

# Incroquat Behenyl 18-MEA

## Hair replenishing active

Incroquat Behenyl 18-MEA\* is a fatty quaternised derivative of 18-Methyl Eicosanoic Acid (18-MEA), the primary lipid of the hair surface. Human hair contains a thin, protective layer of lipids covalently bound to the cuticle and comprised primarily of 18-MEA. Chemical treatment or environmental stress (ie UV) can remove part or all of this fatty layer, making hair unmanageable, less healthy-looking, and more susceptible to further damage.

Incroquat Behenyl 18-MEA was developed as a means of replenishing this important lipid.

## Benefits

- Replenishes lipid surface of hair
- Highly substantive conditioning agent, adding lubricity and shine
- Restores integrity of hair surface
- Restores hydrophobicity of damaged hair
- Improves wet and dry combing
- Emulsifying and stabilising properties
- Easy to handle pastille form

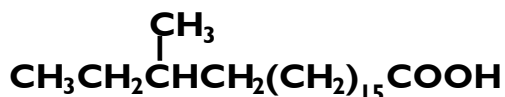
## Applications

- Leave-on & rinse-off conditioners
- Nourishing & treatment-type products
- Products for dry, permed and colour treated hair
- Styling products
- Ethnic hair care products



## 18-MEA - Chemical identity

18-MEA is not found in nature in large quantities, nor is it present in sources where it could easily be extracted. Although 18-MEA is seemingly virtually exclusive to hair, it was thought that the lipid might be found in lanolin, due to the close similarity between human hair and wool. On investigation, we found that 18-MEA is present in lanolin acid as part of a complex mixture of ante-iso, conventional iso, and hydroxy acids<sup>1</sup>. The 18-MEA component of Incroquat Behenyl 18-MEA is derived from this mixture. The structure of 18-MEA shows that it is an ante-iso fatty acid, meaning that its methyl group is attached to the carbon that precedes the iso carbon.

