HORIBA Scientific

Application Note

Particle Size Analysis of Cosmetics

AN161

Cosmetics can be defined as products or substances that protect or enhance the appearance or odor of a human body. Many cosmetic products include particulate material or emulsions. Some examples of cosmetic products consisting of or including particulates include facial powders, moisturizers, and lipstick. Particle size analysis of cosmetics is used to study formulation, characterize raw materials, perform quality tests on end product, and potentially determine the amount of nano-particles in a product.

Facial Powders

By definition, any cosmetic product including powders features particulate material and could require control and measurement of the particle size distribution. Foundation provides full coverage while finishing powders can help set the foundation and provide additional specific appearances by reflecting light in flattering colors or diffusing light evenly over the surface of the skin. Facial powders may include talc, kaolin, iron oxide, rice powder, zinc oxide, and titanium dioxide. Additionally, face powders provide sunscreen-like UV protection with the inclusion of strong light scattering components such as zinc oxide. The particle size distribution of these components effects appearance, feel, stability, and sunscreen protection.

The LA-960 measures the particle size distribution of these powders either in the natural, dry powder state, or dispersed in a liquid medium.

Figure 1 shows the particle size distribution of food and cosmetic grade rice powder - an alternative to using talc in foundation formulas. It is also used as a setting powder/mineral veil in place of cornstarch.

Figure 2 shows particle size distribution results for mica, also analyzed as a dry powder using the LA-960 PowderJet feeder. Mica powder is created from the crushed, purified mineral. It is available in a variety of different colors and can add opalescence, sparkle or a matte finish to cosmetic powders. Some mica powders have a shimmer effect that makes them also known as glitter.

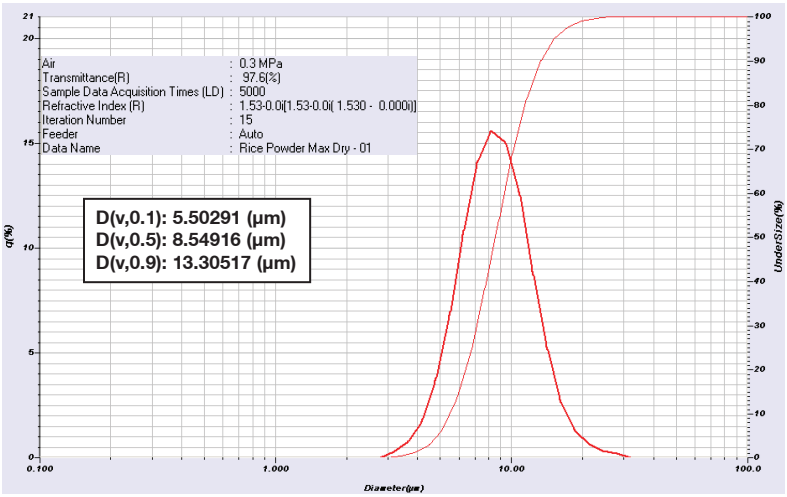

Figure 1: Rice Powder

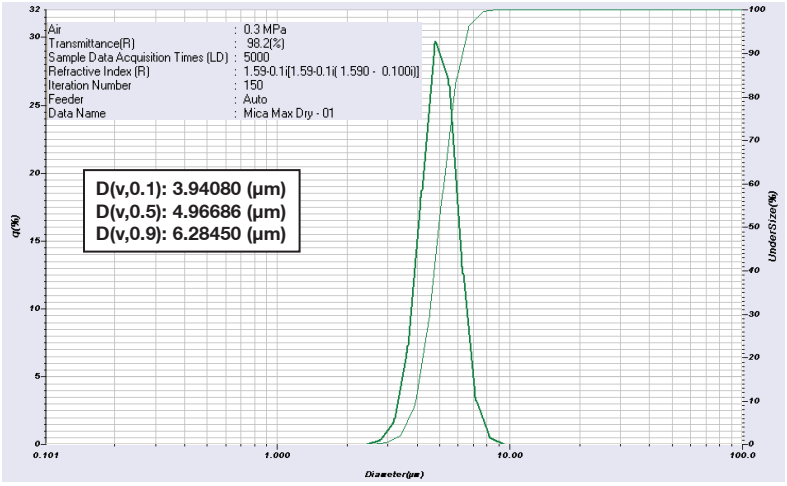

Figure 2: Mica

Figure 3 shows the particle size distribution of gold glitter powder measured both as a dry powder and also dispersed in water. The close agreement between the two measurements indicates that either approach to the measurement is equally valid.

Figure 4 shows particle size distribution data for kaolin measured as a powder dispersed in water. Kaolin is used for many purposes: filler, moisture absorbent, toner for oxide pigments, and powder flow aid.

Figure 5 shows particle size distribution data for red iron oxide shade 170. This powder is used as a pigment to provide undertones in foundation blends, blushes, eye shadows and lipstick. Particle size factors into the even distribution and application of color.

