

Revitalising hair beauty with aminosilicones

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In today's competitive personal care market, consumers are demanding more when it comes to hair care products. Consumers value strong, shiny and full-bodied hair as healthy hair.¹

To meet these requirements, the hair care industry develops innovative products with protection and moisturisation claims, which have become important functionality claims in many hair care products, ranging from shampoo to conditioning and styling.

Importance of hair protection & moisturisation

Hair become brittle and dull as moisture is lost through daily washing and styling, permanent or temporarily dyed, stress, inadequate diet and hormonal changes.² Other factors like heat from grooming tools make hair prone to damage easily.²

Thus, hair care products that help strengthen and protect hair from environmental factors, colour loss and heat are always in demand.

Hair moisturisation is also one of the most popular claims in hair care products nowadays. The definition of hair moisturisation is different from skin moisturisation. Hair moisturisation is expressed by hair that is easy to comb when wet as well as dry, has healthy-looking shine, and fibres that align more easily to provide a sleek look.

Silicone does not provide moisturisation to hair but when silicone is added to a leave-on or rinse-off hair products, it gives the slippery texture that makes hair feel it is being moisturised.

Specialty silicone as multifunctional ingredient

Specialty silicones are a recognized performer to create premium hair care products that help

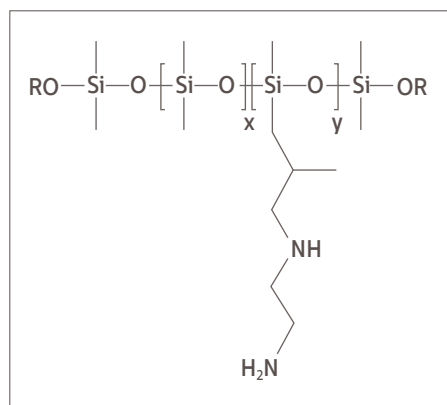


Figure 1: Molecular structure of Bis-Hydroxy/Methoxy Amodimethicone



strengthen and protect hair from environment factors, colour fading and heat. In addition, they can offer a package with combination of moisturisation and repair to restore smoothness, shine and manageability.

The multifunctional efficacy of specialty silicone is illustrated based on an amino functional silicone. A 100% silicone active, it is specially designed to use in conditioning shampoo, rinse-off or leave-on conditioner as well as styling products.³

Bis-Hydroxy/Methoxy Amodimethicone

The nature of the primary amine groups enables Bis-Hydroxy/Methoxy Amodimethicone (Figure 1) to develop a positive charge in an aqueous system.⁴ This cationic polymer readily coats the negatively charged surface of hair, providing excellent conditioning properties, softening and long-lasting effect.

It has a lower amine content but a higher molecular weight than standard amino oils. Recommended use levels are 0.25% to 3.0% for shampoo, rinse-off and leave-on conditioner and styling products.³

Maintaining colour vibrancy

The use of a hair dye to colour the hair has been common practice over the last few decades. Although the primary use of the permanent hair dye is to improve hair colour, it is also used to cover up grey hair for both men and women.²

These permanent hair dyes, also referred to as oxidative dyes, are peroxide based alkalis

agents that swell the hair fibre, enabling the dye precursors and a catalyst to reach the cortex. It is observed that hair treated with a red dye are prone to fading after UV exposure and shampooing.

Thus, consumers always seek products for their normal care routine that can help to maintain the colour of hair.

The hair colour retention test was conducted on virgin blond Caucasian hair tresses. The tresses were treated with a commercial red colour dye. The tresses were then washed with shampoo followed by a rinse off conditioner. The tresses were washed and conditioned in 15 cycles.

Hair tress A is an untreated swatch, directly after dyeing; hair tress B was treated 15 times with control shampoo and conditioner without Bis-Hydroxy/Methoxy Amodimethicone and hair tress C was treated 15 times with shampoo (Formula 1) and conditioner (Formula 2) using Bis-Hydroxy/Methoxy Amodimethicone.

The results in Figure 2 demonstrate a clear improvement in colour fading on hair tresses treated with Bis-Hydroxy/Methoxy Amodimethicone after 15 cycles of washing. Amodimethicone maintains colour vibrancy by forming a hydrophobic surface on hair.

Reduced combing force

Hair will experience greater damage especially if an appropriate hair care routine is not made. Hair combing is one of the most basic grooming done daily, thus it is important to assess if hair care products used can facilitate the combing experience, avoiding hair breakage.

