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Creating a Streamlined and Inclusive Shade Palette for the USA and the UK

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Introduction:

Companies marketing color cosmetics for face may update their color palette over time as demographics, regulations, and trends or needs change. Many brands offer a large number of foundation shades sometimes exceeding 50 choices. The purpose of our study was to create a smaller, optimized version of a foundation shade palette to satisfy consumers for skin tones and undertones (warm, cool, and neutral) in the USA and UK [Table 1], [1, 2].

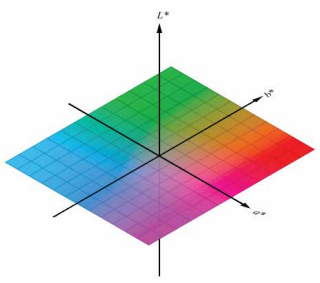
Demographics	USA	UK
Total Population	335 million	67 million
White/Caucasian	60.1%	87.1%
Hispanic or Latino	18.2%	Not Reported
Black or African American	12.2%	3.0%
Asian	5.6%	7.0%
American Indian/Alaska Native	0.6%	N/A
Native Hawaiian	0.2%	N/A
Multiracial or all other ethnic groups	3.1%	2.9%

[Table 1]

There is a complex structure of color and optics within the skin matrix. Melanin (pheomelanin and eumelanin), hemoglobin (oxygenated and reduced), beta carotene, and bilirubin are the primary skin pigments absorbing light. Collagen, capillaries, veins, and blood vessels are scattered, refracted and reflected by light providing an undertone.

Materials & Methods:

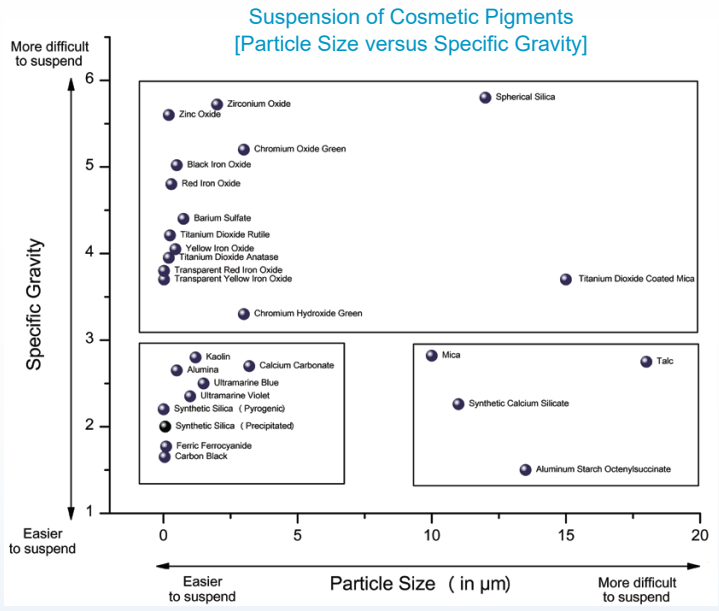
We used the CIELAB color space, L* (light/dark), a* (red/green), b* (yellow/blue), as well as the CIELCh coordinates, chroma and hue, as needed [Fig. 1]. When measuring color we made use of the D65/10 illuminant for skin and drawdowns as well as CIE D50/2 for print. Drawdowns were made on uncoated Leneta cards at 6 mils wet and allowed to dry using Cabnal smartheat technology before color measurements were taken using Datacolor spectrophotometers, Microflash D200 and 500.



[Fig. 1] *

In order to create guiding charts and the formulation of color mixes we made over 500 L.a.b. measurements. For software, we utilized the Adobe Color Wheel, Adobe Photoshop and Design Expert, a statistical tool, to create color mixes. We ran consumer tests to identify the best 18 shade palette from printed charts. After the 18 shades were formulated we tested them on consumers to assess their overall satisfaction in color selection on skin.

