Mandom Succeeds in Developing White Activated Carbon, Which Has Higher Adsorbing and Deodorizing Ability for Odor-causing Compounds without Appearing Black on the Skin after Application

Mandom Corporation (Head Office: Osaka, President Executive Officer: Motonobu Nishimura, hereafter "Mandom") has, in the interest of marketing deodorant products with superior deodorizing ability, been developing ingredients with high efficacy. In this study, we focused on activated charcoal, a substance with high deodorizing and adsorptive properties. We developed a form of activated carbon (high-adsorbent activated carbon) highly capable of adsorbing odor and sweat compounds, the causes of body odor. Further, in order to incorporate this high-adsorbent activated carbon into a deodorant that does not wash away, we undertook efforts to whiten it and have successfully developed a form that does not appear black when applied to the skin, which we have named "white activated carbon."

This technology has enabled the implementation of activated carbon in a deodorant that does not wash away. We have obtained a patent (No. 6084234) for this compound.

1. Developing High-adsorbent Activated Carbon: Specialized for the Uptake of Odor-causing Compounds and Suitable for Deodorants

As a part of this research, we tested 25 types of powders used in cosmetic products for their ability to adsorb sweat compounds that result in armpit odor and middle-aged oily odor (lactic acid, pyruvate, 3-hydroxy-3-methyl hexanoic acid-glutamine, etc.). We confirmed that activated carbon had the best adsorptive properties against sweat compounds released from the body (Figure 1). Further, we found that different types of activated carbon had different levels of adsorptivity; we named the form that was the most adsorptive of sweat compounds "high-adsorbent activated carbon" and continued to investigate its application to deodorants.

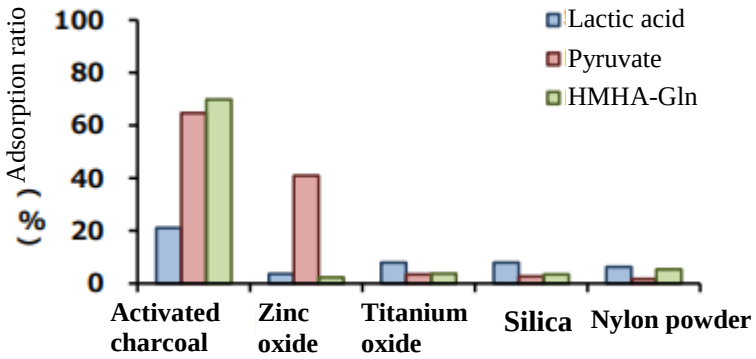

Figure 1: Comparison of Adsorptivity of Powders on Sweat Compounds

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2. Using High-adsorbent Activated Carbon to Develop a Form Applicable to Deodorants: White Activated Carbon

In order to incorporate high-adsorbent activated carbon into a deodorant that does not wash away, we bound it to the sort of adhesive compound used in eye makeup. By coating it with an appropriate amount of titanium oxide, we whitened it (Figure 2).

A large amount of titanium oxide would certainly turn activated carbon white, but it would also clog the pores on the surface of the substance that adsorb odor-causing compounds. In other words, its deodorizing and adsorptive properties would decrease. Conversely, if we added too little titanium oxide, such that the activated carbon's deodorizing/adsorbing properties would be preserved, it would appear black when applied to skin; therefore, it could not be included in a deodorant that does not wash away. At Mandom, we tested via trial and error the ratios and incorporation methods of these compounds and succeeded in developing a white activated carbon that does not appear black on the skin.

