Development of Concept behind “ASTALIFT Light Analyzing Moisture Foundation”


Abstract

Within the spectral reflectance of skin for the typical Japanese individual exists a concavity in wavelengths between 550 and 600 nm, which corresponds to yellow light. On the other hand, the spectral reflectance of conventional foundations has no such concavity. Therefore, skin with make-up applied appears different from bare skin under certain types of light and conditions. The angular profiles of the light source can also affect the apparent skin tone. So as to rectify this, we have developed “ASTALIFT Light Analyzing Moisture Foundation” to correct the apparent tone of made-up skin under a variety of light sources in daily life.

1. Introduction

We have launched an anti-aging functional cosmetic line, the ASTALIFT Series, based on the original technology we have acquired through development of photographic films. Since then, we have been developing skincare cosmetics. These cosmetics have gained a good reputation. Customers say “These cosmetics do work,” “They are good for skins,” or “They are perfect for my skin.” Next, customers have wanted foundation and other makeup bases of the series.

“ASTALIFT Light Analyzing Moisture Foundation” launched in September 2011 (Fig. 1) is the first makeup base of the ASTALIFT Series. It is the product of our expertise on “beautiful skin tone” we have sought in development of photographic films and digital cameras. We have developed this new product to embody an utterly new concept. Skin tone looks beautiful or it does not look very nice depending on light source, which varies from place to place and time to time of a day. The effect of light is determined by three factors: (1) type of light source (spectral distribution), (2) intensity of light source (illuminance) and (3) light distribution pattern (angular distribution of light). We have researched into ways of improving the appearances of the skin tones of women's made-up faces, which vary with combinations of those factors of light source.

Fig. 1   ASTALIFT Light Analyzing Moisture Foundation.

2. Functions of Foundation

The purpose of foundation in making up is to cover blemishes on the skin, such as spots, freckles and open pores. In addition to the basic purpose of (1) hiding blemishes, foundation is increasingly required to (2) give a natural finish, (3) keep the makeup in place and (4) make the skin not dry. The requirement (2) means that blemishes are covered up and that the makeup does not look heavy. It is important for finishing of makeup. Ideal foundation must provide both coverage and transparency to the skin. That is said to be impossible in principle as they are completely opposite characteristics1). The ultimate goal in pursuit of beautiful finishing of makeup is that foundation covers up skin blemishes while giving a natural finish. Leading cosmetics manufacturers have worked toward this goal in various approaches1), 2).
3. Desirable Skin Tone

3.1 Various Light Sources and Skin Tones

We are exposed to light of various sources different in spectral distribution (Fig. 2). The skin tone often looks beautiful when you are in evening sunlight outdoors or in incandescent light at a restaurant. The skin tone, however, looks surprisingly bad when you look at your reflection in a windowpane on a train at night or on a subway. Our survey on women shows that 80% of the respondents are dissatisfied with the fact that appearances of their skin tones vary with light and that they want to improve it.

There are various skin tones and their reflectance spectra vary, too. Tones of bare skins differ according to race, gender, age, living environment, season and physical condition. The skin tones on prints or those of foundation greatly differ from those of bare skins in that they do not have the so-called “spectral concavity,” which the skins of most Japanese people have. Spectral concavity is a drop in the reflectance curve in the wavelength range of 550 nm to 600 nm (Fig. 3). The spectral concavity tends to be more noticeable when the transparency of the skin is higher.

A person identifies a skin tone in this process. The photoreceptor cells of the eyes receive the spectrum of the light source combined with the spectral reflectance of the skin as a stimulus. The received stimulus is transmitted to the brain. For example, when the light source is changed from fluorescent light (three-band) to sunlight, even if they are the same in color temperature (they look the same in color), changes in appearance are different between the tone of a bare skin and the tone of conventional foundation. Compared with a bare skin, conventional foundation has a high reflectance in the yellow part (Fig. 3). The similar differences are observed between different types of fluorescent lamps (e.g., three-band lamp to daylight white lamp) or to LED light (blue + yellow type), which is rapidly becoming popular. Finishing of makeup with foundation often looks unnatural due to various causes. We have decided that the light-source-dependent difference from a bare skin is one of the causes and have explored ways of improving it.