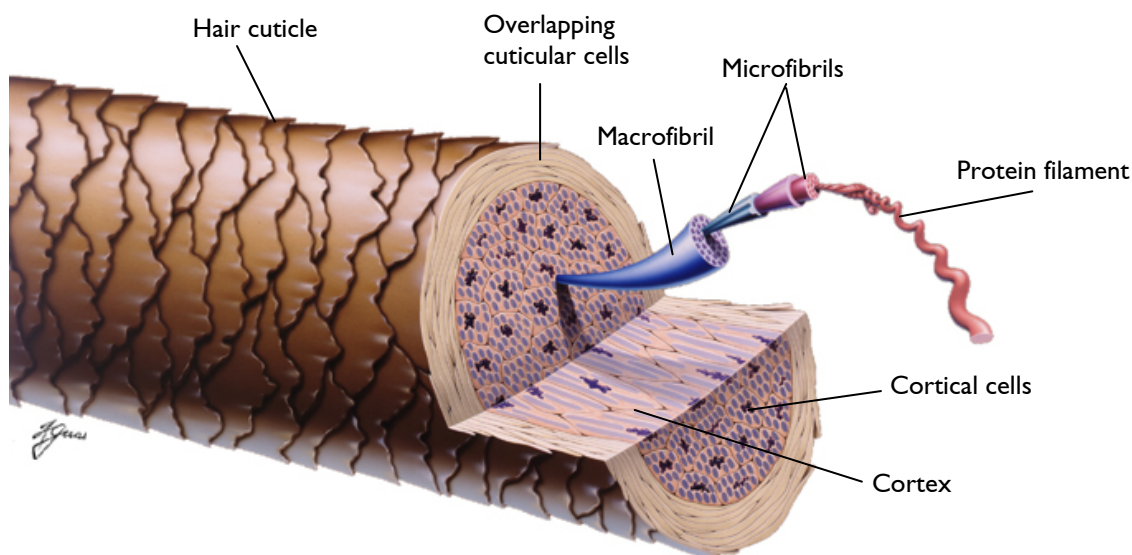


**Figure 1** Structure of 18-Methyl Eicosanoic Acid (18-MEA)

\* Patent pending

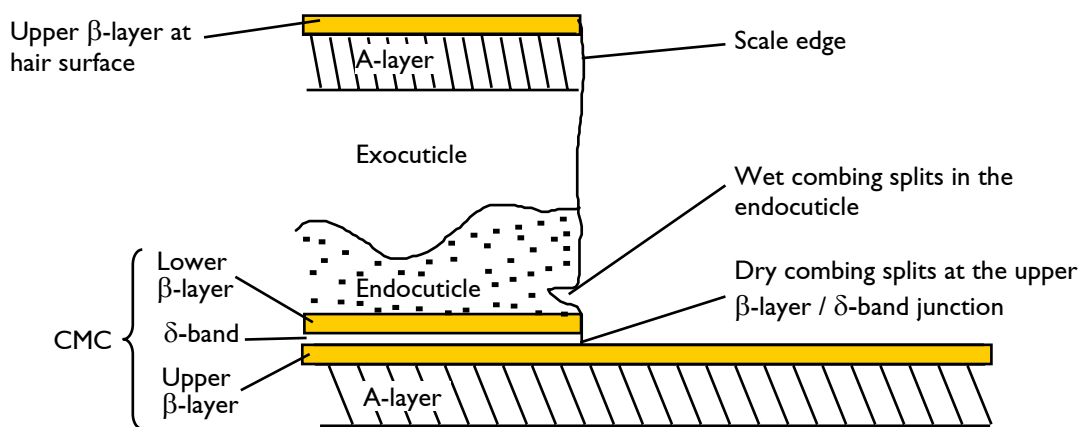
### 18-MEA and healthy hair

Human hair is primarily composed of protein, with lipids and water making up the remainder. The hair fibre is a shaft-like structure, as shown in figure 2, and consists of a cortex, a cuticle, and occasionally a medulla (not shown). The cortex is a cylinder-like structure comprised of long, spindle-shaped cortical cells and constitutes the major portion of the fibre's mass. The cuticle is a thin laminar-like structure consisting of layers of overlapping, flat scale-like cells. The cuticle surrounds the cortex and constitutes the outer surface area of the hair fibre, acting as a protective sheath. As the visible area of the hair, the cuticle also gives hair its optical properties such as shine and gloss.



**Figure 2** Structure of human hair

Sandwiched in between the overlapping cuticle cells is a multi-component layer known as the Cell Membrane Complex (CMC). Sometimes referred to as the epicuticle, the CMC cements the cuticle together and binds it to the cortex, becoming the top layer of one cuticle cell and the bottom layer of the one directly beneath it. Most of the evidence to date<sup>2</sup> suggests that the CMC is comprised of a glycoprotein  $\delta$ -layer pressed between two  $\beta$ -layers of lipids, as depicted in figure 3.



**Figure 3** Cuticle cross-section showing Cell Membrane Complex (CMC)

### 18-MEA most abundant hair lipid

The lipids contained in the CMC's two  $\beta$ -layers are responsible for giving hair its natural hydrophobicity. They coat the surface of adjoining cuticle cells and help contribute to the hair's wet and dry combing properties. Studies have shown that the major lipids present at the hair surface are 18-MEA, palmitic, and oleic acids<sup>3</sup>. 18-MEA is reported to be the most abundant of the lipids and accounts for approximately 40% (w/w) of the lipid mass. 18-MEA and other lipids of the CMC are covalently attached to protein residues on the surface of the cuticle cells, possibly through thioester linkages.

