Natural origin: Surface treatments and pigmentary dispersions

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INTRODUCTION

In the field of cosmetics increased attention has been focused on the importance of the ingredient origin used to produce finished products. Specifically natural origin ingredients are in high demand from consumers focusing on earth derived products. Although a vast library of materials fit this defined natural origin category, this article will focus on natural origin surface treatments and natural origin color dispersions. Surface treated materials specifically applied towards colored pigments are highly prevalent in personal care products used for modification of the substrate. These treatments and also pigmentary grade colored dispersion materials can be ultimately found in a multitude of applications including liquid and powder foundations, BB creams, concealer, blush, eye liner, eye shadow, lipstick, mascara, skin care and sunscreens.

SURFACE TREATMENTS

There is large incentive to alter the chemical and physical properties of colors and other substrates with surface treatments. The ultimate goal is to use this as an avenue to enhance the performance of the end material. Pigment surfaces are commonly found to be hydrophilic where polar hydroxyl groups and absorbed moisture can be found. Furthermore pigment particles are prone to agglomeration, exhibit poor skin feel as well as poor wettability and dispersibiltiy in cosmetic grade media, poor dispersion and formulation stability, poor chemical stability of metal oxides, and poor pressability in pressed powders. For chemists, modification by method of surface treatment provides the ability to customize the properties of a substrate particularly esthetics and functional qualities for suitable incorporation of the ingredient into a specific formulation. This is achieved since treatments impart qualities such as enhanced dispersion, powder flow characteristics and flow during mixing (1). Also, treatment materials allow for higher filler loading with loading level on the filler surface dependent on the surface area of the filler. These treatments pre-wet the pigments surface to achieve lower oil absorption and also decreased the absorption of the dispersant. In formulation, treated products have improved flow and dispersion stability due to the minimization of re-aggregation of the particulates (2).

The performance of a treatment is governed by several properties including the physical/chemical properties of the treatment, integrity of the bonding between the treatment and substrate, the degree of coverage the coating provides and the potential of the substrate for surface treatment due to available reaction sites. The treatment potential is dependent on individual surfaces and their ability to react with treatment material. Examples such as silicates, hydroxides and inorganic metal oxides exhibit hydroxyl groups and will therefore have a higher surface treatment potential than a material which lacks these qualities such as carbon black. The bond strength between the treatment and substrate is an important parameter since that governs the potential enhancement of mechanical properties, reduced shrinkage, increased stability, and lessening of surface defects.

Alterations from various treatments can achieve surface behaviors that are

Treatment	Details	Selected Properties
Jojoba Ester (NJE)	Natural origin and Ecocert	• Hydrophobic • High oxidative stability • Does not turn rancid with heat • Creamy feel • Good skin affinity • Good pressability in powders • Successful in hot pours and emulsions
Stearoyl Glutamic Acid Treatment (ASG)	Natural origin and Ecocert	• Hydrophobic • Imparts a moist feeling to the skin • Creamy feel • Good skin adhesion • Easily dispersed in anhydrous systems • Good for emulsions, hot pours, gels, and powders
Hydrogenated Lecithin Treatment (PC)	Natural origin A natural phospolipid with anti-oxidant, moisturizing and emollient properties	• Hydrophobic yet moisturizing • Creamy feel and affinity to the skin • Good for powders, mineral makeups, emulsions and hot pours
Carnauba Wax Treatment (CW)	Natural origin	• Hydrophobic • Creamy feel • Good adhesion to the skin • Improves pressibility in powders
Aloe Treatment (EM)	Natural origin	• Creamy feel • Improves adhesion to the skin • Improves pressability and spreadability

Table I – Featured surface treatments and their selected properties.

hydrophobic, hydrophilic and also lipophilic with the results dependent on desired properties to be exhibited by the substrate. The chemistries of the available surface treatments vary. Particular focus will now be placed on five natural surface treatments: jojoba ester treatment (NJE), the stearoyl glutamic acid treatment (ASG), the hydrogenated lecithin treatment (PC), the carnauba wax treatment (CW), and the aloe treatment (EM) (Table I).

Jojoba Ester Treatment (NJE)

The natural jojoba ester treatment, trade name NJE (3) is colorless and flavorless. The resultant material is a functional, pure white solid which is stable at high temperatures (6 hours at 90°C). NJE does not turn rancid upon heating, lacks odor and renders substrates hydrophobic (Figure 1). The NJE treatment also possesses high oxidative stability. Jojoba esters are chemically similar to human sebum, imparting moisturization to dry skin while easing sebum production in oily skin (4). Furthermore, powders and pigments treated with NJE provide a creamy feel and good affinity to the skin in formulation (Figure 2). This type of treatment can be applied to a variety of substrates including (black, red, yellow) iron oxides, ultramarine blue, red 7 lake, yellow 5 lake, (pigmentary, attenuation, non-nano) TiO_2, (attenuation, non-nano) ZnO, mica, and talc. Applicability is found in powder products, natural treated mineral powder, liquid foundation, and also in emulsions and hot pours. Its natural origin is ideal for formulations with natural claims. NJE is a patented Kobo surface treatment (3). Many materials surface treated with the NJE treatment are Ecocert approved for 2014.

Figure 1 – An image showing the hydrophobic nature of yellow iron oxide treated with NJE.

Figure 2 – An image showing a formulation using NJE treated powder applied to the skin versus an untreated powder in formulation.

