The Science Behind
Hair Damage Repair

Denise Costrini
Marketing Manager

Marni Dexter
Applications Team Leader

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Hair Damage Repair
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Agenda

- Market Trends and Damaged Hair Overview
- Damage Repair and Prevention Technology
- Formulating for Damaged Hair Repair and Prevention
The Science Behind

Hair Damage Repair

Market Trends and Damaged Hair

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CRODA
Top Global Hair Care Claims

Consumers seek damaged hair repair and prevention with long-lasting performance

Source: GNPD Mintel
26% of Global Hair Care launches from 2010 through H1 2015 claimed **Damaged Hair**

During same time period:
- Damaged Hair launches increased 24% vs. 13% increase for Total Hair Care launches

*Source: Mintel*
Damaged Hair in the US

- 25% of product offerings for the Top 10 Mass Shampoo and Conditioner Brands* in the United States claim Damaged Hair Repair as a primary or secondary benefit.

*Source: Nielsen 2014 - $ Sales

28% of New Launches for Top 10 - $ Sales Claim Hair Damage Repair

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*Source: Nielsen 2014 - $ Sales
Global Hair Care launches claiming Split End Repair have grown 9% annually from 2010 to 2014
Hair Anatomy

- The bulk of the hair fibre
- Comprised of long fibrous chains of hard keratin
- Strength and elasticity is attributed to the cortex
- Melanin is found in the cortex and gives hair its colour
- Key lipids coat hair fibre to keep hair hydrated and optimised
- Infused with keratin and formed in the follicle sebaceous gland
- Comprised of fatty acids, ceramides, triglycerides, cholesterol
- Acts as a protective barrier for the softer inner structure
- Formed from keratinized cells
- Regulates moisture content of hair fibre
- Cuticle condition is primary factor in shine
- Formed from keratinized cells
- Regulates moisture content of hair fibre
- Cuticle condition is primary factor in shine
- Cuticle lipids

Cross Section of Cuticle

Overlapping Cuticular Cells

Hair cuticle cross-section showing Cell Membrane Complex (CMC)
Sources of Hair Damage

- Mechanical Damage
- Thermal Damage
- Chemical Damage
- Environmental Damage
- Internal Influencers (Aging, Stress, Illness, Diet)
Types of Hair Damage

- Cuticle Decementation & Lifting
- Cuticle Abrasion
- Cuticle Shear band formation (split ends)
- Longitudinal Cracking
- Bulges & Craters
- Breakage of Hair fiber
Consumer cues of damage

**Signs of damage**

- Dulling
- Thinning
- Breakage
- Split Ends
- Rigidity
- Frizzing
- Dryness
- Fading
- Scalp irritation

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Audience Poll 1

What signs of damage do you think consumers are most concerned about?

- Dullness
- Split Ends
- Breakage
- Dryness
- Rigidity
- Other
The Science Behind Hair Damage Repair

Damaged Hair Repair and Prevention

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Cuticle Lifting and Split End Repair and Prevention

- **Damage Sources:**
  - Chemical Treatments
  - Mechanical Practices
  - Internal Factors

- **Technology Solution:** Crodabond™ CSA
Hair Damage Repair

Cuticle Sealing and Split End Repair

- **Crodabond CSA**
  - INCI: Hydrogenated Castor Oil/Sebacic Acid Copolymer
- Locks down lifted cuticles to keep them sealed throughout multiple shampoo washings
- Repairs split ends and keeps them sealed throughout multiple shampoo washings, even when used in a rinse-off system
- Provides consumer-perceivable, long-lasting conditioning benefits to help prevent future hair damage

- **Consumer benefits:**
  - Bonds damaged cuticles
  - Repairs split ends
  - Smoothes hair fibres
  - Enhances shine properties
  - Delivers long-lasting, consumer-perceivable repair
How Crodabond CSA Works

Crodabond CSA works its way in between lifted cuticles and adheres, cementing down cuticles and smoothing out the hair fibre.
Long-lasting Performance of Crodabond CSA

Damaged Hair

Commercial Benchmark claiming Intensive Hair Repair

Simple Conditioner containing Crodabond CSA at 2% w/w

After Treatment  Shampoo Cycle 3  Shampoo Cycle 7  Shampoo Cycle 14

Cuticles have remained sealed down allowing for long-lasting conditioned hair to help prevent future damage

