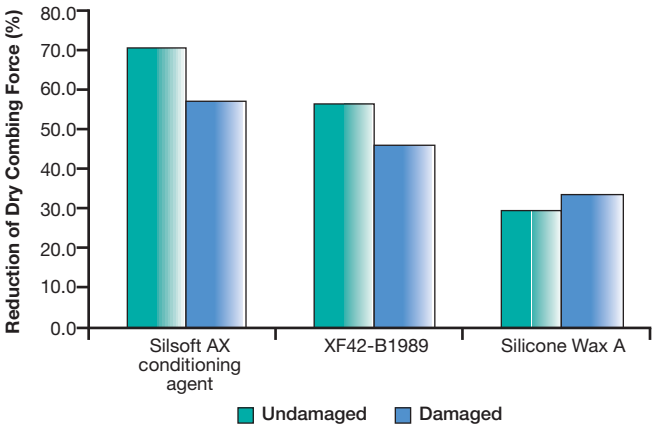
(2) Washed damaged hair tresses with non-silicone shampoo and dry

(3) Uniformly treated the 9 gram-hair tress with 1.5 gram of solution and dry†

† Control: Damaged hair treated with D_5

(4) Measured dry combing force of hair tress with combing tester

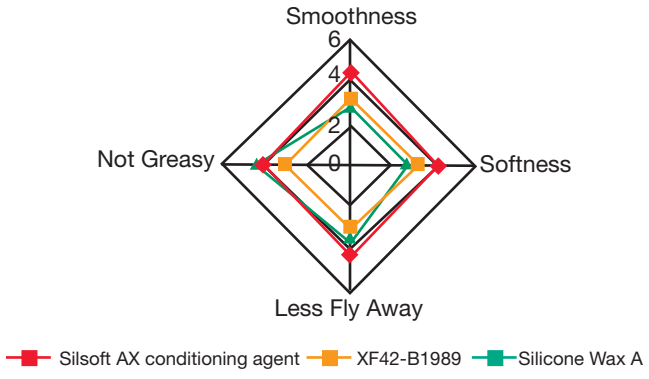
Dry Combing Results



Sensory

Panelists evaluated the sensory of each hair tress. The 3.0 sensory score of XF42-B1989 was fixed as the standard; the other products are scored accordingly.

Sensory Results



Silsoft AX conditioning agent provided excellent hair manageability, softness and smoothness, without greasiness.

Sensory at 2 Dosage Levels

Test Method

(1) Prepared D_5 solutions containing 0.5 wt% and 1.0 wt% of tested product. Used Isoparaffin for Silicone Wax A

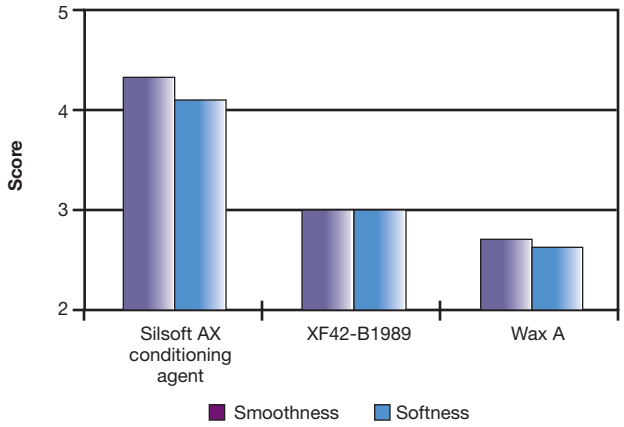
(2) Washed hair tress with non-silicone shampoo and dry

