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SPECIALTIES

Abyssinian Oil
Pigment Dispersion Studies

Study Objective:

Examine and quantify the pigment dispersion properties of Abyssinian Oil

I. Materials and Methods:

Choice of oils:

1. Abyssinian oil is a new vegetable oil that has significant application in decorative (color) cosmetics owing to the following attributes:
    a. Essentially colorless
    b. Essentially odorless
    c. Very light weight, very "light" skin feel
    d. Non-oily, no "greasy" after-feel
    e. Highly stable (able to be heated, long shelf-life)
    f. Biodegradable, non-GMO, non-toxic
2. Castor Oil comes from the seeds of the castor bean plant. It is used to bind waxes and disperse pigments as in lipsticks, hair pomades, ointments, creams and lotions. Owing to the wide usage of castor oil in pigmented products, it was chosen as an appropriate comparative control.
3. Abyssinian oil/Castor oil 50:50 blend was used to determine if there is an intermediate effect by blending the two oils.

Choice of pigment:

Titanium Dioxide is the world's most widely utilised white pigment. It's high refractive index, ease of dispensability and photochemical stability are unique. For this reason it is used to impart opacity and whiteness to an enormous variety of products including paints, plastics, inks, paper, cosmetics, foodstuffs and pharmaceuticals.

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Visual examination of dispersion:

Titanium dioxide (TiO_2) obtained from Sun Chemicals was suspended in Abyssinian oil, Abyssinian oil/Castor oil 50:50 blend and Castor oil at a concentration of 30% (w/w). The pigment was mixed into the oil with the use of a hand held spatula for 2 to 3 minutes until smooth and uniform. Two (2) grams of the 30% pigment suspension was added to a 16mm x 125mm glass test tube followed by the addition of eight (8) grams of distilled water. The test tubes were covered and shaken vigorously, by hand, for two minutes. The contents were allowed to settle overnight at room temperature. The resultant appearance of the pigment dispersion was photographed using two types of image capture and processing instrumentation. Digital photography was achieved using a Sony Cyber-Shot digital still camera equipped with an 1.4X Teleconversion lens (VCL-1452H). For higher magnification, visualization was achieved using a portable high resolution fiber optic microscope with external lighting sources was. In some instances oblique lighting provided an optical “shadow casting” effect to better define the pigment/oil topology.

Viscosity:

As a general rule, the lower the viscosity of a "wetting agent" or "dispersion medium", the more even (uniform) will be the dispersion (pigment distribution). Viscosity of the oils, both with and without (TiO_2), was measured using a Brookfield LVT viscometer at 22° C.

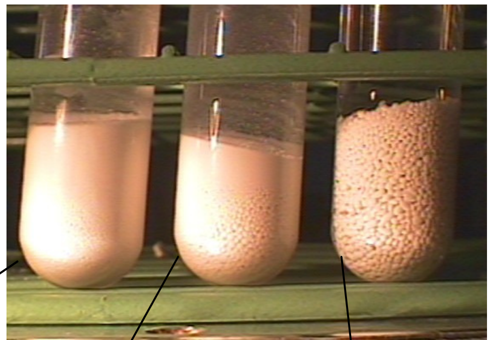
II. Results:

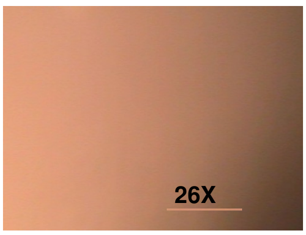
The nature and characteristics of the resulting pigment dispersions can be seen in the following photographs:

Digital Photography

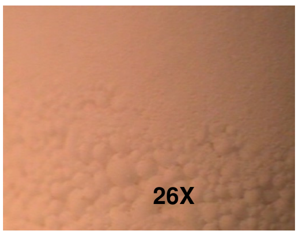
Abyssinian oil | **Abyssinian/Castor 50:50 blend** | **Castor oil**

Photomicrogrpahs (higher magnification shows particulate character of dispersed pigment