### Restoring lipid balance

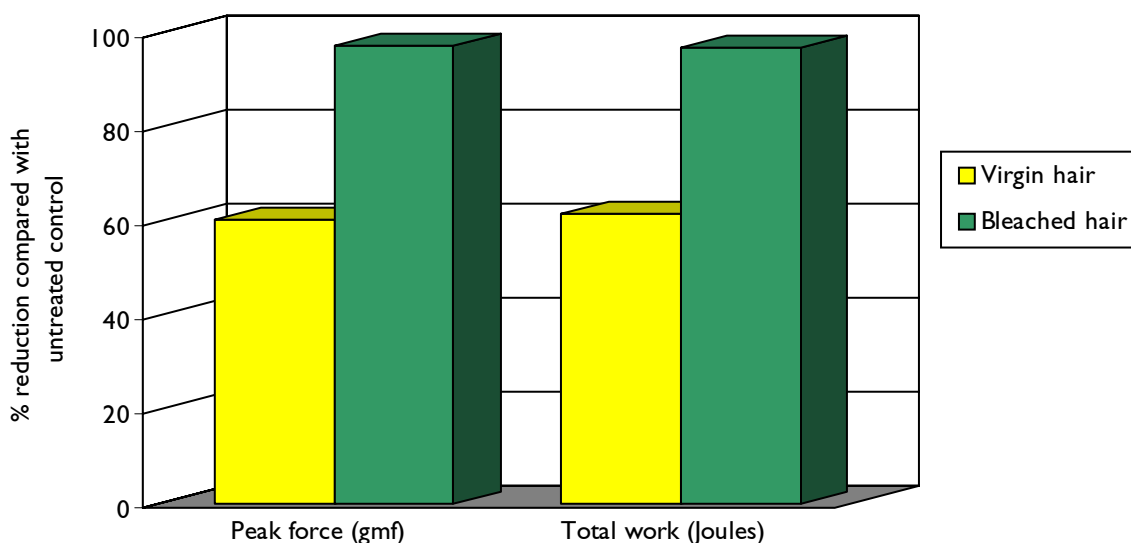
Environmental factors and chemical treatment can both compromise the integrity of 18-MEA. Although 18-MEA and the other hair surface lipids have shown resistance to extraction with organic solvents, they can be readily removed by alkaline hydrolysis. This suggests that the use of high pH products such as perms, hair dyes, or hair relaxers, could deplete these important lipids from the hair surface. Studies on wool fibres have shown that exposure to natural or artificial weathering or UV irradiation increases the hydrophilicity and wettability of fibres<sup>4</sup>. Exposure to UV irradiation has also been shown to deplete wool of its lipid content. Of the fatty acids, 18-MEA appears to be lost to the greatest extent<sup>4</sup>.

Incroquat Behenyl 18-MEA is a novel ingredient that may help restore the 18-MEA that is depleted from the hair surface.

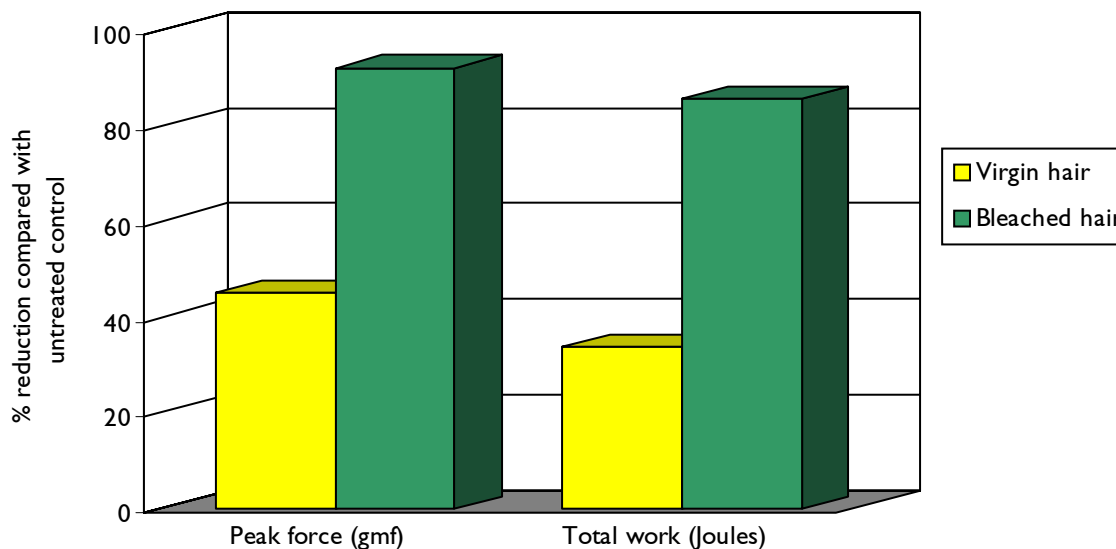
### Combing studies

Incroquat Behenyl 18-MEA significantly improves both wet and dry combing - dramatically so, in the case of bleached hair.