(3) Uniformly treated the 9 gram-hair tress with 1.5 gram of solution and dry

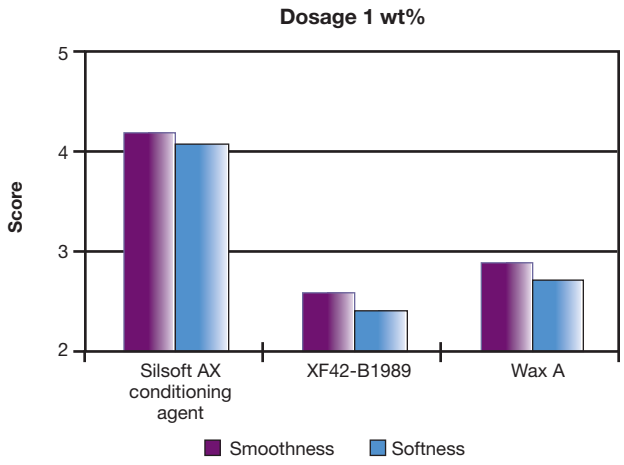
(4) Evaluated sensory of each hair tress

Dosage Results

Dosage 0.5 wt%



Dosage 1 wt%



As a specialty product, Silsoft AX conditioning agent provided superior smoothness and softness. Comparatively, the aminosilicones resulted in a greasier, heavier sensory when dosage was increased.

Note: Test data. Actual results may vary.

*Silsoft is a trademark of Momentive Performance Materials Inc.

Performance Data (continued)

1. Rinse-Off Conditioner

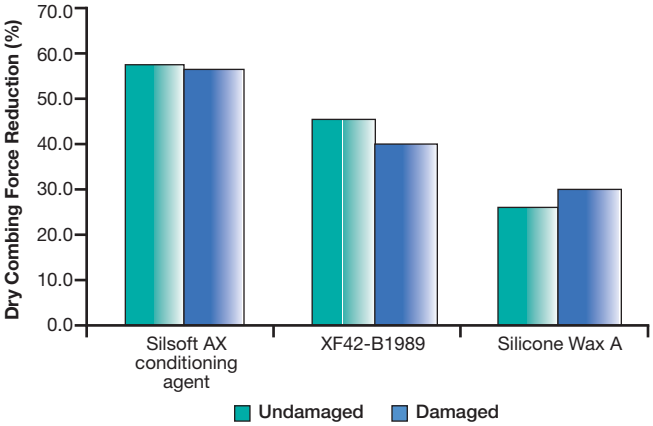
Dry Combing

Test Method

(1) Dry combing Techno Hashimoto combing tester. Measurement was an average of 10 comb passes.

Ingredient	Wt/wt%
Steartrimonium (28% active)	7.1
Stearyl Alcohol	4
Silicone	2
Water	qsp. 100

Dry Combing Results

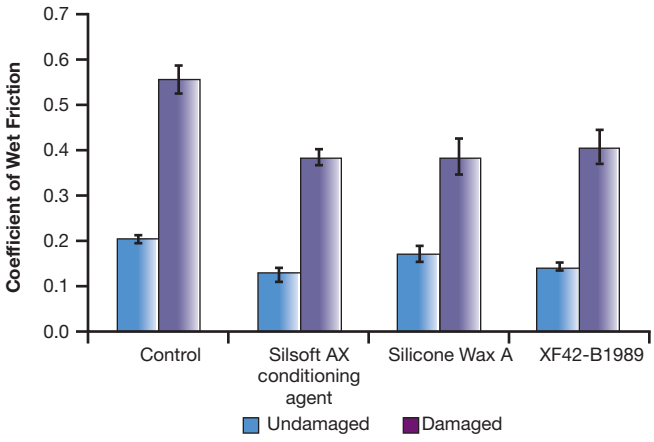


Wet Friction

Test Method

1) After application of conditioner and rinsing (standard protocol) excess water was squeezed between 2 fingers
2) Tresses mounted flat on the friction apparatus (TMI)
3) Normal load was 200g. Data are an average of 6 measurements (tress duplicate with 3 slider passes)

Wet Friction Results



Silsoft AX conditioning agent, when used in a rinse-off conditioner, significantly improved wet and dry combing of undamaged and damaged hair.

Control: Conditioner without silicone

Note: Test data. Actual results may vary.

