MILBON

News Release

July 21, 2015

Determination of the Damage Control Mechanism Provided by Interim Washing During Perming

~Establishment of New Technology that “Elasticizes” Hair in Order to Analyze its Structure~

The Milbon Co., Ltd. (President and CEO: Ryuji Sato) Central Research Institute has worked in collaboration with Doctor Kozo Arai from the KRA Wool Research Laboratory and Professor Kunihiro Hamada from the Faculty of Textile Science and Technology at Shinshu University to discover that a lengthy period of interim washing during the perming process leads to a large reduction in the damage caused to hair. Furthermore, through the establishment of new technology that processes hair in order to turn it into an expandable state, similar to that of rubber, and then analyzes its internal structure, the mechanism by which this interim washing controls damage has also been determined.

In the past, a great deal of the research into controlling damage to the hair during perming has been focused on perming agents*1. However, these new research results indicate that not only the perming agents but also changes to the perming process itself can help reduce the damage caused to hair. They can be considered results that will lead to the development of new hair damage control technologies.

These new findings are intended to be reflected in the development of perming agents and hair straightening agents in the future.

These research results were published in the following scientific journal.

[Thesis]

Publication: Sen’i Gakkaishi, 2015, Vol. 71 Issue 2, Pages 112-120

Thesis Title: Reproduction Mechanism of SS Cross-Links in Permed Hair by Washing after Reduction in Thioglycolic Acid

Authors: Kazuyuki Suzuta (Milbon), Kunihiro Hamada (Shinshu University), Kozo Arai (KRA Wool Research Laboratory)

DOI Number: http://dx.doi.org/10.2115/fiber.71.112

[Research Background]

Perming is an important technique, central to the beauty salon business and significantly expanding the possible range of hairstyles. However, many points remain unknown concerning the causes of damage to hair during the process and the detailed mechanisms behind them, and further research was required.

The majority of perming processes use the following 5 steps.

(1) Winding: The hair is wound onto rods.

(2) 1st Agent Treatment: The 1st agent is applied to the hair and then left for a period of time.

(3) Interim Washing: The hair is washed with water and the 1st agent removed.

(4) 2nd Agent Treatment: The 2nd agent is applied to the hair and then left for a period of time.

(5) Washing & Drying: The hair is washed with water and then dried with a dryer etc.

Almost all of the past research into the damage caused to hair by perming has been focused on the perming agents, and the effects on the hair caused by the other steps in this process have not been thoroughly investigated.

Milbon therefore settled upon step 3 in the above perming process, Interim Washing, and proceeded with research into the effects that interim washing has on the hair.

[Research Results]

~ Control of Damage to Hair Using Interim Washing ~

Hair was permed using a range of different interim washing times, and the degree of damage caused to it by the perming process was then evaluated by measuring the tensile strength*2 of the hair. Interim washing during a standard perm is normally performed for a few minutes, but it was discovered that extending the period of interim washing greatly reduced the damage caused to the hair, (fig. 1).

~ Establishment of New Technology that "Elasticizes" Hair in Order to Analyze its Structure ~

Hair is formed from a protein called keratin. It is comprised of a large number of disulfide bonds*3, which recent research has determined can be classified into a variety of types depending upon their properties and functions. When disulfide bonds connect two proteins together it is called "intermolecular disulfide linkage," and these are thought to be the bonds that affect the strength of hair and in turn are affected by any damage to it. However, existing methods have never allowed for this intermolecular disulfide linkage to be analyzed separately from other types of bonds.

We therefore undertook the development of a process to analyze intermolecular disulfide linkage in isolation. When hair is treated with a special reagent it is transformed into a "rubber–like" state that allows it to expand and contract a great deal more than normal (fig. 2). By applying rubber elasticity theory*4 - a theory developed through research in such fields as industrial rubber - to this "elasticized" hair a method has been developed that allows just the condition of the intermolecular disulfide linkage within the hair to be analyzed.

