Discovery of reduced hair coloring sensory irritation using carbonate ions by Mandom

-Identifying the mechanism of "alkali" sensory irritation for the first time in the world-

Mandom Corporation (Head Office: Osaka, President Executive Officer: Motonobu Nishimura, hereafter "Mandom") has been developing products offering "superior feel and function" and that are of "reliable and safe quality." In particular, we have been developing a technique to offer customers with "reliable" products while completely assuring gentler effects on the skin.

As part of this research, Mandom has identified the mechanism of sensory irritation caused by "alkali" jointly with Professor Makoto Tominaga of the National Institutes of Natural Sciences. Furthermore, using this mechanism we discovered the possibility of reducing sensory irritation from hair coloring by using carbonate ions.

At Mandom, we are adopting this technique to reduce sensory irritation for "GATSBY Bubble Bleach Hair Color" and "LUCIDO-L Bubble Hair Color," which will likely be available this spring.

Mandom is attempting to further explore this technique to improve the product "reliability" from a consumer perspective.

Furthermore, we presented the results of this study at the "The 26th Congress of the International Federation of Societies of Cosmetic Chemists (IFSCC)" held from September 20 to 23, 2010 in Argentina.

1. "Alkali" are the cause of sensory irritation from using hair color

Many people experience "tingling" and "stinging" sensory irritation on their scalps when using hair coloring. Mandom discovered that it is often caused by "alkali" (ingredients to increase pH) that are normally added to hair coloring (excluding manicures, etc.). "Alkali" are needed, both for color removal by breakdown of melanin in the hair, and coloring through dye polymerization, which are essential for hair coloring. Previously, addition of excessive "alkali" was considered to augment the dyeing effect, but it also simultaneously increases the sensory irritation of the scalp. In addition, the mechanism of sensory irritation from "alkali" is unknown, and therefore, there has been no definitive approach to reducing it.

* "Alkali" are medically known to cause pain, including the "tingling" pain from illnesses as the blood alkalizes due to hyperventilation (hyperventilation alkalosis) and nasal mucosal pain caused by ammonia gas.

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2. Identifying the mechanism of “alkali” sensory irritation for the first time in the world

Mandom has focused on “TRP channels”. Recent research confirms that these are receptors of chemical irritants and temperature. Exploiting these receptors, Mandom has developed an alternative technique for evaluating sensory irritation. Mandom is pursuing various studies to reduce the slightest unpleasant “sensory irritation” caused in rare instances by “safe” cosmetics that do not trigger inflammation. Among the TRP channels, we identified that TRPA1, a receptor for spicy ingredients in wasabi and pepper, is activated by “alkali” (Fig. 1). Furthermore, the mode of action is identical to the activation of TRPA1 due to intracellular alkalization by “alkali” (especially ammonia) (Fig. 2).

3. Discovery of carbonate ions for reducing sensory irritation from hair coloring

Mandom hypothesized that sensory irritation from hair coloring could be reduced by preventing intracellular alkalization. Therefore, the quest for ingredients capable of inhibiting intracellular alkalization due to “alkali” commenced. We discovered that “carbonate ions” are able to inhibit intracellular alkalization (Fig. 3). So, we first, confirmed the ability of “carbonate ions” to reduce sensory irritation using a sensory irritation evaluation method for hair coloring involving sensitive subjects recruited by Mandom. Based on the results, we confirmed that sensory irritation caused by hair coloring could be reduced by adding “carbonate ions” (Fig. 4).

4. Application of carbonate ion-based sensory irritation reduction to new spring 2011 products

At Mandom, we are applying this sensory irritation reducing technique to “GATSBY Bubble Bleach Hair Color” and “LUCIDO-L Bubble Hair Color,” which will be available by spring 2011. We shall continue refining this technique so many more consumers are able to enjoy hair coloring without experiencing unpleasant “tingling” or “stinging” sensory irritation.