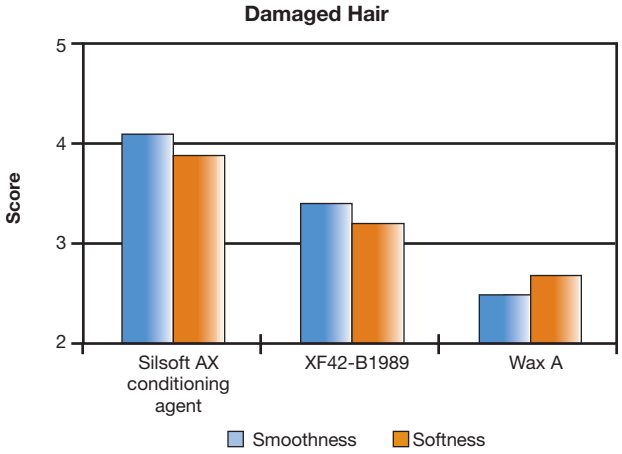
Sensory

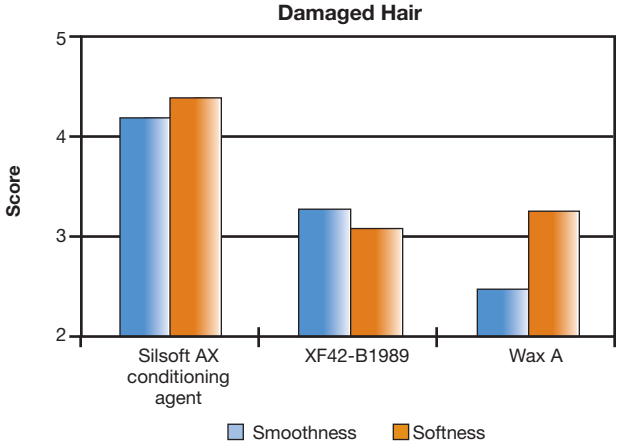
Test Method

1) Prepared conditioner containing 2% active silicone
2) Uniformly applied 2g of conditioner after immersing 10g (30cm length) into 40°C bath
3) Rinsed hair tress in 40°C warm bath for 10 seconds. Repeated 3 times
4) Dried the hair tress
5) Evaluated sensory of each hair tress

Ingredient	Wt/wt%
Silsoft AX conditioning agent	2
Mineral Oil	1
Cetearyl Alcohol	1
Stearyl Alcohol	1
Streartrimonium Chloride, 28%	2
Glycerin	3
Preservative	Per manufacturer's label
Water	q.s.

Sensory Results





Silsoft AX conditioning agent significantly improved smoothness and softness of undamaged and damaged hair.

Performance Data (continued)

3. Comparison to Silicone Quat on Undamaged Hair

Sensory

Test Procedure

Conditioner:	2% active silicone
Hair Tresses:	Undamaged hair, 10gram, 20cm length
Sensory:	5 trained panelists

Silsoft Q quat silicone **Silsoft AX conditioning agent**

Silsoft AX conditioning agent delivered sleekness. Silsoft Q quat silicone provided volume without flyaway.

4. Comparison to Silicone Quat on Damaged Hair

Sensory

Test Procedure

Conditioner:	2% active silicone
Hair Tresses:	Undamaged hair, 10gram, 20cm length
Sensory:	5 trained panelists

Silsoft Q quat silicone **Silsoft AX conditioning agent**

Silsoft AX conditioning agent delivered sleekness. Silsoft Q quat silicone provided volume without flyaway.