In the combing studies, if excessive force was applied, it explained that the comb encountered either more tangles or stronger tangles, thus the hair was not easier to comb. Experiments were conducted in both dry and wet conditions to determine if hair tresses treated with Bis-Hydroxy/Methoxy Amodimethicone would play a crucial role.

Wet & Dry Combing

Hair tresses were double bleached following our in-house bleaching protocol and pre-cleaning. The hair tresses were assembled flat and one millilitre of 10% SLES was applied to each tress and gently lathered for one minute. The hair tress was then rinsed for 30 seconds under flowing tap water with a controlled flow rate of four litres per minute.

Hair tresses were dipped three times into a

large beaker of tap water and excess water was removed. The hair tress was placed in MTT175 tensile tester (Dia-Stron). The hair tress was always applied in the same comb area and comb through.

A 'wet control' measurement of wet combing force was taken. The hair tress was dried with a hair dryer and hand combed from top to bottom. It was then placed back in the tensile tester and a 'dry control' measurement of dry combing force was taken.

Then, one millilitre of shampoo (Formula 1) was applied to a hair tress and massaged for one minute. The hair tress was rinsed for 30 seconds under flowing tap water with a controlled flow rate. One millilitre of a rinse-off conditioner (Formula 2) was applied to the same hair tress, massaged for one minute and rinsed for 30 seconds.

The hair tress was dipped three times into a large beaker of tap water and excess water was removed. The hair tress was placed in MTT175 tensile tester (Dia-Stron). The hair tress was always applied in the same comb area and comb through.

A measurement of combing force of a wet treated hair tress was taken. The hair tress was dried with a hair dryer and hand combed from top to bottom. It was then placed back in the tensile tester and a measurement of dry treated combing force was taken. All steps were repeated with the other nine hair tresses.

These studies show a significant conditioning performance benefits of Bis-Hydroxy/Methoxy Amodimethicone based on ease of combing in wet (combing force reduction of 84.6%) and dry conditions (combing force reduction of 77.4%). Efficient conditioning effect from Bis-Hydroxy/Methoxy Amodimethicone reduces combing forces and help to reduce hair breakage over time.

Improved hair smoothness

Bis-Hydroxy/Methoxy Amodimethicone has played a major role in a product development partly due to its excellent conditioning properties but also because it provides hair smoothness and softness.

The results in Figure 4 indicate that hair tress treated with shampoo (Formula 1) and conditioner (Formula 2) formulated with

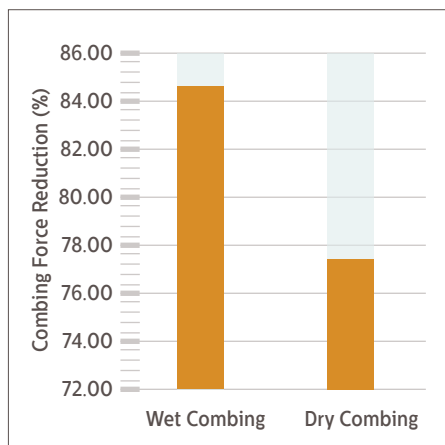


Figure 3: Dia-stron combing data (2.5% of BRB SF 242 in shampoo and conditioner vs shampoo without silicone)

A	Colour reference (no washing)
B	Control (no silicone)
C	BRB SF 242 (2.5% Si active)



Figure 2: Colour protection with Bis-Hydroxy/Methoxy Amodimethicone

Bis-Hydroxy/Methoxy Amodimethicone have improved smoothness compared to control during the wet combing test.

Improved hair manageability

Today, consumers have expectations on hair care products that stretch beyond merely hair cleaning. There is a notable manageability concern regarding fizziness, especially for curly hair when exposed to high temperature and high humidity environments.²

In these studies, ring method technique was used to measure the force required to pull tresses of hair through varying sizes of ring fittings on Dia-Stron tensile tester. This test required to create volume of hair tress by placing it in Burrell wrist action flask shaker at the maximum setting. A Dia-Stron was then used to measure force required for hair tresses to pass through various sizes of ring fittings.

The results in Figure 5 show that less force was required on treated hair tresses with Formula 1 and Formula 2 compared to control.



Figure 4: Hair smoothness

FORMULATION 1: SHAMPOO

No	Ingredients	Dosage (%)
1	Aqua	q.s. to 100
2	Tetrasodium EDTA	0.10
3	Acrylates Copolymer	3.00
4	Sodium Laureth Sulfate 70%	15.00
5	Triethanolamine	q.s.
6	Cocamidopropyl Betaine	10.00
7	Cocamide DEA	2.00
8	BRB SF 242 (Bis-Hydroxy/Methoxy Amodimethicone)	2.50
9	Sodium Laureth Sulfate (and) Glycol Distearate (and) Cocamide MEA	1.50
10	Preservative	q.s.

