Voluminis

Ethyltrimonium Chloride Methacrylate/ Hydrolyzed Wheat Protein Copolymer

Turn up the Volume!
Presenting a solution to flat, limp hair. Voluminis is a hair volumizing active that delivers exceptional volume from rinse-off conditioners.

Voluminis is a novel and optimized copolymer of hydrolyzed wheat protein and a cationic monomer. The parent hydrolyzed protein is functional in its own right providing substantivity and moisturization both on the surface but primarily inside the hair cortex. By combining the properties of the hydrolyzed protein with a cationic polymer through controlled copolymerization, we have developed a highly functional cationic derivative that provides hair volumization from rinse-off systems through a combination of substantivity without build-up, film formation, controlled charge repulsion and reduction in fiber-fiber cohesion.

<table>
<thead>
<tr>
<th>Product</th>
<th>INCI name</th>
<th>Preservative system</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluminis</td>
<td>Ethyltrimonium chloride methacrylate/ Hydrolyzed wheat protein copolymer</td>
<td>Phenoxyethanol and potassium sorbate</td>
<td>Clear yellow liquid</td>
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</tbody>
</table>

**Features / Benefits**
- Hair volumizing active
- Hair looks and feels fuller
- Effective from rinse-off conditioners
- Lasting results
- Salon tested
- No build-up
- No frizz

**Applications**
- Rinse-off conditioners
- Leave-in conditioners
- Serums
- Spritzes

**Claim Substantiation Studies**
The performance benefits of Voluminis have been evaluated using a series of laboratory and sensory tests, including a novel mannequin head method and an independent salon study.

- Tress Evaluations page 3
- Mannequin Head Study page 5
- Lasting Volume Mannequin Head Study page 7
- In-House Salon Study page 9
- Independent Salon Study page 10
Competitive Benchmarks
Other ingredients that are marketed for hair volumizing benefits have been tested for comparative purposes –
- Polyquaternium-10
- Methoxy PEG/PPG-7/3 Aminopropyl Dimethicone

Formulations:
Evaluations to date have examined performance from rinse-off systems. In all of the evaluations described in this document, either a “Basic Conditioner” or an “SD conditioner” were used, each of which is detailed below:

<table>
<thead>
<tr>
<th>Basic Conditioner Formulation</th>
<th>% by wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (deionized)</td>
<td>to 100</td>
</tr>
<tr>
<td>INCROQUAT BEHENYL TMS 50</td>
<td>5</td>
</tr>
<tr>
<td>Butylene Glycol</td>
<td></td>
</tr>
<tr>
<td>CRODACOL C (Cetyl Alcohol)</td>
<td>5</td>
</tr>
<tr>
<td>Phenonip</td>
<td>1</td>
</tr>
<tr>
<td>(Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Propylparaben (and) Butylparaben (and) Isobutylparaben)</td>
<td></td>
</tr>
<tr>
<td>Citric Acid</td>
<td>0.20</td>
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<tr>
<td>Active</td>
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</table>

<table>
<thead>
<tr>
<th>SD Conditioner Formulation</th>
<th>% by wt</th>
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</thead>
<tbody>
<tr>
<td>Water (deionized)</td>
<td>to 100</td>
</tr>
<tr>
<td>COSMOWAX D (Cetearyl Alcohol (and) Ceteareth-20)</td>
<td>4</td>
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<tr>
<td>INCROMINE SD (Stearamidopropyl Dimethylamine)</td>
<td>2</td>
</tr>
<tr>
<td>CRODACOL S95 (Stearyl Alcohol NF)</td>
<td>1</td>
</tr>
<tr>
<td>Phenonip</td>
<td>1</td>
</tr>
<tr>
<td>(Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Propylparaben (and) Butylparaben (and) Isobutylparaben)</td>
<td></td>
</tr>
<tr>
<td>Citric Acid</td>
<td>0.50</td>
</tr>
<tr>
<td>Active</td>
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</table>

Tress Evaluations - Test Protocol
In order to demonstrate the performance of Voluminis in tightly controlled laboratory conditions, tress studies have been completed. Performance has been assessed from a variety of conditioner bases.