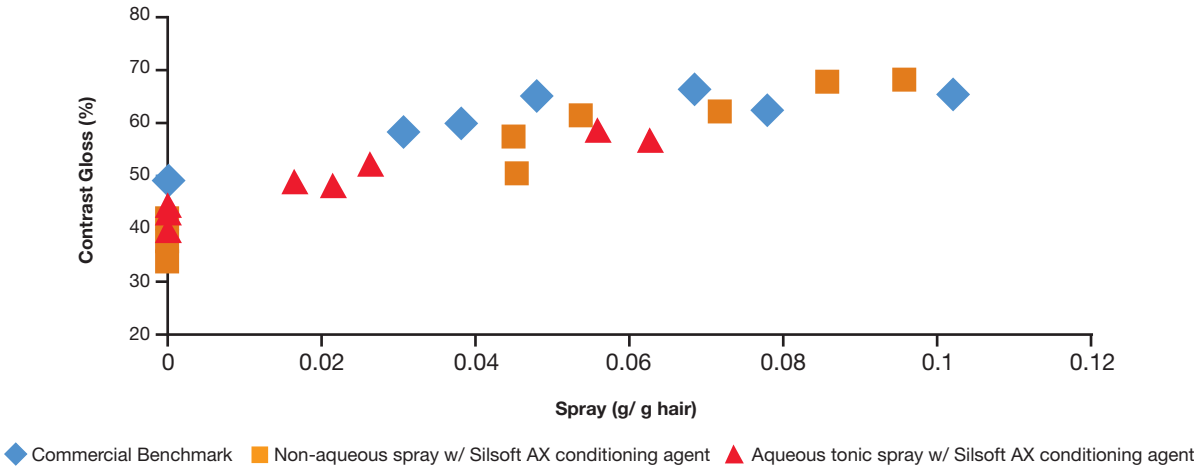
Note: Test results. Actual results may vary.

Performance Data (continued)

5. Shine Spray: Comparison to Silicone Benchmark

Test Procedure

1) Single bleached hair was sprayed and spray amount recorded by weight
2) Tresses blow dried
3) Measurement of diffuse reflectance used Murakami Spectrogoniophotometer
4) Gloss Contrast = (S-D)*100/S with S specular reflectance (max value) and D diffusive reflectance at 0° viewing angle



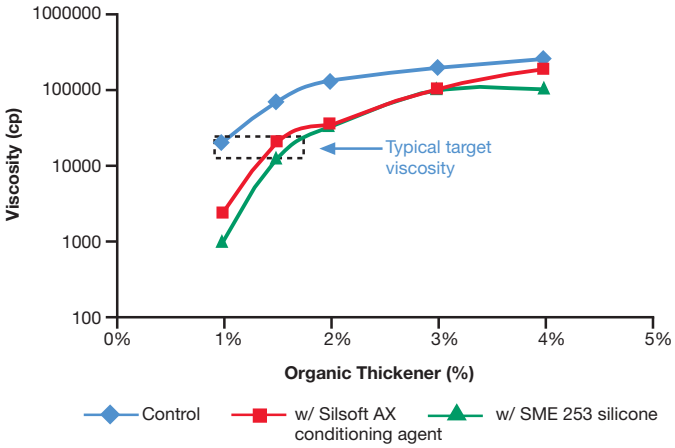
Shine level obtained with Silsoft AX conditioning agent was comparable to shine level of commercial benchmark at similar dose. In addition to comparable shine, the Silsoft AX conditioning agent tress has a better, non-greasy look and combed smoothly. Silsoft AX conditioning agent can be delivered from non-aqueous and aqueous sprays.

Note: Test results. Actual results may vary.

Performance Data (continued)

6. Clear Shampoo

Structure



Organic thickener: PEG-150 polyglyceryl-2 tristearate and laureth-3 and dipropylene glycol.

Typically, with a pre-emulsion of Silsoft AX conditioning agent, a clear stable shampoo can be obtained, and the viscosity can be adjusted using organic thickener (~1.5%). Generally, to achieve the same viscosity, less thickener is required with Silsoft AX conditioning agent than with SME 253 silicone.

Deposition

	Deposition (ppm) Results	
	Undamaged	**Damaged**
Control	0	0
Silsoft AX conditioning agent	20	43
SME 253 silicone	23	40

Deposition efficiency (without use of organic deposition aid polymer) was similar to the deposition of Silsoft SME 253 silicone.