Cuticles have lifted and become extremely damaged and flaky
## Long-Lasting Split End Mending – Leave On System

<table>
<thead>
<tr>
<th>Treated Hair</th>
<th>3 Washes</th>
<th>5 Washes</th>
<th>10 Washes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crodabond CSA 0% Control</strong></td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td><strong>Crodabond CSA 2%</strong></td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td><strong>Crodabond CSA 5%</strong></td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td><strong>Commercial Split End Repair Benchmark</strong></td>
<td>![image]</td>
<td>![image]</td>
<td>![image]</td>
</tr>
</tbody>
</table>

- 5% **Crodabond CSA** and benchmark retain seal after 10 washes
- Benchmark leaves visible residue
- Split hair fibre before treatment

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Long-Lasting Split End Mending – Even from a Rinse Off System

<table>
<thead>
<tr>
<th></th>
<th>Treated Hair</th>
<th>3 Washes</th>
<th>5 Washes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crodabond CSA 0%</strong></td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
</tr>
<tr>
<td><strong>Crodabond CSA 2%</strong></td>
<td><img src="image4" alt="Image" /></td>
<td><img src="image5" alt="Image" /></td>
<td><img src="image6" alt="Image" /></td>
</tr>
<tr>
<td><strong>Crodabond CSA 5%</strong></td>
<td><img src="image7" alt="Image" /></td>
<td><img src="image8" alt="Image" /></td>
<td><img src="image9" alt="Image" /></td>
</tr>
<tr>
<td><strong>Commercial Restoring Conditioner</strong></td>
<td><img src="image10" alt="Image" /></td>
<td><img src="image11" alt="Image" /></td>
<td><img src="image12" alt="Image" /></td>
</tr>
</tbody>
</table>

Only 5% Crodabond CSA retained seal after 5 washes

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Is the Repair Consumer Perceivable?

**After Initial Application**

<table>
<thead>
<tr>
<th></th>
<th>0% Crodabond CSA</th>
<th>2% Crodabond CSA</th>
<th>5% Crodabond CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks Smoother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Looks Shinier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feels Smoother</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tresses treated with Crodabond CSA look smoother, look shinier, and feel smoother.

**After 5 Washes**

<table>
<thead>
<tr>
<th></th>
<th>0% Crodabond CSA</th>
<th>2% Crodabond CSA</th>
<th>5% Crodabond CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks Smoother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Looks Shinier</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Feels Smoother</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tresses treated with Crodabond CSA look smoother, look shinier, and feel smoother—even after 5 washes.

Crodabond CSA delivers long-lasting, consumer perceivable look and feel improvement.
Replenishing Lipids due to Cuticle Abrasion

- **Damage Sources:**
  - Environmental Exposure
  - Chemical Treatments
  - Mechanical Practices
  - Internal Factors

- **Technology Solution:**
  
  Cutissential™ Behenyl 18-MEA

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**Lipid Replenishment**

**Cutissential™ Behenyl 18-MEA**
- INCI: Behentrimonium Methosulfate (and) C10-40 Isoalkylamidopropylethyldimonium Ethosulfate (and) Cetyl Alcohol
- Replenishes 18-MEA, the primary lipid found on the hair surface
- Restores hair Integrity and increases hydrophobicity

Fluorescence micrographs of hair fibers (X 100; attenuation: 1)

1.5 % Aqueous Cutissential Behenyl 18-MEA

Chemical treatments, UV exposure and everyday grooming can deplete 18-MEA from the hair surface, leaving it unprotected and damage-prone. **Cutissential Behenyl 18-MEA** returns 18-MEA to the hair cuticle, making it easier to style, more resistant to damage and healthier looking.
Preventing Cuticle Abrasion

- **Damage Sources:**
  - Environmental Exposure
  - Chemical Treatments
  - Mechanical Practices
  - Internal Factors