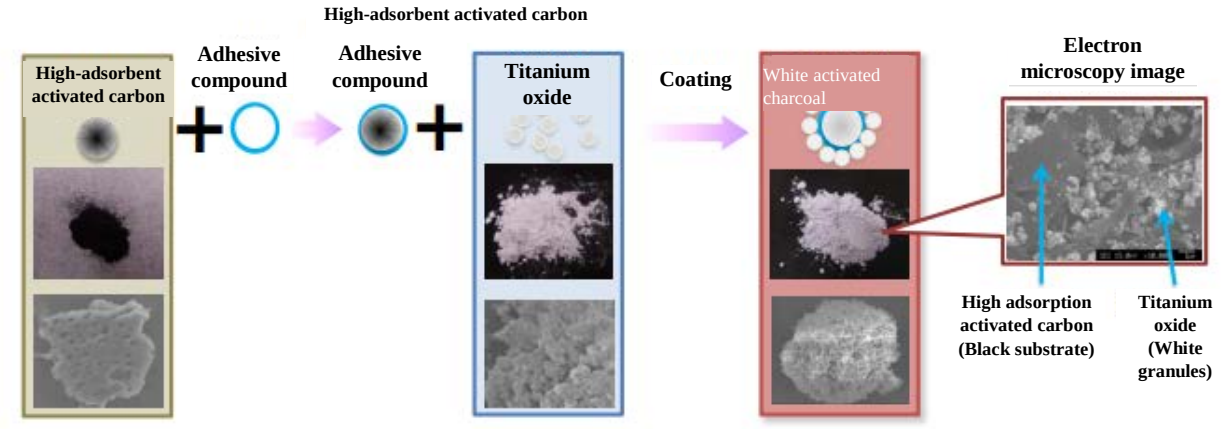

Figure 2: Manufacturing Method of White Activated Carbon

3. We investigated the deodorizing properties of white activated carbon manufactured

from high-adsorbent activated carbon (hereafter, white activated carbon) by using the causative compounds of middle-aged oily odor, aging body odor, sweaty odor, and foot odor. Compared to zinc oxide, often used as a deodorizing powder, white activated carbon had higher deodorizing power on diacetyl (causative compound of middle-aged oily odor) and 2-nonenal (causative compound of aging body odor; Figure 3). Despite the fact that zinc oxide had high deodorizing power against acetic acid (causative compound of sweaty odor), white activated carbon also deodorized it with over 75% effectiveness. White activated carbon and zinc oxide had roughly equal deodorizing power against isovaleric acid (causative compound of sweat and foot odor).

Taken together, these findings suggest that white activated carbon has high deodorizing power against various body odors.

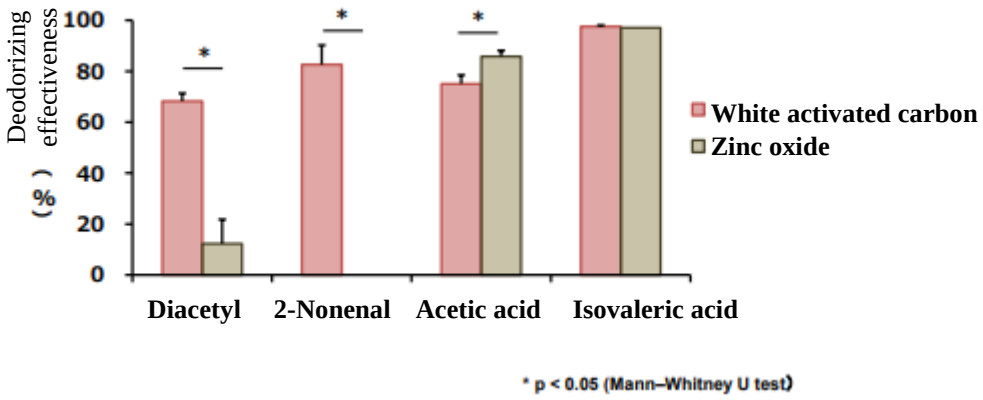

Figure 3: Comparison of Deodorizing Power of White Activated Carbon against Body-odor-causing Compounds

4. White Activated Carbon Retains its Deodorizing Properties against Body-odor-causing Compounds even in Prepared Products

We investigated the deodorizing powers of a deodorant stick with 1.0% white activated carbon and another without any white activated carbon against diacetyl (causative compound of middle-aged oily odor) and acetic acid (causative compound of sweaty odor) and found that the stick with white activated carbon had significantly higher deodorizing power against diacetyl and acetic acid (Figure 4). This result indicates that white activated carbon retains its deodorizing properties in formulations.