Note: Test results. Actual results may vary.

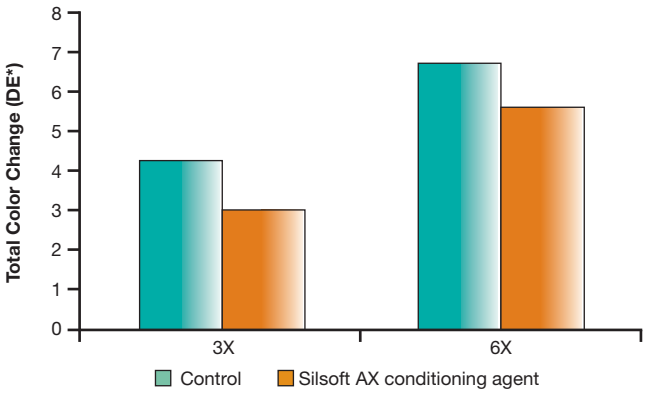
Color Retention

Test Method

1) 6 g single bleached tresses dyed with well-known commercial red hair dye; contact time 30 min
2) Tresses rinsed, shampooed with the test shampoo (standard protocol), blow dried
3) L*, A*, b* measured with a spectrogoniophotometer (baseline value)
4) Tresses washed 3 times with test shampoo, color measured
5) Tresses washed 3 more times with test shampoo, color measured
6) Control was the SLES/CAPB shampoo without silicone
7) Each result was an average of 2 tresses

1% silicone in Shampoo Formulation 2

Color Retention Results



About 20% improvement of color retention from the shampoo base.

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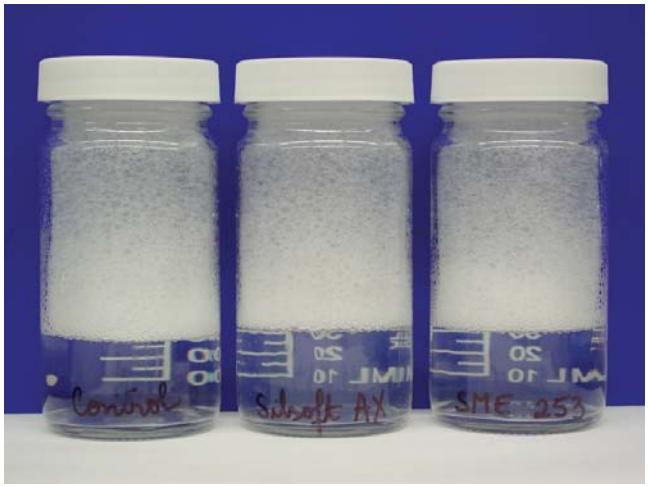
Performance Data (continued)

7. Lather

Automated Shake Text



Control | **Silsoft AX conditioning agent** | **SME 253 silicone**

Control | **Silsoft AX conditioning agent**

Automated shake test with hair tress (10 g diluted shampoo (1% solution) for 4 g tress).

No significant impact on shampoo lather.

Note: Test results. Actual results may vary.

Performance Data (continued)

5. Sample Formulas

Pre-emulsion for Both Formulas

Procedure

1. Charge Silsoft AX conditioning agent and Tergitol® TMN-6 to flask. Mix with high shear blade at 800 rpm while heating mixture to 65ºC. Mix until materials are incorporated and homogeneous.
2. Add initial water slowly while continuing to mix with high shear and maintaining 65ºC temperature. Increase shear speed as necessary as viscosity of the mixture increases.
3. Add acetic acid slowly while continuing to mix with high shear. Continue to shear for 10 minutes while maintaining 65ºC temperature.
4. Add let down water at once while mixing with high shear and remove from heat. Continue to shear for 30 minutes.