~ The Mechanism of Damage Control Through Interim Washing ~

Using this new analytical method to investigate the changes in disulfide bonds during the interim washing process revealed that the longer the interim washing is performed for, the greater the reduction in the volume of lost intermolecular disulfide linkage (fig. 3). This correlates with the trend for interim washing time to reduce the damage taken by hair (fig. 1). Furthermore, it was discovered that the volume of intermolecular disulfide linkage is reduced by the 1st perming agent, but then increases again during interim washing (fig. 4).

It was therefore discovered for the first time ever that the reformation of intermolecular disulfide linkage via interim washing can be used to reduce the damage caused to hair during perming.

~Conclusion~

It has generally been thought that due to the damage to hair during perming being caused by the perming agents, improvements to those agents were required in order to limit the damage caused to the hair. This research has shown that damage may be controlled not only by the perming agents but also by adjusting the "interim washing" step of the perming process. These results will be used as new technology for the prevention of damage to hair in the development of perming agents and hair straightening agents.

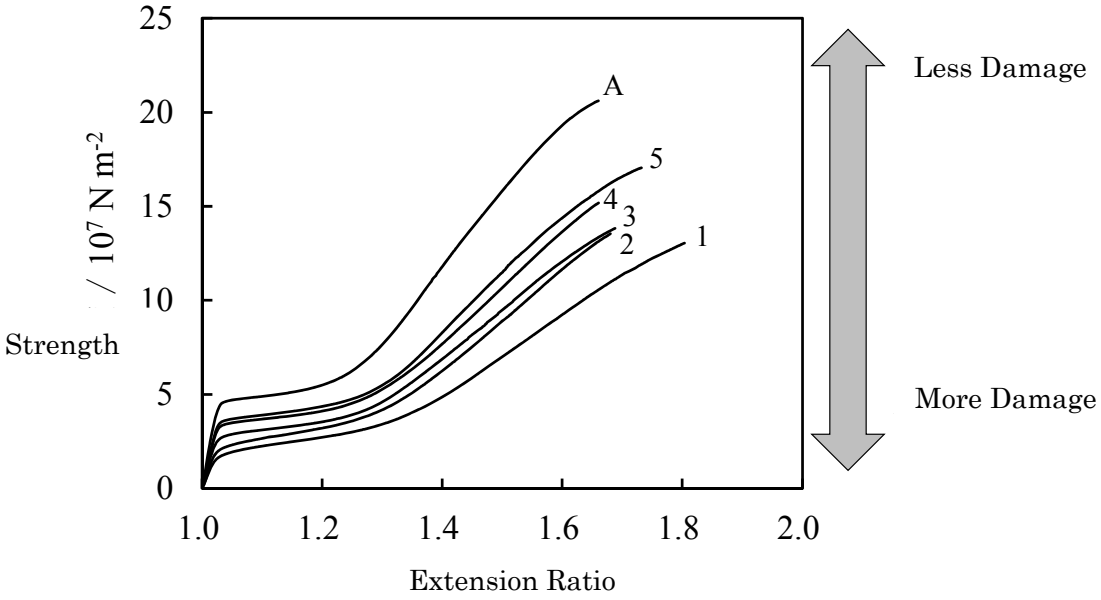


Fig.1 Changes in hair strength due to interim washing length during the perming process.
Interim washing times as 1: 1 min, 2: 20 mins, 3: 4 hours, 4: 24 hours, 5: 72 hours.
A is hair prior to being permed.

The longer interim washing is performed for, the stronger hair remains and the less damage it takes.