Wax-bound, extra-wide tresses of hair were cut into tresses of 15mm width, and labeled. Each tress was wetted by quick submersion in water and then washed with 1ml basic shampoo for 30 seconds then rinsed with warm tap water for one minute. The tress was then gently detangled with a wide toothed comb. The tress received 0.50g of the conditioner, which was sprayed along the tress and massaged for 30 seconds. The tress was rinsed for one minute with warm tap water and then suspended from the top and allowed to dry naturally overnight in a humidity cabinet set to 50% relative humidity. These steps were repeated for each product tested. Photographs from the
front and side were taken the following morning. These were subsequently evaluated with Image J software to give
tress size quantification.

**Tress Evaluations – Results**

Study 1, in which all actives were included in the Basic Conditioner at 1% active, showed that the parent hydrolyzed
wheat protein gives no measureable volume boost whereas Voluminis gives a visually obvious and enhanced
boost. The copolymerization of the parent hydrolyzed protein evidently provides the volumizing functionality of
Voluminis.

Voluminis and the benchmark ingredient Methoxy PEG/PPG-7/3 Aminopropyl Dimethicone (silicone benchmark)
were both found to boost tress volume and by similar quantities compared to the basic conditioner but, critically,
these products were seen to impart very different types of volume. Tresses treated with Voluminis showed a neat,
controlled volume, whereas those treated with Methoxy PEG/PPG-7/3 Aminopropyl Dimethicone were very frizzy,
as shown in figure 1.

**Tress Study 1 in Basic Conditioner** (for formulation see p2)

![Photographic Results from Study 1 in Basic Conditioner](image)

Figure: 1- Photographic Results from Study 1 in Basic Conditioner
Figure: 2- Tress size quantification results for Study 1 in Basic Conditioner

The second study, which again used actives at 1% but this time in the SD conditioner base, gave little quantifiable difference between the tested actives, all of which performed better than the INCROMINE SD conditioner base without active. The appearance of each tress, however, was strikingly different as shown in Figure 3.

Tress Study 2 in INCROMINE SD Conditioner (for formulation see p2):

Figure 3- Photographic Results from Study 2 in INCROMINE SD Conditioner
We found that Polyquaternium-10 (PQ-10) delivers some hair volumizing from this system. However, the dried tress treated with PQ-10 was frizzy. Additionally, the wet and dry feel of the hair was compromised by the inclusion of PQ-10 in the formulations, to a point that was deemed unlikely to be popular with the consumer.

As in study 1, Voluminis gave volume a volume boost with a neater appearance than the benchmark ingredients.

In our tress evaluations, Voluminis was found to have some effect on wet hair feel and combing compared to the same conditioner without the active. The magnitude of the effect on these wet sensory properties seemed formulation dependent but, in all systems tested, Voluminis-containing formulations remained ‘conditioning’, i.e. resulted in smoother, easier to comb tresses than shampoo alone. The volumizing/conditioning balance may be optimized through formulation adjustment.

**Mannequin Head - Test Protocol**

In hair care, there is a methodology gap between in-vitro testing on small, individual tresses and in-vivo salon studies in consumer relevant conditions. A new method has been developed designed to obtain a higher level of consumer relevancy in the laboratory and therefore bridge this gap. Tresses of hair are implanted in to a mannequin head to reflect the situation of hair on the human head while retaining scientific control over test conditions.

The ‘scalp’ of the mannequin head was divided in half by a line (forehead to back of head) and an even number of rectangular shaped slots were prepared on each side of the this line. Tresses 15mm wide were attached into each slot. The hair was sprayed with deionized water and combed into a natural style then allowed to dry naturally. Once dry, the implanted hair on the mannequin head was washed with 2g of basic shampoo for one minute and rinsed with warm tap water until no foam remained. The hair was then parted symmetrically into two equal half-
sections. Each side was treated with 1g of conditioner simultaneously, in order that the scientist could pick up any sensory differences. The hair was massaged for 1 minute and rinsed with warm tap water until no product remained. The hair was gently combed to remove any tangles with 2 identical combs, one for each side, and was left to dry overnight. Photographs from the front and back were taken the following morning. These were subsequently evaluated with Image J software to provide hair volume quantification.