Stearoyl Glutamic Acid Treatment (ASG)

The ASG treatment is an amino acid coating that provides hydrophobicity to the substrate. This material will give a moist feeling to the skin. In finished formulations, powders treated with ASG will give a creamy feel while simultaneously providing good skin adhesion. The ASG treatment allows for pigments to be easily dispersed in anhydrous systems allowing for full color development (5). Applicability is found in emulsions, hot pours, gels, and powders. Materials available with this treatment include (black, red, and yellow) iron oxides, TiO_2, non-nano ZnO , and mica. Most unique to this treatment is its natural origin for natural claims. Some materials featured with the ASG treatment are Ecocert approved for 2014.

Hydrogenated Lecithin Treatment (PC)

This PC treatment is a natural phospolipid with anti-oxidant, moisturizing and emollient properties suitable for use in powders, mineral make up, hot pours, and can also be used in emulsions due to its hydrophobic properties. It offers a creamy texture, and excellent affinity to the skin.

Carnauba Wax Treatment (CW)

Carnauba wax is a hard, yellowish wax extracted from *Copernicia cerifera*. This treatment has a high melting point (ca. 85°C). The CW treatment renders pigments hydrophobic and aids in the improvement of pressing powders and spreadability on application. This treatment imparts a creamy feel and good adhesion to the skin.

Aloe Treatment (EM)

The aloe treatment imparts products with a creamy feel and improves adhesion to the skin. This treatment is applicable in powders for improving pressability, and spreadability.

PIGMENTARY DISPERSIONS

Pigments in powdered form are not particularly ideal since they require appropriate handling and subsequent processing to adequately prepare them for final formulation. Color dispersions are a pivotal component to avoiding intermediate handling and preparation steps while also providing full color development with consistency of batches. A dispersion is characterized as particles that are dispersed in a continuous phase of a different composition. Dispersions include a pigment, a vehicle, and a dispersant. The vehicle serves as the liquid that the particulate medium is dispersed in. The dispersant functions to assist in wetting out the pigment, prevent settling, and stabilize the pigments by ensuring pigment separation in the dispersion. Wetting out the pigment is important to increase the concentration of the pigment in the chosen vehicle (6). Often, the solid content being dispersed includes a surface treatment. Treatments used in dispersion applications are used for the purpose of wetting out the pigment, achieving a uniform dispersion, and allowing for a higher solid content of the end material. Additionally, treatments can help to neutralize a charge on the outer surface of a pigment and to help reduce the aggregates to make smaller size pigments. Treatments reduce the friction and adsorption on pigments so more concentrated dispersions can be achieved. Particle sizes of dispersed materials are typically greater than 0.2 microns often suffering from agglomeration within formulation. Aggregate particle size is an important parameter since it has direct correlation to color strength, gloss, and opacity (7). Theoretically, the highest color intensity generates more opaqueness and is achieved when the dispersion particle size in formulation is at a size closest to their primary state. Color dispersion materials boast small size particles which are fully dispersed. By using dispersions, the internal forces are reduced thus limiting re-agglomeration and reduced settling for the most effective product.

Since a dispersion imparts high color strength of pigments and contains high solids content, these materials allow for high loading levels of solids and provide room for other materials in formulation. A pronounced feature particularly for the formulator is that these dispersions are easy to incorporate with mixing and homogenizing. Since batches are consistent this will eliminate some color correcting issues and generally color dispersions offer better stability in a formula. Finished products using dispersed materials offer improved wear and pleasing aesthetics such as better skin feel since incorporated pigments are treated. Dispersions are also easy to use for color correcting and better batch consistency of color or transparency. Color consistency between batches for reproducible results meaning global plants will have uniformity when using the same materials. There are fewer issues with streaking and better mass tone to skin as in the case of foundation formulations when using dispersions. From a manufacturing perspective these dispersions are highly cost effective. These products eliminate the need for additional labor, equipment, and time to plan processing and to make the actual grind. This in turn contributes towards energy conservation in the manufacturing process. Furthermore, many incoming quality control checks on pre-shipments are eliminated by utilizing these materials.

Pigments such as Iron Oxides/transparent grade Iron Oxides, TiO_2, Ultramarines, Organic Lakes, and Carbon Black, in treated and untreated form, are typically used in color

cosmetic formulation for enhanced skin feel and high color intensity of the pigments. The available pigmentary grade dispersions on the market are plentiful with key emphasis on the varying carriers available. This variety essentially allows for dispersion products to be used in most formulations where these products are applicable.

OD Dispersions

A noteworthy dispersion in this category is the Octyldodecanol (OD) with Jojoba Ester treatment for natural formulations (Figure 3). This natural pigmentary dispersion series is Ecocert approved for 2014. Solids content are high ranging from 55-75%. These materials are applicable in emulsions, and hot pours. Dispersed materials come in (yellow, black and red) iron oxides as well as TiO_2 (7).

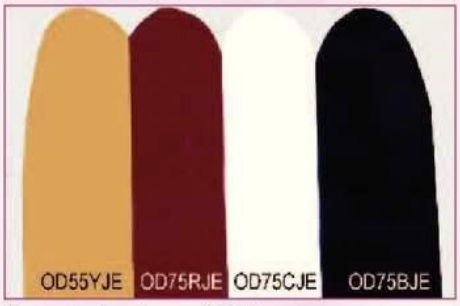

Figure 3 – Drawdowns of OD dispersions.

CONCLUSION

Surfaces treated pigments and powders are useful tools in formulation as an expansion to the library of personalized materials available to chemists. NJE, ASG, PC, CW, and EM are five examples of unique natural treatments available on a broad range of available substrates. Furthermore dispersion materials are a means for efficient and effective color formulations. These two categories of discussed materials showcase Kobo Products capability and expertise in the area of treated/dispersed pigments and powders.

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