- **Technology Solution:**  
  Crodazosoft™ DBQ

Innovation you can build on™
Preventing Cuticle Abrasion

**Croda**zoso**f**t DBQ

- **INCI:** Quaternium-91 (and) Cetrimonium Methosulfate (and) Cetearyl Alcohol
- Provides excellent conditioning to prevent Cuticle Abrasion
- Proven to soften the hair
- Promotes delivery of lipophilic actives
- Provides colorwashfastness benefits for colored hair

![Untreated Hair Before Combing](image1.png) ![Croda**f**soft DBQ-Treated Hair Before Combing](image2.png)

![Untreated Hair After Combing](image3.png) ![Croda**f**soft DBQ-Treated Hair After Combing](image4.png)
Preventing Longitudinal Cracking

- **Damage Sources:**
  - Thermal

- **Technology Solution:**
  - Crodasone™ P

Innovation you can build on™
Preventing Longitudinal Cracking

**Crodasone™ P**
- INCI: Hydrolyzed Pea Protein PG-Propyl Silanetriol
- Protection against damage caused by blow-drying, combing and styling
- Heat activated defense against cuticle cracking

The reduced number of cuticle cracks are evident in the sample treated with 2% active **Crodasone P** aqueous solution compared to the control.
Audience Poll 2

What consumer benefits are the most challenging to deliver from hair care formulations?

• Color protection
• Anti-Frizz
• Split Ends
• Moisturization
• Strengthening
• Long-lasting results
• Other
The Science Behind
Hair Damage Repair

Formulating for Damaged Hair Repair and Prevention

Innovation you can build on™
Need a miracle to fix your split ends? Apply this leave-on smoothing serum to the ends of your hair for split end repair and shine with a perceivable, long-lasting effect.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>84.00</td>
</tr>
<tr>
<td>Kerestore™ 2.0 (Aqua (and) Laurdimonium Hydroxypropyl Hydrolyzed Keratin)</td>
<td>1.00</td>
</tr>
<tr>
<td>VisCaress™ PC (Polyquaternium-37 (and) Propylene Glycol Dicaprylate/Dicaprate (and) PPG1-Trideceth-6)</td>
<td>2.00</td>
</tr>
<tr>
<td>Part B</td>
<td></td>
</tr>
<tr>
<td>KeraDyn™ HH (Bis-Ethyl(isostearylimidazoline) Isostearamide)</td>
<td>0.50</td>
</tr>
<tr>
<td>Crodabond™ CSA (Hydrogenated Castor Oil/Sebacic Acid Copolymer)</td>
<td>2.00</td>
</tr>
<tr>
<td>Crodamol™ STS (PPG 3 Benzyl Ether Myristate)</td>
<td>5.00</td>
</tr>
<tr>
<td>Cyclomethicone</td>
<td>5.00</td>
</tr>
<tr>
<td>Phenoxyethanol/Ethylhexylglycerin²</td>
<td>0.50</td>
</tr>
<tr>
<td>Citric Acid (10% solution)</td>
<td>qs</td>
</tr>
</tbody>
</table>

VisCaress PC allows for a cold-processable emulsion.
Meeting the Need: Long-Lasting, Split End Repair

**Crodabond™ CSA**
Miracle Cuticle Smoothing
- Repairs split ends
- Seals down lifted cuticles
- Enhances shine

**Kerestore™ 2.0**
Biomimetic Keratin
- Intelligently repairs the most damaged areas of the hair
- Proven to enhance combability of different hair types
- Highly specialised, keratin derived conditioning active

**VisCaress™ PC**
- Provides substantive conditioning
- Results in a light, silky afterfeel
- Allows for a cold-processable emulsion

