Analyzing the Touch Quality of Formulations on Human Hair and Skin

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Abstract

Tactile touch is becoming more and more key in the perceived value of formulas in cosmetics for their efficacity when applied to hair or skin in vivo. This creates the necessity of having an objective and quantitative way to characterize and evaluate a formulation and its corresponding tactile perception when applied on hair on skin. The goal is to finely analyze the tactile sensation of human hair under different skin and hair preparation conditions and make the link with the formula characteristics (surface modification, rheology of the formula, etc.).
We used a connected and augmented patented technology: "TouchyFinger"(i) to perform this study. This device (instrumented by force and vibration sensors.) is used to be adapted on the human finger and measure the contact force and vibrations generated by friction during its movement. A particularity of this device is that it allows to work in vivo on free gestures that are closer to those used by consumers, for example, kneading wet strands of hair or applying a cream with a circular movement. It is equipped with a vibration frequency analyzer that can identify the average vibration level in decibels (dB), time frequencies and wavelengths of vibrations in each frequency band of the mechanoreceptors. The spectral analysis developed makes it possible to sample the average vibrational level in the mechanoreceptors located at the boundary between the epidermis and the dermis: Merkel (0.3 – 3Hz), Meissner (3 – 50 Hz), as well as the deep mechanoreceptors located at the level of the dermis: Ruffini (50-300 Hz) and Pacini at the level of the hypodermis (300 – 1000 Hz). On each of the frequency bands, the average vibration level in dB, the frequency centroid and the vibration wavelength in the same frequency band are quantified. All of these three parameters make it possible to reconstruct the vibration signal in the frequency band of each mechanoreceptor and to quantify an indicator of the tactile acuity of the hair.

Initially, we analyzed the surface roughness with a multi-scale wavelet analysis method(ii) Then we measured the tactile sensorial properties of the samples using "TouchFinger".The experimental protocol was conducted on a diversity of samples : strands of hair of different sensitization level and in vivo on hair and skin traited with several products. To stablish the

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protocol of frequency-touch correlation, a first evaluation of the touch of the samples was done by a small panel of 3 people, aged 22 to 30 years, trained to the same gesture. They performed 3 succesive touches and replicated the measurement 2 times.

The average values obtained of the La (dB) parameter for each of the mechanoreceptors were analyzed in correlation with the treatment used and the surface topography. The results show the richness of the spectral analysis and allow for the first time to quantify indicators of the stimulation of cutaneous mechanoreceptors that are sensitive to contact and friction of complex textures in cosmetic treatments.

(i) Patent FR3099359

(ii) S. Mezghani, H. Zahouani, J.-J. Piezanowski, Multiscale characterizations of painted surface appearance by continuous wavelet transform, Journal of Materials Processing Technology, Volume 211, Issue 2, 2011, Pages 205-211.