We incorporated grades of zinc oxide and titanium dioxide in a W/O emulsion base that provided the highest transparency necessary for deeper tones while adding more opaque pigments and powders to achieve the color targets. We tested the products by shipping them over long distances (200 miles), centrifugation, and vibrational testing to assess stability [Fig. 2].



[Fig. 2]

Results & Discussion:

COLOR

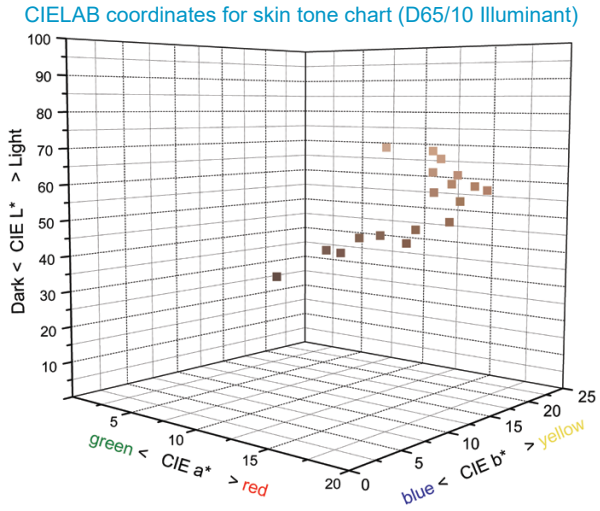
Yellow, red, and black iron oxides with ultramarine blue and violet together with mica, and transparent or pigmentary forms of titanium dioxide & zinc oxide provided a palette to achieve the tonal colors we were seeking [Fig. 3].
Ultramarine pigments were key in achieving deeper tones because of their lower refractive indices and proximity to the dispersion medium [3]. The medium in which the pigment is dispersed helps to determine the final opacity of the pigment and can increase transparency [4]. Optical variable pigments were also explored to both enhance skin tone and neutralize undertones [5].

Mixtures of yellow, red, and black iron oxides with ultramarine blue and violet.
[Fig. 3]

CONSUMER TESTING

Consumers rated the best of the shade charts as being moderately to mostly inclusive of all skin tones. We ran statistical t-Tests to determine the significant P values and for selecting the most favorable printed chart to formulate the 18 shades. Subsequently, the 18 shades of liquid foundation make-up were presented to consumers for application to their skin [Fig. 4]. Again, they agreed that the palette was moderately to mostly inclusive of all skin tones. When they applied the selected make-up to their skin they were able to select a shade from the palette that met their needs.

CIELAB coordinates for skin tone chart (D65/10 Illuminant)



[Fig. 4]

FORMULATION

We classified the pigments with a higher specific gravity or a larger particle size. Both attributes reduce the time that the pigments can remain in suspension through buoyancy or the effect of molecular impacts. The variations in the levels and pigment density presented suspension issues that we needed to further explore and solve. In our experiments, we found that pigments surface treated with stearoyl glutamic acid and polyhydroxystearic acid (ASGP), emulsifiers, and organophilic clay contributed in stabilizing the formulation base [6]. We calculated the formula's natural origin to be 98.34%.

Conclusions:

Selecting a balanced palette of pigments at the correct levels can help to deliver products with optimal color benefits. Special care and consideration was taken to formulate only with ingredients that fit our criteria for "Clean" and "Natural Origin". We were able to streamline a foundation palette that could be adapted quickly over time through the use of design of experiment software. Our analysis of the data when coupled with our experience in formulation and color matching of skin tones proved invaluable for this project. Our more economical approach to consolidating a foundation line can assist formulators when resources or marketing opportunities may be limited. A smaller offering of SKUs for a shade line can potentially prove to be more economical and environmentally beneficial.

Acknowledgements:

We would like to thank our Applications Laboratories in the UK and USA, Sales & Marketing, R&D, Sales Sample (Gratis) departments and David Schlossman for their direction, communications, and support.

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