Cuticle Sealing & Split End Repair

Restore from root to tip

Condition

Innovation you can build on™
Hair Rescue Conditioner and Damage Defender HP-407

Rescue your damaged hair and protect it from the elements and heat styling. This leave-in conditioner will restore your hair to health and replenish its natural lipids, leaving it looking and feeling healthy while defending against thermal and UV damage.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part A</strong></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>83.50</td>
</tr>
<tr>
<td><strong>Part B</strong></td>
<td></td>
</tr>
<tr>
<td>Crodazoquat™ MCC (Behentrimonium Methosulfate (and) Quaternium-87 (and) Cetearyl Alcohol)</td>
<td>3.00</td>
</tr>
<tr>
<td>Crodacol™ 1618 (Cetearyl Alcohol)</td>
<td>6.00</td>
</tr>
<tr>
<td>Cutissential™ Behenyl 18-MEA (Behentrimonium 40 Isoalkylamidopropylethyldimonomium Ethosulfate)</td>
<td>4.00</td>
</tr>
<tr>
<td><strong>Part C</strong></td>
<td></td>
</tr>
<tr>
<td>ChromaVeil™ (Quaternium-95 (and) Propanediol)</td>
<td>2.00</td>
</tr>
<tr>
<td>Crodasone™ P (Hydrolyzed Pea Protein (and) PG-Propyl Silanetriol)</td>
<td>1.00</td>
</tr>
<tr>
<td>Water, Sodium Benzoate, Potassium Sorbate</td>
<td>0.50</td>
</tr>
<tr>
<td>Citric Acid (25% solution)</td>
<td>qs</td>
</tr>
</tbody>
</table>

Contains high level of **Crodazoquat MCC** for use on extremely damaged hair

**Chromaveil** added after emulsion set up instead of in the oil phase

Viscosity targeted so that formulation spreads easily but does not drip

Suppliers: 1. Croda 2. Euxyl K712, Schülke Inc.
Meeting the Need: Damaged Hair Repair and Protection

**Crodazoquat™ MCC**
MultiCultural Conditioning for Damaged Hair
- Restores hydrophobicity
- Especially effective on damaged hair
- Enables conditioning on various ethnic hair types

**Cutissential™ Behenyl 18-MEA**
Essential Replenishment
- Adds lubricity and shine
- Restores the integrity of the hair surface
- Replenishes the primary lipid of the hair

**ChromAveil™**
Exceptional Colour Protection
- Prevents hair colour fade from UV exposure
- Protects hair fibre integrity from UV exposure
- Consumer perceivable benefits

**Crodamone™ P**
Cuticle Defense
- Heat activated cuticle defense
- Forms a protective film on the hair surface on drying
- Defends against cuticle cracking

Improved Feel/ Conditioning
Replenish Vitality
Hair Colour Protection from Sun
Superfood Protection
Pre-Shampoo Protective Primer

HP-405

Very damaged hair needs extra protection and repair. Apply this oil primer to the hair before washing to repair damaged hair and protect it from further damage.

[Image of woman with long, wavy hair]

### Ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part A</strong></td>
<td></td>
</tr>
<tr>
<td>Crodamol™ GTCC (Caprylic/Capric Triglyceride)</td>
<td>81.00</td>
</tr>
<tr>
<td>Arlamol™ LST (PPG-3 Isostearyl Methyl Ether)</td>
<td>5.00</td>
</tr>
<tr>
<td>Novarom™ ROSEMARY OIL FORTE (Caprylic/Capric Triglyceride, Rosmarinus Officinalis (Rosemary) Leaf Extract)</td>
<td>1.00</td>
</tr>
<tr>
<td>Ginger Extract OS (Glycine soja (Soybean) Oil, Zingiber officinale (Ginger) Root Extract)</td>
<td>1.00</td>
</tr>
<tr>
<td>Cropure™ Olive (Olea Europaea (Olive) Fruit Oil)</td>
<td>5.00</td>
</tr>
<tr>
<td>Cropure Wheatgerm (Triticum Vulgare (Wheatgerm) Oil)</td>
<td>5.00</td>
</tr>
<tr>
<td>Crodabond™ CSA (Hydrogenated Castor Oil/Soybean Oil Copolymer)</td>
<td>2.00</td>
</tr>
</tbody>
</table>

**Crodamol GTCC** allows for a clear formulation

Novarom Rosemary and Crodarom Ginger are both oil soluble

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Suppliers: 1. Croda/Sederma
Meeting the Need: Long-Lasting, Damaged Hair Repair and Prevention

Crodabond™ CSA
Miracle Cuticle Smoothing
- Repairs split ends
- Seals down lifted cuticles
- Enhances shine

Ginger Extract OS
- Regulates moisture
- Energising
- Anti-irritant that increases blood circulation

Cropure™ Olive
Absolute Purity
- Extremely gentle to the skin
- Stabilises active ingredients
- Low colour and odour

Cuticle Sealing & Split End Repair
Crodabond™ CSA
Revitalising
Crodarom™ Ginger Extract OS
Healthy Hair
Cropure™ Olive

Innovation you can build on™
**Extreme Damage Repair Balm**

HP-406

Extremely damaged hair requires intense repair. This damage repair balm contains a cocktail of advanced conditioning ingredients designed to intelligently repair your hair and protect it from future damage, leaving it healthy looking and feeling soft and smooth.

