

December 17, 2015

## **Development of Formulation Technology for Heightening Care Effects on New Growth Hair**

**~ Use of an Ionic Surfactant to Increase Sorption of CMADK into New Growth Hair in the Acidic Region ~**

Milbon Co., Ltd. (President and CEO: Ryuji Sato) has, through research making use of CMADK<sup>\*1</sup>, developed formulation technology that uses an ionic surfactant to disperse the CMADK that normally precipitates when in the acidic region. Furthermore, this technology has been successfully used to create a solution that can enhance the sorption<sup>\*2</sup> of CMADK at the root section of hair (new growth hair) that has not yet suffered damage from chemical processes etc. We have announced part of these research results externally as shown below and also intend to make use of them in our future products, starting with those hair care products to be released in spring next year.

### **[External Release]**

Released At: The 66th Divisional Meeting on Colloid & Interface Chemistry (Held by the Division of Colloid and Surface Chemistry, Chemical Society of Japan)

Release Title: Stabilization of CMADK acid solution by ionic surfactant and effects on hair

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### **[Research Background]**

Milbon has already successfully industrialized CMADK, which has the effects of preventing damage to hair while heightening its elasticity and internal density, and makes use of CMADK in a series of products. While sorption of CMADK occurs easily into hair that has already been damaged by such factors as chemical processes, sorption does not occur easily at the undamaged root section of hair (new growth hair). It has been determined that in order to prevent damage to hair and heighten its elasticity, which decreases with advancing age, care for new growth hair is also required, and the development of a technology that would increase the sorption of CMADK into new growth hair has therefore been an ongoing challenge.

CMADK is a keratin exactly like the proteins that are found inside hair. In the acidic region, heightening the forces that act between the molecules of the keratin proteins, the sorption of CMADK into hair is enhanced, which can be expected to not only help resolve the issue of sorption into new growth hair but also offer further protection from damage and increase in elasticity. However, CMADK suffers from reduced solubility in the acidic region, caused it to precipitate and making it difficult to achieve a stable

distribution of CMADK within a liquid with an acidic pH. Milbon therefore initiated formulation research, seeking dispersion technology that would allow CMADK to be stabilized in the acidic region.

**[Research Results]**

**~ Formulation Technology to Disperse CMADK in the Acidic Region ~**

In the acidic region, between pH 2.5 and pH 5.5, CMADK suffers from reduced dispersibility, leading to turbidity and precipitation in formulation. As a result of investigations into the dispersal of CMADK that has precipitated in the acidic region, it was discovered that the addition of a certain volume or more of a specific ionic surfactant was effective. This process has been used to successfully formulate a solution with a pH in the acidic region but with CMADK completely dispersed (Fig.1).

**~ Confirmation of CMADK Sorption by New Growth Hair ~**

In order to confirm the sorption of CMADK by new hair growth, a chemically treated cross-section of hair was observed using a fluorescence microscope. As a result of confirming the effects of different types of ionic surfactants, it was determined that a CMADK formulation including a specific anionic surfactant had the effect of increasing sorption of CMADK by new growth hair (Fig. 2).

The results of this research will be linked into the creation of products with heightened CMADK care effects in regard to new growth hair.

**<Reference Materials>**

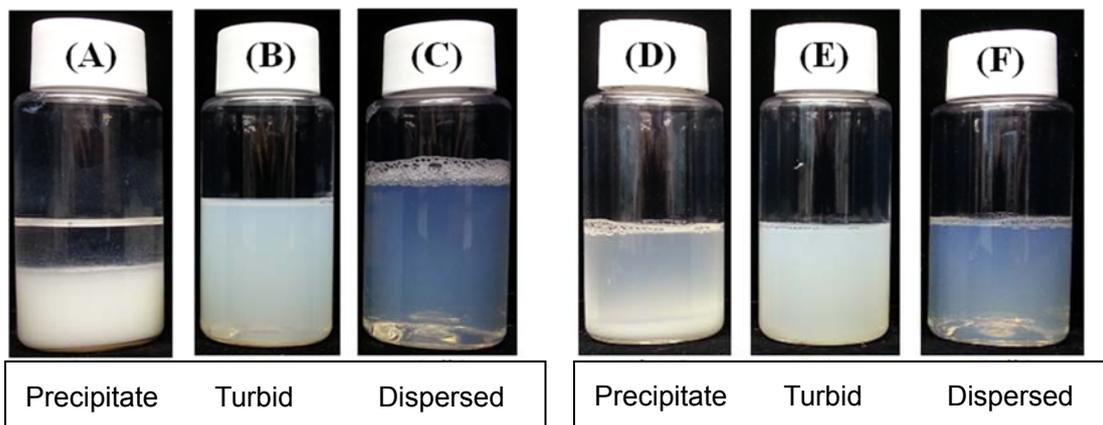


Fig. 1 Appearance of an acidic solution in which CMADK has precipitated after the addition of surfactant  
 CMADK / Anionic Surfactant (wt%/wt%) = (A) 1.0/1.5, (B) 1.0/3.5, (C) 1.0/9.0  
 CMADK / Cationic Surfactant (wt%/wt%) = (D) 1.0/1.0, (E) 1.0/1.5, (F) 1.0/4.0

The addition of a certain volume or more of specific anionic or cationic surfactants allows CMADK to be successfully dispersed in the acidic region

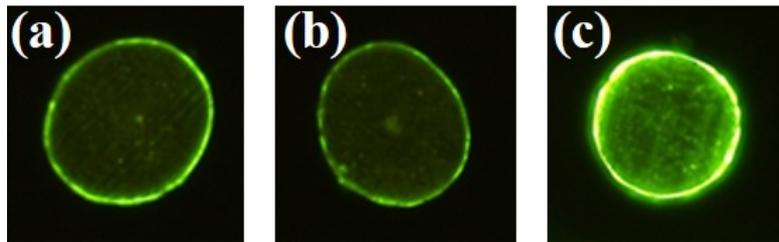


Fig. 2 Fluorescence microscope images of a cross section of new growth hair processed by a formulation containing fluorescent labeled<sup>\*3</sup> CMADK.

(a) Existing formulation, (b) Formulation in the acidic region that uses specific cationic surfactant to disperse CMADK, (c) Formulation in the acidic region that uses specific anionic surfactant to disperse CMADK

A formulation that uses a specific anionic surfactant to disperse CMADK in the acidic region is confirmed to enhance the sorption of CMADK by new growth hair.

### <Terminology>

#### \*1 CMADK (S-carboxymethyl alanyl disulfide keratin protein)

Also known as carboxymethyl disulfide keratin, this is a new soluble keratin protein with a disulfide bond (two covalently-bonded sulfur (S) atoms found in hair). The properties of these disulfide bonds cause CMADK to bond tightly with the protein found in hair, and expectations for CMADK are high as a material that retains its properties even after repeated washing.

#### \*2 Sorption

When a solid comes into contact with a gas or a liquid, the gas or liquid either adhere to the solid or are absorbed by it. In the case of porous mediums with an extremely small internal surface, however, such as hair, the distinction between the boundary surface and the interior is unclear, and no real distinction can be made between adhesion and absorption. Phenomena that include both adhesion and absorption, or in which the two cannot be told apart, are called overall as “sorption.”

#### \*3 Fluorescent labeling

The processing of labeling certain molecules by attaching fluorescent molecules to them. In this experiment linking fluorescent molecules to the CMADK allows the use of a fluorescence microscope to then see where the CMADK is located inside the hair.

#### ■Inquiries relating to the press release

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