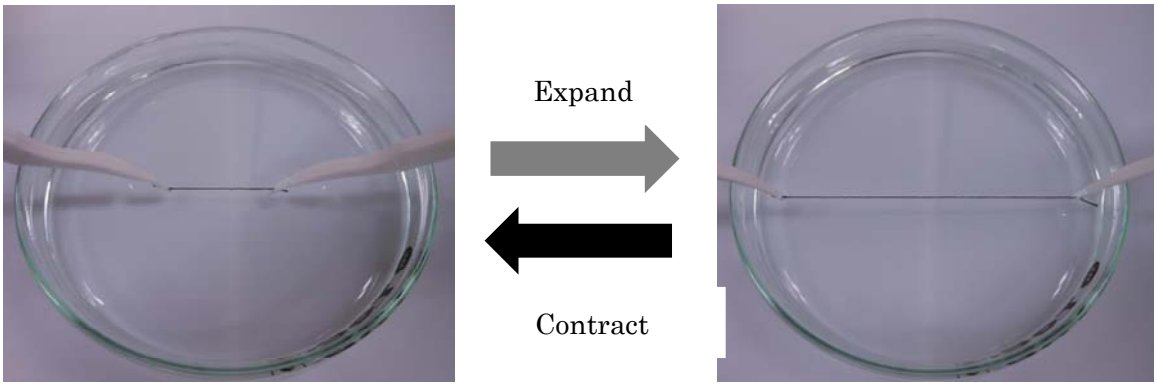


Fig. 2 The expansion and contraction of “elasticized” hair.

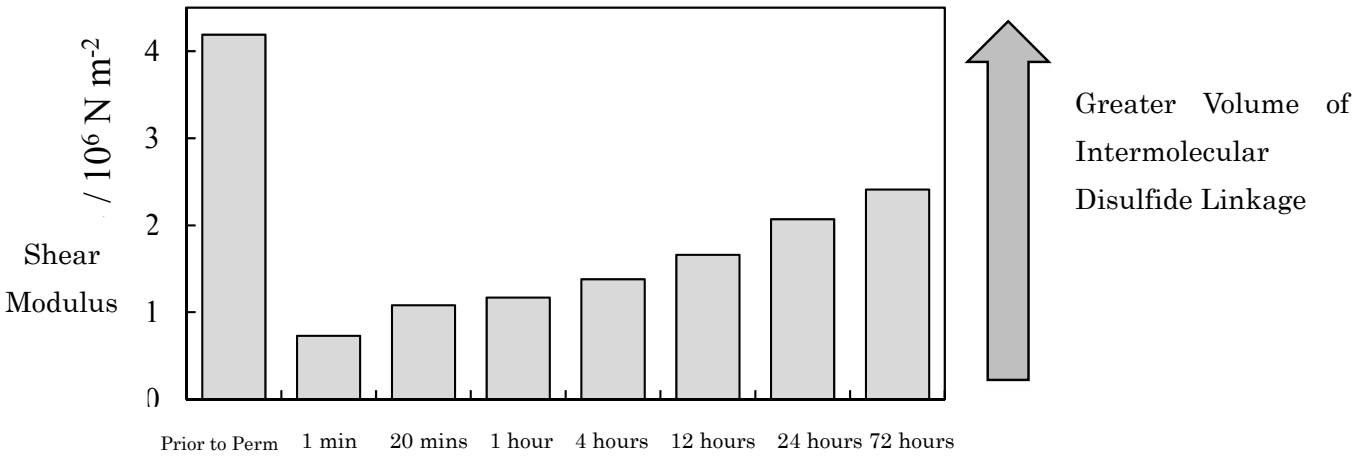


Fig.3 Changes in shear modulus in “elasticized” hair by interim washing time during the perming process.

The longer interim washing is performed for, the greater the volume of maintained intermolecular disulfide links. This trend correlates with the reduction in damage seen in fig. 1.