Particles Below 100 nm

A recently published document by an NGO(1) has suggested that it would be safer for the public if no cosmetic products contained particles below 100nm. A document from the cosmetics industry (2) also addresses this issue, reaching a different conclusion. The FDA has reacted (3) by essentially stating that more investigation in peer reviewed articles is required before action or regulation is required.

This application note takes no stance on the subject other than agreeing that peer reviewed articles are the proper place for the exchange of scientific information, but does present data from a cosmetic ingredient and one complete formulation showing the percent of the total particle concentration detected below 100nm. HORIBA sells several instruments capable of measuring particles in this size range including the LB-550 dynamic light scattering (DLS) system, the DT-1200 acoustic spectrometer, and the LA-960 laser diffraction particle size analyzer.

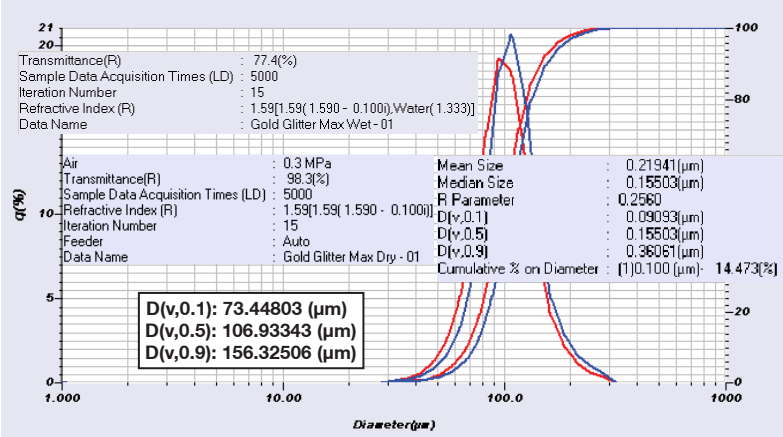

Figure 3: Gold Glitter Powder

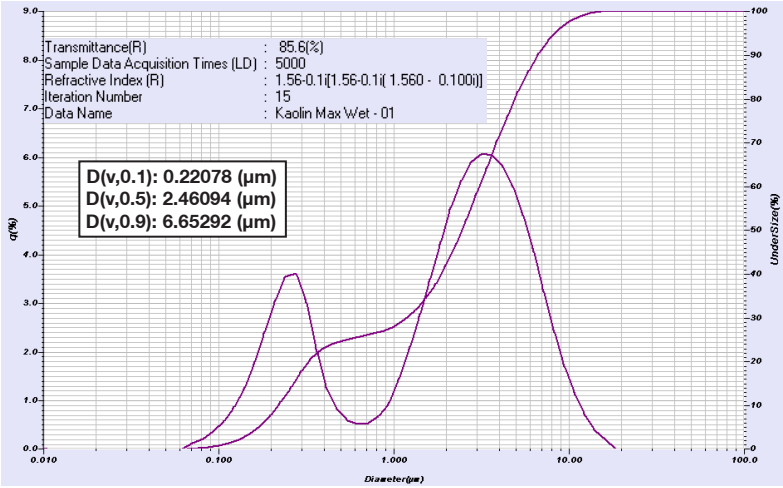

Figure 4: Kaolin Clay

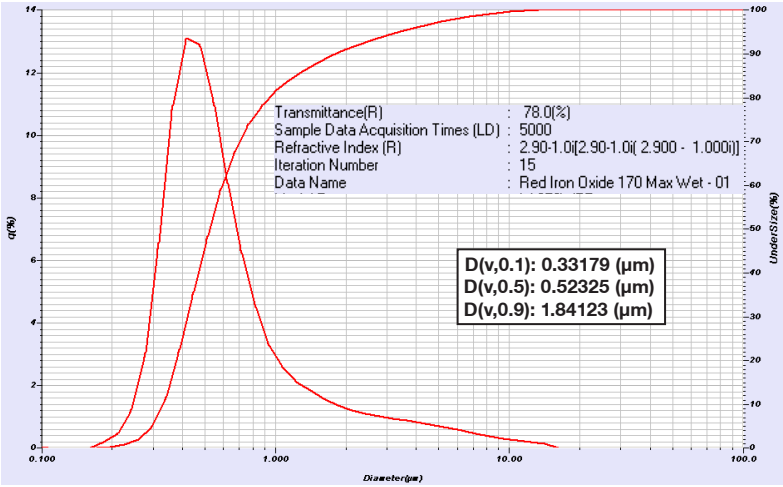

Figure 5: Iron Oxide – 170 Shade

Titanium Dioxide

TiO2 is used in cosmetics both as a pigment and a sunscreen. Much of the TiO2 produced in the world is currently analyzed for particle size distribution on HORIBA laser diffraction systems. A bulk sample of TiO2 powder was dispersed in water using a surfactant and ultrasound before measurement on the LA-960 (Figure 6). Note that 14.5% of the sample falls below 100nm in the dispersed phase as analyzed in the system.