<Reference material>

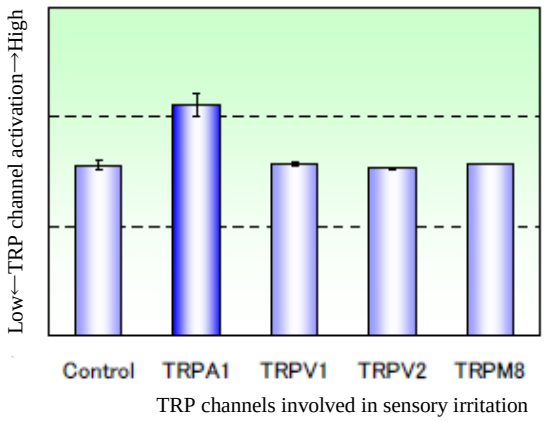

Fig. 1. Effect of alkali on TRP channels

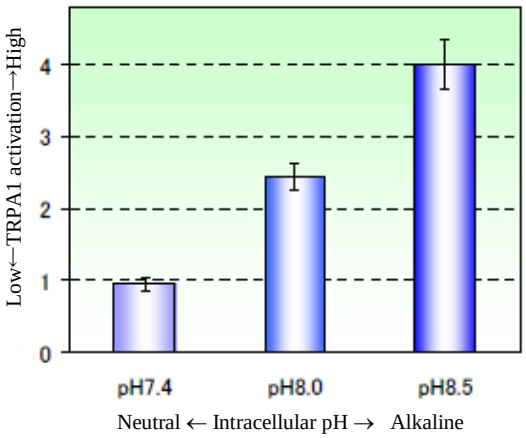

Fig. 2. Effect of intracellular alkali on TRPA1

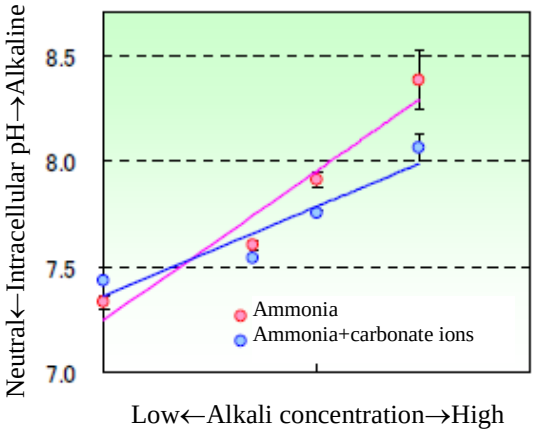

Fig. 3. Effect of carbonate ions on intracellular alkalization

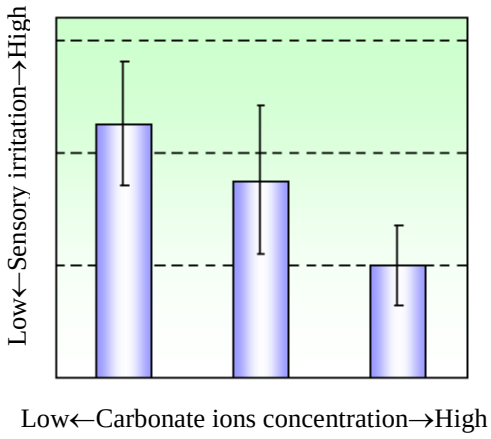

Fig. 4. Suggested sensory irritation with carbonate ions

<Mechanism of sensory irritation>

Thanks to the recent progress in life sciences that has led to the identification of “irritation sensors” in nerve cells in the skin. These sensors detect chemical substances and temperature, convert the sensory signal to electrical signal, which is key to sensory irritation (Fig. 4) cascade. “Tingling” and “stinging” irritation partly resembles temperature perception. It has been reported that irritating sensations and temperature perception are perceived via the same sensor, namely the “TRP channels” (Fig. 5).

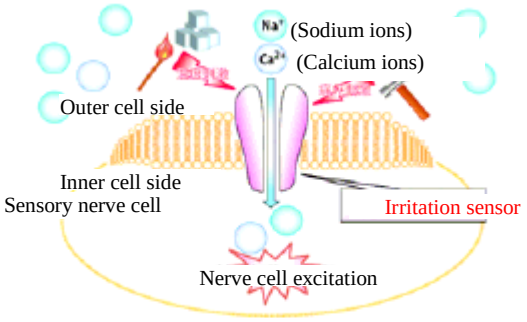

Fig. 4. Irritation sensors in sensory nerves

TRP channels have recently gained attention as receptors present in the skin and sensory nerves functioning as sensors. Typical examples include TRPV1, the receptor for capsaicin (main ingredient in chili pepper) and TRPM8, the receptor for menthol (main ingredient in mint). Many ingredients added to cosmetics generally cause sensory irritation and activate the TRP channels. Examples include citric acid, lactic acid, alcohols and camphor.

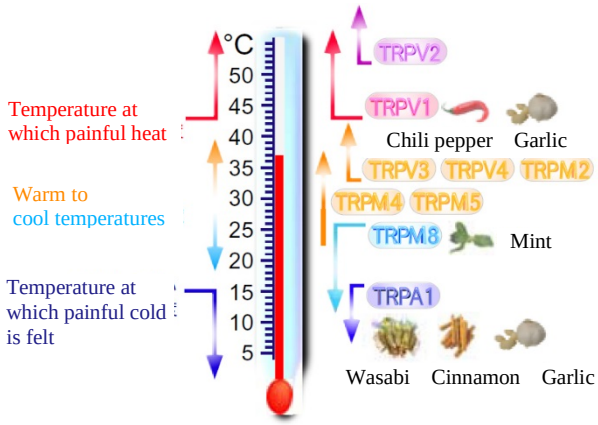

Fig. 5 TRP channels receiving temperature and irritation