3.2 Angle of Light and Skin Tone

When surroundings are dark and light comes almost from one direction, for instance on a subway train, your skin tone does not look good (Fig. 4). The parts of the face that specularly reflect the fluorescent light coming from above, such as the forehead and cheekbones, look brighter than the other areas and the skin tone is lighter (like over exposure in photography). Specular reflections by the jaws under the cheekbones do not reach the eyes of a person who is looking at her but only weak diffuse light reaches them. As a result the skin tone looks darker. This means that skin tones vary greatly with the angle of light. When the light angle distribution is inadequate, sagging by aging and shadows under the eyes are emphasized and the skin tone looks bad.

![Fig. 4 A snapshot of a woman on the subway.](image)
3.3 Desirable Skin Tones in Photography

In our long history of photographic film development, we have researched into ways of smoothing out differences in skin tone to achieve pictures of desirable faces. We have found various ways to minimize the gaps between light and dark tones of a face in a picture. Among them, we have developed techniques for preventing a decrease in chroma saturation in the lighter skin tones (over exposure) and making them closer to natural skin tones in shooting, development and printing processes. In the development of this new foundation, we sought to reproduce the desirable skin tone of a 2D picture on a 3D made-up face.

4. Improvement of Skin Tone Appearances in Various Light Sources

4.1 Improvement of Yellowing by Change in Lighting

To reduce the light-source-dependent difference between foundation and bare skin, which causes yellowing of foundation appearance by change in lighting, we have developed organic-inorganic composite powder, Light Analyzing Powder, and launched new foundation that uses organic pigment instead of iron oxide for some of the color materials. We tested the new foundation on a woman in her 50s. We applied equal amounts of the conventional foundation (basic formula) and the new foundation on her cheeks and compared the reflection characteristics. The new foundation has reproduced the drop in the wavelength range of 550 nm to 600 nm, which bare skins have (Fig. 5).

We applied the conventional foundation to one side of the woman’s face and the new foundation to the other until the two sides appear to wear the same amount of makeup. We took a photo of the face in sunlight. The new foundation gave the face a healthy complexion and a natural and desirable skin tone (Fig. 6a).

4.2 Smoothing out Differences in Skin Tone

Light Analyzing Powder used for the new foundation reflects light of skin tone specularly. We applied this new foundation and the conventional foundation in equal amounts to a model sheet. We measured lightness, chroma and hue angle of reflections in various directions from specular reflection to diffuse reflection using a spectro-goniometer (-45 degrees incidence) and compared them between two types of foundation. Changes by light angle in chroma of the new foundation are smaller (Fig. 7).

We applied the conventional foundation to one side of a woman’s face and the new foundation to the other until the two sides appear to wear the same amount of makeup. We took a photo of the face in a dark room with a fluorescent lamp placed above her. The new foundation reduced the differences between skin tones and improved the appearance of skin tone (Fig. 6b).
5. Other Characteristics

5.1 Coverage
ASTALIFT Light Analyzing Moisture Foundation covers up skin blemishes, such as spots (Fig. 8).

5.2 Moisture Retention
This new foundation contains astaxanthin and watersoluble collagen, which are common ingredients of ASTALIFT skincare series, as beauty components to retain moisture (Fig. 9).

5.3 Perspiration Resistance and Sebum Resistance
The new foundation is provided with perspiration resistance and sebum resistance to prevent makeup from wearing off due to perspiration and sebum (Fig. 10).

5.4 Texture
The new foundation provides an airy moist texture, which is difficult to achieve with the conventional formulae of powder foundation. We have achieved it by optimizing the manufacturing process.

6. Conclusion
ASTALIFT Light Analyzing Moisture Foundation is the first makeup base of the ASTALIFT Series. It is a unique product based on the original concept only Fujifilm, an expert on light and color, can come up with. Using the newly developed Light Analyzing Powder, we have achieved spectral reflectance characteristics that bring the light-source dependence of skin tone to that of a bare skin and the reflection-angle dependence that smoothes out differences in skin tone.

We will continue to improve Light Analyzing Powder and develop highly user-beneficial functional cosmetics to enhance women’s quality of life.

References
1) Katsuyama, Tomosuke. Functions of foundation and issues in development. Proceedings for the 140th FJ seminar. 2-6 (2010).

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