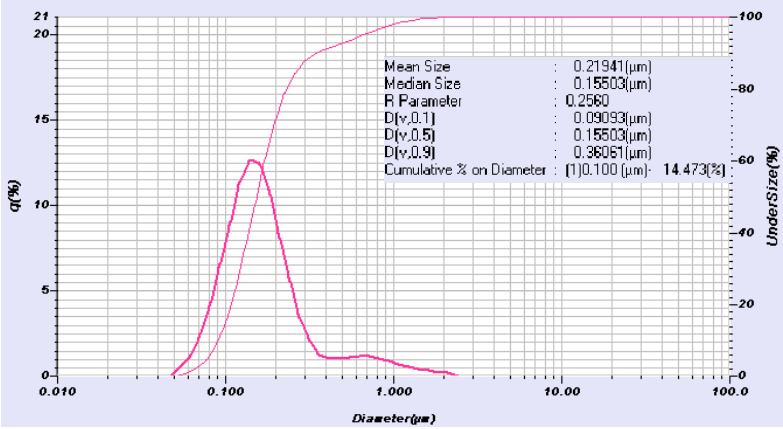

Figure 6: TiO2

Skin Cream

A boutique skin cream purchased over the counter was measured on the LA-960. The main peak seen in Figure 7 centered near 200 nm is most likely micro-emulsion droplets, with 9% lying below 100 nm. A more detailed understanding of the cream composition would be required to draw further conclusions other than stating the LA-960 accurately detected particles/droplets below 100 nm.

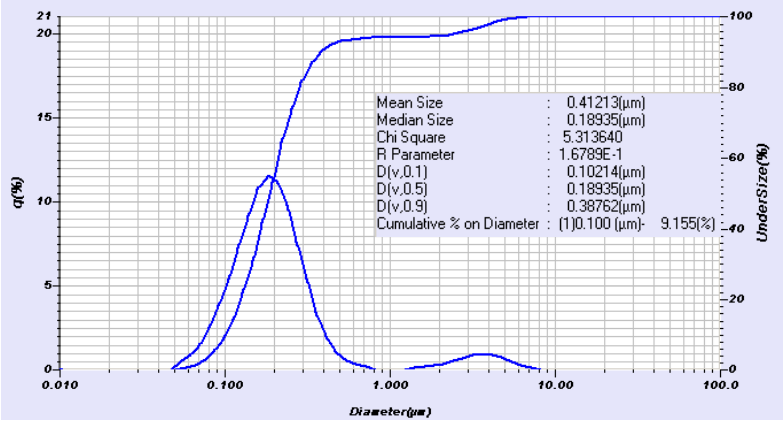

Figure 7: Skin Cream

Zinc Oxide

Another metal oxide used as both a pigment and sunscreen is zinc oxide. Two formulations of zinc oxide were analyzed using the DT-1200 acoustic spectrometer. Figure 8 shows the acoustic attenuation spectrum for the formulations, while Figure 9 shows the particle size distributions including the sub-100nm nanoparticles range.

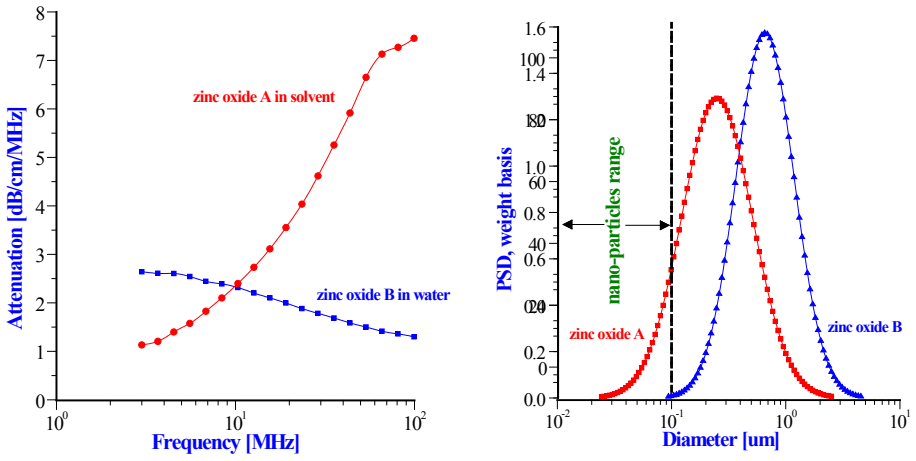

Figure 8 & 9: Zinc Oxide

References

1. Nanomaterials, sunscreens, and cosmetics: small ingredients big risks, Friends of the Earth Report, May 2006.

2. Comments of the Cosmetic, Toiletry, and Fragrance Association (CTFA) Regarding the Scientific and Legal Issues Associated with Nanotechnology in Personal Care Products

3. Nanotechnology: A Report of the U.S. Food and Drug Administration Nanotechnology Task Force, July 25, 2007

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