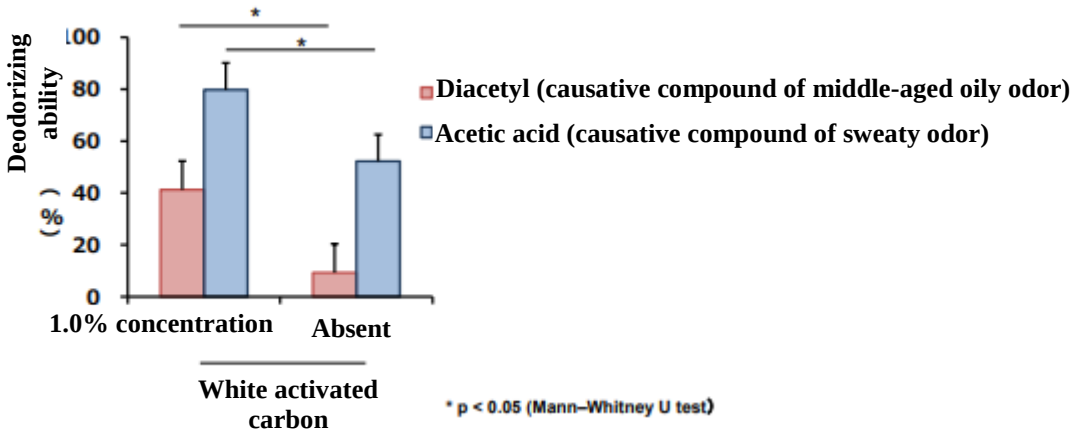

Figure 4: Comparison of Deodorizing Effects Based on the Presence or Absence of White Activated Carbon

We plan to sequentially incorporate this newly developed white activated carbon into deodorants that will be marketed in the future.

[Reference]

<u>Adsorption Mechanism of Activated Carbon and Adsorption Differences</u>

Activated carbon is a product obtained by carbonizing coconut shells and the like at high temperature (turning them into carbon) and then heat-treating (activating) the resultant product at temperatures as high as 1000°C. This activation process produces fine holes (pores) on the surface of the activated carbon where various components can enter and become adsorbed (Figure 5). The size of these pores (pore diameter) determines the components that can be adsorbed as well as the overall adsorption power. Thus, using activated carbon with a pore diameter that increases its adsorptive power for a given component is necessary.

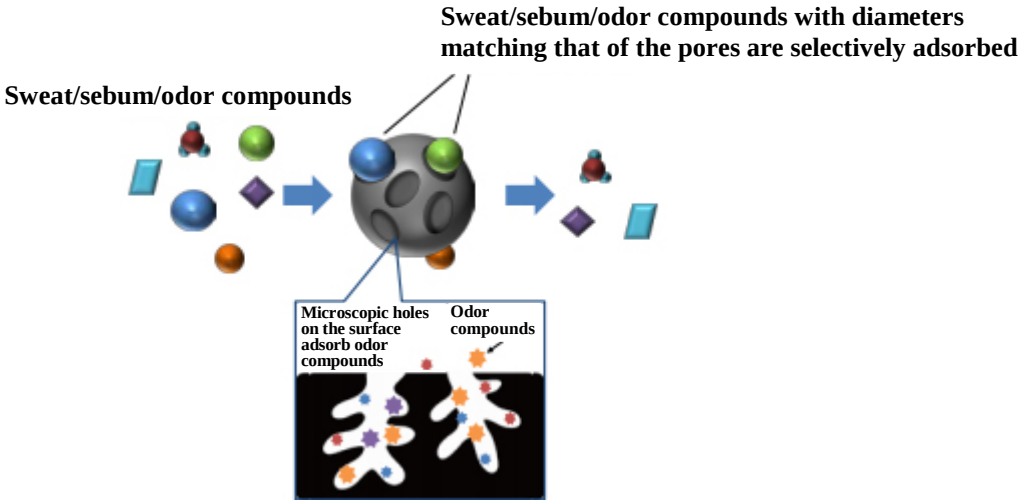

Figure 5: Adsorptive Mechanism of Activated Carbon