FORMULATION 2: CONDITIONER

No	Ingredients	Dosage (%)
1	Aqua	q.s. to 100
2	Glycerin	2.00
3	Cetearyl Alcohol (and) Ceteareth-20	7.00
4	BRB SF 242 (Bis-Hydroxy/Methoxy Amodimethicone)	2.50
5	Preservative	q.s.

Improved hair shininess

Dull hair tends to lack in moisture, shine and body. It can be due to many factors, like overusing harsh chemicals or techniques, hormonal imbalance, overexposure to sun and aging. The demand for products that enhance hair shine and lustre has grown dramatically in recent years.

In these studies, double bleached virgin hair tresses were used. Hair tresses were washed with 10% SLES solution under the controlled temperature, time, and flow rate of water. The hair tresses were dried followed by an application of ten drops of Bis-Hydroxy/Methoxy Amodimethicone solution with a pipette.

The solution was massaged into hair for ten seconds and left for one minute. The hair tresses were examined with Lenovo microscope under magnification of 40X.

The results in Figure 6 clearly indicate that hair tresses treated with Bis-Hydroxy/Methoxy Amodimethicone provide notably higher gloss levels. The shine of the hair is much improved demonstrating healthy-looking hair, a common claim of many hair care products.

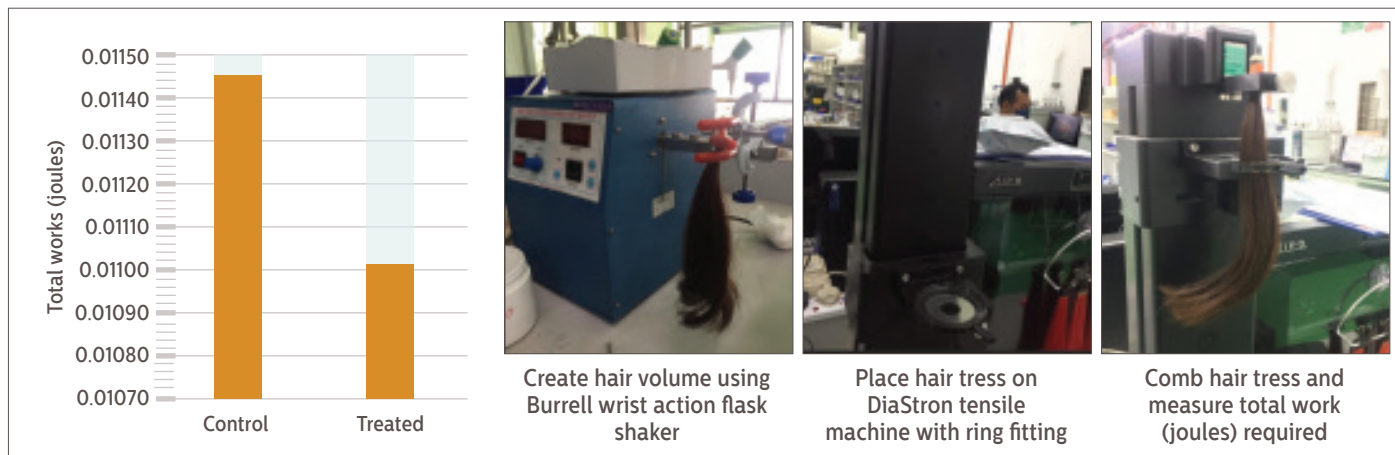


Figure 5: Hair manageability

Application

Bis-Hydroxy/Methoxy Amodimethicone has a lower amine content but a higher molecular weight than standard amino oils. It is a 100% silicones active, pourable liquid and therefore is easy to incorporate into hair care formulations.

It is recommended to be used at levels 0.25% to 3.0% for shampoo (Formula 3), rinse-off conditioner (Formula 4) and leave-on conditioner (Formula 5) and styling products (Formula 6).