Such a restorative effect is consistent with reports in the literature that associate a loss of 18-MEA with damage to the hair. Combing studies conducted on virgin and bleached hair evaluated the peak load and total work required to comb wet and dry tresses, either treated with a 1.5% dispersion of Incroquat Behenyl 18-MEA or left untreated as a control. The results for virgin and bleached hair are depicted in figures 4 and 5 and are given as percent reductions compared to the control. The bleached hair results are impressive, showing that Incroquat Behenyl 18-MEA provides a nearly 100% improvement in combing compared with the control. The combing improvements for virgin hair are also substantial, with Incroquat Behenyl 18-MEA providing a reduction in peak load of 60% and 44% for wet and dry combing, respectively.



**Figure 4** Significant improvement in wet combability after treatment with Incroquat Behenyl 18-MEA



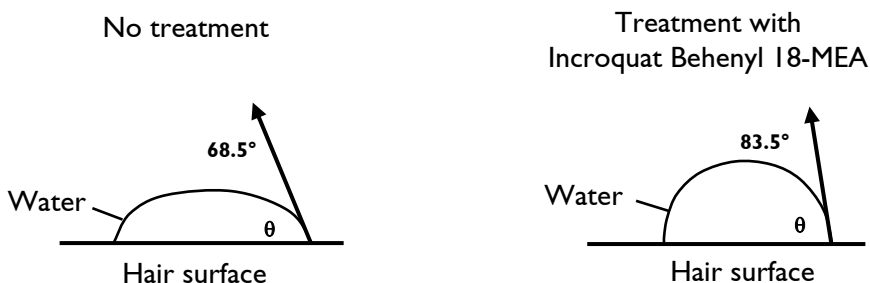
**Figure 5** Significant improvement in dry combability after treatment with *Incroquat Behenyl 18-MEA*

**Contact angle - a measure of hydrophobicity**

*Incroquat Behenyl 18-MEA* has been shown to improve the hydrophobicity, and hence perceived condition, of bleached hair.

The dynamic advancing contact angle of virgin and bleached hair samples was measured before and after treatment with a 1.5% dispersion of *Incroquat Behenyl 18-MEA* to determine the effect of the quat on the hydrophobicity of the hair surface. There was virtually no change in contact angle for the treated and untreated virgin hair. However, a significant difference was observed in the case of bleached hair, with contact angles for the untreated and treated fibres averaging 68.5° and 83.5°, respectively. The 68.5° contact angle means the hair is very hydrophilic and indicates how severely the bleaching process can damage the hair surface.

The surface hydrophobicity of the bleached hair fibres is much improved after treatment with *Incroquat Behenyl 18-MEA*, as seen by the average 15° increase in the contact angle to 83.5°, as shown in figure 6. This may partially account for the dramatic reduction in wet combing force that was observed for the bleached hair fibres treated with *Incroquat Behenyl 18-MEA* (see combing study).



**Figure 6** *Incroquat Behenyl 18-MEA* helps improve the hydrophobic nature of damaged hair

**Formulating**

Incroquat Behenyl 18-MEA is a mixture of a behenyl quat and an 18-MEA quat in cetearyl alcohol and contains 40% active cationics. As a pastille, Incroquat Behenyl 18-MEA offers the convenience of easy formulating and eliminates the handling problems associated with some solid materials. Incroquat Behenyl 18-MEA should be included in the oil phase and heated to 70-75°C with mixing. The surface active nature of Incroquat Behenyl 18-MEA provides emulsification properties which can facilitate the incorporation of oils such as silicones into conditioner systems. Recommended use levels 1.0-5.0%.

**INCI name**

Cetyl Alcohol and Behentrimonium Methosulfate and  
C10-40 Isoalkylamidopropylethyldimonium Ethosulfate

**Health and safety**

A separate material safety datasheet is available on request from the Personal Care sales department.

**References**

1. Woolgrease, Richard N. Cawthorne and Robert W. Humble, International Patent WO 98/30532.
2. J. A. Swift, "Human Hair Cuticle", *J. Cos. Sci.*, **50**, 23 (1999).
3. N. Yorimoto and S. Naito, "Physical and chemical properties of integral lipids in hair cell membrane complex", *Proc. Internat. Symp. Fibre Sci. Tech., Tokohama*, 215 (1994).
4. A. Korner, H. Schmidt, Th. Merten, St. Peters, H. Martin, H. Hocker, "Changes in the Content of 18-Methyleicosanoic Acid in Wool after UV-Irradiation and Corona Treatment", *The 9<sup>th</sup> Internat'l Wool Textile Research Conference*.

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