Ingredients	Wt%
Silsoft AX conditioning agent	20
Tergitol™ TMN 6	12
Initial Water	10
Let Down Water	58
Acetic Acid	To adjust to pH 5

Shampoo Formula 1

Procedure

1. Acidify water to pH 5 with the citric acid
2. Add Guar to acidified water under good agitation (1300 rpm)
3. Add the Cocamidopropyl Betaine with moderate agitation (800 rpm)
4. Add Sodium Laureth Sulfate with moderate agitation (800 rpm)
5. Add the NaCl with moderate agitation (800 rpm)
6. Lower agitation to 500 rpms
7. Add emulsion of Silsoft AX conditioning agent
8. Adjust pH to 5 with additional citric acid if needed

For best results, pre-emulsify Silsoft AX conditioning agent before adding to the formulation.

Ingredients	Wt/wt%
Sodium Laureth Sulfate 2EO (25% actives)	56
Cocamidopropyl Betaine (35% actives)	5.7
NaCl	1.5
Guar Hydroxypropyltrimonium Chloride	0.3
Silsoft AX conditioning agent (20% actives emulsion)	25
D.I. Water	11.5
Citric Acid	To adjust to pH 5

Shampoo Formula 2

Viscosity ~ 10000 cp

Ingredients	Wt/wt%
Sodium Laurylether Sulfate 2EO	9
Cocamidopropyl Betaine	3
PEG-150 polyglyceryl-2 tristearate and laureth-3 and dipropylene glycol	1.5
Silicone pre-emulsion (20%)	5
Water	qsp. 100

Performance Data (continued)

5. Sample Formulas (continued)

Cationic Conditioner

Procedure

1. Heat water to 70°C and add Behenamidopropyl dimethylamine while agitating at 600 rpm. Mix until melted and homogeneous.
2. Add the lactic acid while continuing to agitate.
3. Add the cetearyl alcohol, and mix until melted and homogeneous. Continue to mix for 30 minutes at 70°C.
4. Cool mixture, 10°C every 30 minutes. Increase agitation slowly as viscosity increases until temperature reaches 40°C.
5. Add Silsoft AX emulsion and mix at 1000 rpm until homogeneous. Continue to agitate until temperature reaches ambient.

Ingredients	Wt/wt%
Behanamidopropyl Dimethylamine	1.7
Cetearyl Alcohol	3.3
Lactic Acid	0.5
Silsoft AX conditioning agent (20% actives emulsion)	**7.1**
Water	q.s. 100

Non-aqueous Hair Shine Spray

~ 6% non-volatile

Ingredients	Wt/wt%
Silsoft AX conditioning agent	4.5
Light Mineral Oil	1.5
Cyclopentasiloxane	94

Non-aqueous Commercial Hair Shine Spray

Benchmark

~ 7.4% non-volatile

Ingredients: alcohol denat., cyclopentasiloxane, bis-phenylpropyl dimethicone, dimethicone, C12-15 alkyl benzoate, benzophenone-3, fragrance.

Non-Ionic Conditioner

Procedure

1. Heat water to 70°C.
2. Add wax component while agitating at 400 rpm. Mix until homogeneous.
3. Cool to 40°C while mixing.
4. Add emulsion of Silsoft AX conditioning agent.
5. Increase agitation to 600 rpms and cool to room temperature.

Ingredients	Wt/wt%
Glyceryl stearate (and) ceteareth-20 (and) ceteareth-12 and cetearyl alcohol and cetyl palmitate	10
Silsoft AX conditioning agent (20% actives emulsion)	7
Water	q.s. 100

Patent Status

Technical subject matter in this publication is described and protected by one or more pending US patent applications and foreign counterparts.

Product Safety, Handling and Storage

Customers considering the use of this product should review the latest Material Safety Data Sheet and label for product safety information, handling instructions, personal protective equipment if necessary, and any special storage conditions required. Material Safety Data Sheets are available at www.momentive.com or, upon request, from any Momentive Performance Materials representative. Use of other materials in conjunction with Momentive Performance Materials products may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

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