Mannequin Head - Results

![Mannequin Head Study in Basic Conditioner](image-url)

*Figure 5 - Photographic Result from Front from Mannequin Head Study in Basic Conditioner*

*Figure 6 - Photographic Result from Back from Mannequin Head Study in Basic Conditioner*
Image analysis techniques allow quantification of the volume boosting performance. In this mannequin head study using the basic conditioner, Voluminis gave a 30% increase in hair volume, when analysed using Image J software. It was also observed that there was no increase in flyaway or frizz and there was no impact on shine.

![Figure 7 – Contrast Image from Mannequin Head Study used for Volume Quantification by Image Analysis](image)

**Lasting Volume - Test Protocol**

Since Voluminis does not rely on a rigid polymer film for its effectiveness, lasting benefits can be expected and have been indicated in a simple mannequin head study.

The ‘scalp’ of the mannequin head was divided in half by a line (forehead to back of head) and an even number of rectangular shaped slots were prepared on each side of this line. Tresses 15mm wide were attached into each slot. The hair was sprayed with deionized water and combed into a natural style then allowed to dry naturally. Once dry, the implanted hair on the mannequin head was washed with 2g of basic shampoo for one minute and rinsed with warm tap water until no foam remained. The hair was then parted symmetrically into two equal half-sections. Each side was treated with 1g of conditioner simultaneously so that the scientist could pick up any sensory differences. The hair was massaged for 1 minute and rinsed with warm tap water until no product remained. The hair was gently combed to remove any tangles with 2 identical combs, one for each side, and was left to dry overnight. The mannequin was photographed the following morning (T = 0), then photographed again 24 hours later (T = 24h).
### Lasting Volume Study – Results

**Figure 8** – Photograph of Mannequin Head at start of lasting volume study in basic conditioner

**Figure 9** – Photograph of Mannequin Head after 24 hours in lasting volume study in basic conditioner
The side treated with Voluminis had more volume initially and still showed enhanced volume after 24 hours in ambient conditions. The side treated with the same conditioner without Voluminis was less voluminous initially and appeared visibly deflated after 24 hours.

**In-House Salon Study - Test Protocol**

Although *in-vitro* methods are of value, for an ingredient of this type, the most important assessment is *in-vivo*. 10 panelists were recruited, female with fine or medium texture, straight or wavy hair. The hair length was medium (below the ear and above the shoulder) and either layered or one length. The hair could be chemically treated, but not permanent waved. Washing, styling and evaluation were carried out by a professional hairdresser, specially trained and experienced in hair product evaluation. Attributes were evaluated by a cosmetologist.

First, the test and control products were transferred by the test supervisor to sets of 5ml syringes, one set for each head. The hair was washed twice with mild, frequent use shampoo and rinsed. According to hair length and type, 3-5mls of conditioner was applied to each half-head - one side received INCROMINE SD conditioner without active, the other side INCROMINE SD conditioner with 1% active Voluminis. The identity of the product being applied to each side was unknown to the stylist and panelists, i.e. double blind. The conditioner was spread through the hair and massaged for one minute and the application characteristics were assessed. The hair was then rinsed for 45 seconds and ease of rinsing was scored. After carefully towel drying the two sides of the head, the wet hair properties were evaluated. The hair was then dried and styled and the dry hair attributes were assessed. All parameters were scored out of 10; a higher score being the preference.

**In-House Salon Study - Results**

*Figure 10 - In-house salon study sensory diagram showing volumizing benefits, as well as some differences in wet properties that may be optimised by formulation adjustment*
This small in-house study indicated that volume attributes from the conditioner with 1% active Voluminis are better than the base. It also confirmed previous observations from the tress studies that wet attributes are different with and without the active in an otherwise identical formulation. When asked which side of their hair they preferred, 7 out of 10 of the panelists chose the side treated with the conditioner containing Voluminis.

Independent Salon Study - Test Protocol
An independent study was carried out using a larger group of panelists than in the in-house study, to facilitate statistical analysis of the results.

24 panelists were recruited: female with fine or medium texture, straight or wavy hair. The hair length was medium (below the ear and above the shoulder) and either layered or one length. The hair could be chemically treated, but not permanent waved. Washing, styling and evaluation were carried out by a professional hairdresser, specially trained and experienced in hair product evaluation. Attributes were evaluated by a trained assessor using a 9 point scale, where 1 is poor and 9 is very good.