Conclusion

The hair care market has been badly affected by the COVID-19 crisis as there have been widespread closures of retail and salon store. Following said closures, consumers in the global marketplace have adopted one of the notable trends such as do-it-yourself beauty care. Due to this, consumers are demanding the high-performance hair care products that can achieve similar result as in a hair salon. Functionally, aminosilicone is specially



Figure 6: Hair shininess

developed in response to meet this demand to provide multi benefits in conditioning, colour protection, hair shininess, hair manageability and hair smoothness. **PC**

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FORMULATION 3: DEEP MOISTURISING SHAMPOO

No	Ingredients	Dosage (%)
A1	Aqua	57.60
A2	Disodium EDTA	0.10
A3	Guar Hydroxypropyltrimonium Chloride	0.20
A4	Hydroxypropyl Methylcellulose	0.20
A5	Citric Acid	0.10
B1	Cocoamidopropyl Betaine	4.00
B2	Sodium Laureth Sulfate	17.00
B3	Lauryl Glucoside	2.00
B4	Cocamide MEA	1.00
C1	Glycol Stearate (and) Stearamide AMP	1.50
C2	Cetyl Alcohol	0.50
C3	Laureth-4	1.00
C4	Bis-Hydroxy/Methoxy Amodimethicone	2.00
D1	Aqua	10.00
D2	Carbomer	0.20
E1	Preservative	q.s.
E2	Hydroxypropylgluconamide (and) Hydroxypropylammonium Gluconate	2.00
E3	Parfume	0.50
F1	PEG-150 Pentaerythrityl Tetrastearate (and) PPG-2 Hydroxyethyl Cocamide (and) Aqua	q.s.
F2	Sodium Chloride	q.s.

Procedure: Add A4 into water and the material is thoroughly wetted during 15-20 minutes. Mixed during 15 min and homogenised well. Add A2 into water and heat to 80 °C. Add A3 into the bulk and neutralized with citric acid. Add phase B one by one at 80 °C. Prepared phase D and add into the bulk at 60 °C. Prepared phase E and add into the bulk at room temperature. Adjust viscosity with phase F.

FORMULATION 4: DEEP CONDITIONING HAIR MASK

No	Ingredients	Dosage (%)
A1	Aqua	71.60
A2	Disodium EDTA	0.10
A3	Guar Hydroxypropyltrimonium Chloride	0.20
A4	Malic Acid	0.30
A5	Behentrimonium Chloride	4.00
B1	Cetearyl Alcohol	8.00
B2	Cetyl Esters	3.00
B3	Macadamia Ternifolia Seed Oil	2.00
B4	Phenyl Trimethicone	1.00
B5	Bis-Hydroxy/Methoxy Amodimethicone	2.00
B6	Candelilla Cera	0.20
C1	Glycerine	3.00
C2	Hydroxyethylcellulose	0.50
D1	Acrylamidopropyltrimonium Chloride/ Acrylamide Copolymer	1.00
D2	Polyquaternium-37 (and) PPG-1 Trideceth-6 (and) Glycol Dicaprylate/Dicaprate	0.10
D3	Hydroxypropylgluconamide (and) Hydroxypropylammonium Gluconate	2.00
D4	Preservative	q.s.
D5	Panthenol	0.50

Procedure: Add A2 into water and dissolve well. Add A3 into step 1, mix well and neutralize with malic acid. Heat to 83 °C. Then add A5 into bulk. Mix well. Prepared phase B and heat to 80 °C. Add phase B into phase A and homogenised well. Premix phase C and add into bulk. Prepared phase D and add into the bulk.

FORMULATION 5: HEAT PROTECTIVE HAIR OIL

No	Ingredients	Dosage (%)
A1	Macadamia Ternifolia Seed Oil	2.00
A2	Dimethicone	71.00
A3	Bis-Hydroxy/Methoxy Amodimethicone	2.00
A4	Phenyl Trimethicone	2.00
A5	Dimethicone (and) Dimethiconol	20.00
A6	Argania Spinosa Kernel Oil	1.00
A7	Jojoba Esters	1.00
A8	Parfum	1.00

Procedure: Add phase A one by one into bulk. Mix well after each addition.

FORMULATION 6: HAIR SHINE POMADE

No	Ingredients	Dosage (%)
A1	Ceteareth-25	25.00
A2	PEG-40 Hydrogenated Castor Oil	5.00
A3	Bis-Hydroxy/Methoxy Amodimethicone	2.00
A4	Phenyl Trimethicone	2.00
A5	Isopropyl Myristate	3.00
B1	Aqua	54.70
B2	Disodium EDTA	0.10
B3	Glycerine	5.00
B4	Propylene Glycol	2.00
C1	Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate	0.50
C2	Parfume	0.50
C3	Dye (0.1% solution)	0.20

Procedure: Prepared phase A one by one into bulk to heat to 85 °C. Prepared phase B one by one into bulk and heat to 85 °C. Add phase A into phase B. Add phase C at 60 °C. Pour into mould while hot.