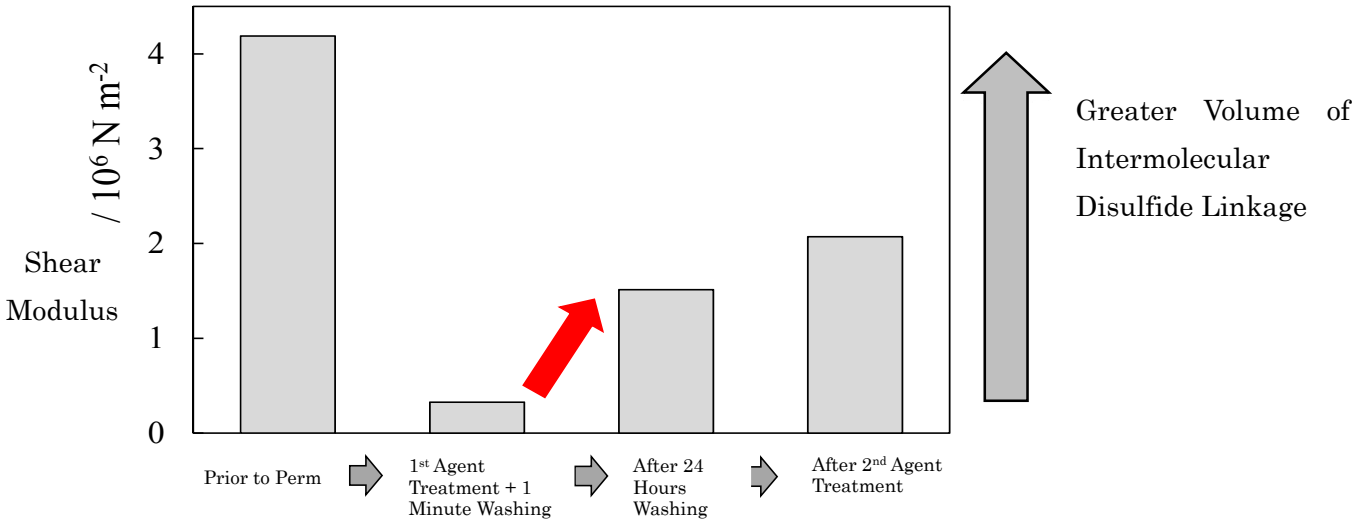


Fig. 4 Changes in shear modulus in accordance with steps in the perming process.

The intermolecular disulfide linkage is reduced by the 1st agent, and then recovered through interim washing.

<<Terminology>>

*1 Perming Agents

The two solutions used during perming (1st agent and 2nd agent) are collectively known as “perming agents.” The reducing agent contained in the 1st agent breaks the disulfide bonds*3 found in hair, and then the oxidizing agent found in the 2nd agent reconfigures the disulfide bonds. Use of the complete perming process brings a curl to the hair.

*2 Tensile Strength

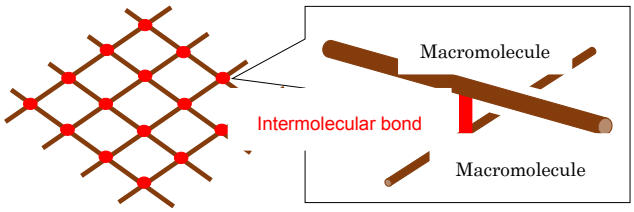
The size of the resistive force in the hair when it is placed under tension. Damaged hair has a lower tensile strength.

*3 Disulfide Bonds

One of the bonds that can form between proteins using two sulfur (S) atoms. Also called SS-bonds.

*4 Rubber Elasticity Theory

A theory established in order to scientifically explain the elastic properties of rubber. Standard rubber is comprised of a concentration of long, string like molecules (macromolecules) joined by many bonds (intermolecular bonds) to create a net-like structure. When rubber like this is analyzed using rubber elasticity theory, the state of the intermolecular bonds can be determined.



The Net-Like Composition of Rubber

■Inquiries relating to the press release
MILBON Co.,Ltd.
Public Relations Unit, 2-3-35 Zengenji-cho, Miyakojima-ku, Osaka
Phone: +81-6-6928-2331, Fax: +81-6-6925-2301

Milbon Co., Ltd / Ryuji Sato, President & CEO; Head Office Miyakojima-ku, Osaka; Securities Code 4919, First Section of the Tokyo Stock Exchange