First, the test product (INCROMINE SD conditioner with 1% active Voluminis) and control product (INCROMINE SD conditioner without active) were transferred by the test supervisor to sets of 5ml syringes, one set for each head. The products were then assigned randomly to the left and right sides of the head, so that for half the panel the test product was on the left and for the other half it was on the right. The hair was then washed twice with mild, frequent use shampoo and rinsed. According to hair length and type, 3-5mls of conditioner was applied to each half-head, the conditioner was spread through the hair and massaged for one minute. The ease of application characteristics was measured. The hair was then rinsed for 45 seconds and ease of rinsing was scored. After carefully towel drying the two sides of the head the wet hair properties were evaluated. The hair was then dried and styled and the dry hair attributes were assessed.

Independent Salon Study - Results

![Sensory diagram showing volumizing benefits, as well as some differences in wet properties that may be optimised by formulation adjustment](image)

Figure 11- Independent salon study sensory diagram showing volumizing benefits, as well as some differences in wet properties that may be optimised by formulation adjustment
In this independent salon study, Voluminis gave a statistically significant increase in the appearance of hair volume compared to a control conditioner at a 99% confidence level. It also gave significant increase in the voluminous feel of hair compared to the control conditioner at a 95% confidence level.

![Bar chart showing comparison of Voluminis versus control conditioner in salon study.]

*Figure 12*—The volumizing benefits of Voluminis were clearly observed in the salon while there were no significant differences in other key dry hair properties.

Critically, Voluminis had no significant impact on shine, softness, smoothness or frizz. In this otherwise identical formulation, Voluminis did have some adverse effect on wet hair feel and combing. However, the conditioner with Voluminis still averaged more than six out of nine for ease of wet combing, so it could certainly be considered as 'conditioning'. The balance of volumizing and conditioning may be optimized by formulation adjustment - no such adjustment was made for the purposes of these studies so that the volumizing benefit could be completely attributed to Voluminis.

**Formulating**

Voluminis is an easy to use liquid with no heating or neutralizing required. It produces low odor solutions in water and alcohol and is compatible with other cationic ingredients.

Typical Usage Levels: 2.5-5% as supplied, which equates to approximately 0.5-1% active.

Although all performance evaluations to date have been in rinse-off conditioners, Voluminis is suitable for and may be expected to be efficient in leave-in conditioners, serums and spritzes applied to damp hair.
Turn Up The Volume Conditioner

with VOLUMINIS™ HP-357

A light but creamy conditioner which increases the volume of the hair thanks to VOLUMINIS. Conditioning and volumizing are now possible in one step! CROPEPTIDE™ W is also included to protect the hair against limpness caused by increases in humidity.

Ingredients %

Part A

Water 85.2
Citric Acid 0.5
INCROMINE™ SD (Stearamidopropyl Dimethylamine) 2.00
CRODACOL™ S95 (Stearyl Alcohol) 1.00
COSMOWAX™ J (Cetearyl Alcohol (and) Steareth-20 (and) Steareth-10) 4.00
VOLUMINIS (Ethyltrimonium Chloride Methacrylate/Hydrolyzed Wheat Protein Copolymer) 5.00
CROPEPTIDE W (Hydrolyzed Wheat Protein (and) Hydrolyzed Wheat Starch) 1.00
Phenoxyethanol (and) Methylparaben (and) Butylparaben (and) Ethylparaben (and) Propylparaben (and) Isobutylparaben2 0.8
Fragrance3 0.5


pH: 4.5 ± 0.5; Viscosity: 7,000 cps ± 10% (Spindle T-C @ 10 rpm, RT); Appearance: creamy white emulsion

Procedure

Charge beaker with deionized water and add citric acid crystals with mixing. Begin heating to 75-80°C and add INCROMINE SD. When the INCROMINE SD is completely melted, add the CRODACOL S95 and COSMOWAX J. Turn up the mixing speed and maintain temperature for 10 minutes. Ensure that all fatty alcohol is melted before cooling begins. Turn down the mixing speed when the batch cools to 60 ºC. On further cooling to 50ºC, replace the mixing blades with side sweeps and turn down the mixing speed to a slower rate.

When the batch cools to 40 ºC, add VOLUMINIS, CROPEPTIDE W, preservative and fragrance one after the other with slow mixing.

References

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