### Ingredients

<table>
<thead>
<tr>
<th>Part</th>
<th>Ingredients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Water</td>
<td>77.32</td>
</tr>
<tr>
<td></td>
<td>Glycerin</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td><strong>Crodazosoft™ DBQ</strong> (Quaternium-91 (and) Cetrimonium Methosulfate (and) Cetearyl Alcohol)</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td><strong>KeraDyne™ HH</strong> (Bis-Ethyl(isostearylimidazoline) Isostearate)</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td><strong>Crodafos™ CS20A</strong> (Cetearyl Alcohol (and) Ceteth-20 Phosphate (and) Dicetyl Phosphate)</td>
<td>2.75</td>
</tr>
<tr>
<td></td>
<td><strong>Brij™ S20</strong> (Steareth-20)</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td><strong>Crodacol™ 1618</strong> (Cetearyl Alcohol)</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td><strong>Crodamol™ SFX</strong> (PPG-3 Benzyl Ether Ethylhexanoate)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td><strong>Crodabond™ CSA</strong> (Hydrogenated Castor Oil/Sebacic Acid Copolymer)</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td><strong>Kerestore™ 2.0</strong> (Aqua (and) Laurdimonium Hydroxypropyl Hydrolyzed Keratin)</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Phenoxyethanol/Ethylhexyglycerin²</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Lactic Acid</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Glycerin was added to help with stability

Brij S20 was added to help to stabilize the KeraDyn HH

Lactic acid was used to neutralize the KeraDyn HH

Suppliers: 1. Croda/Sederma 2. Euxyl® PE9010, Schülke Inc.
Meeting the Need: Repair

**Crodazosoft™ DBQ**
Softness Plus
- Proven softening effect
- Defends against cuticle abrasion
- Protects artificial hair colour

**KeraDyn™ HH**
Healthy Hair Dynamics
- Restores healthy hair dynamics to damaged hair
- Reduces inter-fibre friction
- Enhances fibre alignment

**Crodamol™ SFX**
Delivering Special Effects
- Gives shine to the hair
- Excellent pigment dispersant
- Silky, dry skin feel

**Crodabond™ CSA**
Miracle Cuticle Smoothing
- Repairs split ends
- Seals down lifted cuticles
- Enhances shine

Smoothness, Softness
Healthy Hair
Shine
Cuticle Sealing & Split End Repair
Damage and Repair Summary

- For Cuticle Lifting and Split End Repair and Prevention (from chemical and mechanical damage):
  - Crodabond™ CSA

- For Replenishing Lipids due to Cuticle Abrasion (from environmental, chemical and mechanical damage):
  - Cutissential™ Behenyl 18-MEA

- For Preventing Cuticle Abrasion (from environmental, chemical and mechanical damage):
  - Crodazosoft™ DBQ

- Preventing Longitudinal Cracking (from thermal damage):
  - Crodasone™ P

For a full list of Croda ingredients for damage repair and protection, contact your Croda representative or visit www.crodapersonalcare.com
Focus Technologies

Miracle Split End Mender Serum HP-404
- Crodabond™ CSA
- Kerestore™ 2.0
- VisCaress™ PC

Hair Rescue Conditioner and Damage Defender HP-407
- Crodazoquat™ MCC
- Cutissential™ Behenyl 18-MEA
- ChomAveil™
- Crodasone™ P

Pre-Shampoo Protective Primer SP-405
- Crodabond™ CSA
- Ginger Extract OS
- Cropure™ Olive

Extreme Damage Repair Balm HP-406
- Crodazosoft™ DBQ
- KeraDyn™ HH
- Crodamol™ SFX
- Crodabond™ CSA
Additional Information

To order free samples, click here.

To contact us, email marketing-usa@croda.com

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Thank you for attending!