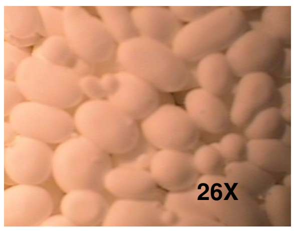




Abyssinian oil



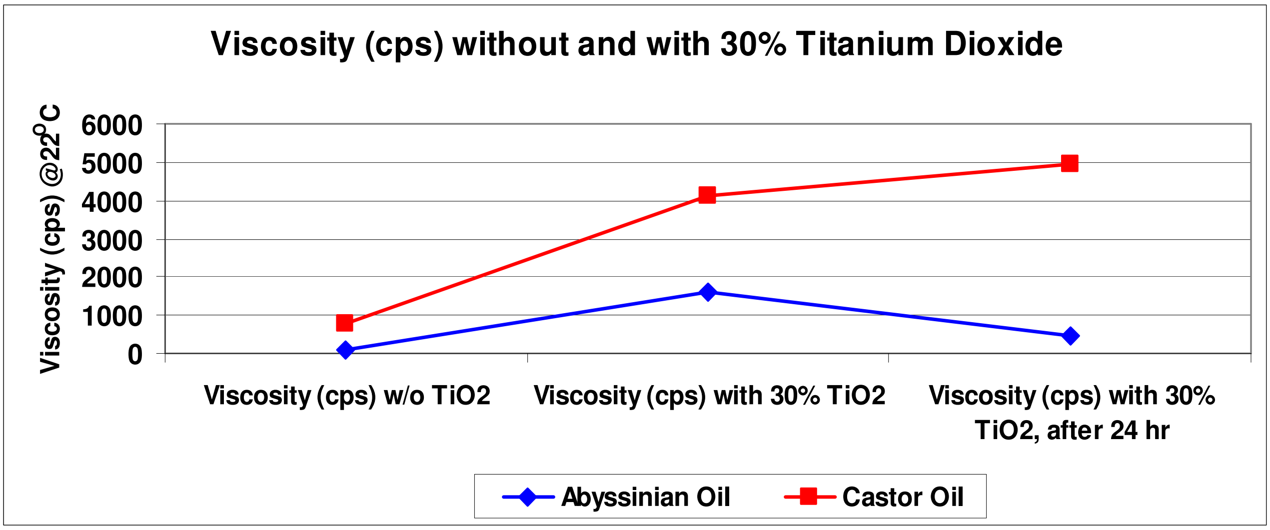
Abyssinian/Castor 50:50 blend



Castor oil

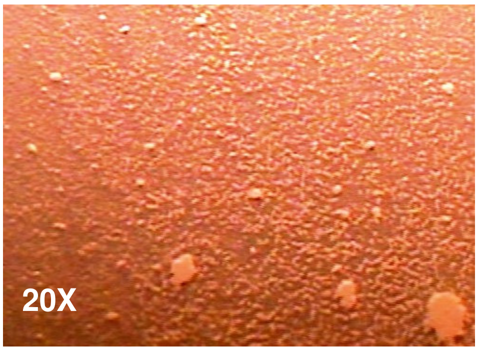
The results of the viscosity studies help explain the improved dispersion of (TiO_2) in the Abyssinian oil compared to castor oil. As can be seen in the following chart and graph, and as expected the castor oil had a higher initial viscosity than did Abyssinian oil and in both cases the addition of the pigment increased the viscosity of the system. However, in the case of castor oil the viscosity continued to increase as the dispersion sat at room temperature for 24 hours in contrast to the Abyssinian oil dispersion which decreased in viscosity over the same time period. This decrease in viscosity for the Abyssinian oil dispersion reflects the improved dispersion properties which generates a stable, small particle size, even distribution of pigment.

Oil	Viscosity (cps) w/o TiO_2	Viscosity (cps) with 30% TiO_2	Viscosity (cps) with 30% TiO_2, after 24 hr
Abyssinian Oil	88.5	1625.0	470.0
Castor Oil	769.0	4125.0	4950.0



<u>Interpretaion of the data:</u>

It is postulated that owing to the fluidity of the Abyssinian oil, the titanium dioxide particles are able to "disperse" or separate spatially such that the pigment is evenly distributed in very small particles throughout the oil. On the other hand, since castor oil is rheologically more viscous the particles tend to clump and experience more restricted distribution. This can be seen it the following photomicrographs showing titanium dioxide suspended in Abyssinian oil and in Castor oil.



TiO_2 in Castor oil

TiO_2 in Abyssinian oil

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When either Abyssinian or Castor oil is mixed with water, the oil phase quickly migrates to the top of the water forming a clear lipid layer. When titanium dioxide is suspended in the oil phase it disperses either fully in Abyssinian oil or partially in Castor oil. The “dispersed” pigment particles settle to the bottom taking the oil with it thereby forming a “pigment dispersion media” below the aqueous phase. The use of the water phase allows the observer to visualize the nature of the pigment/oil dispersion very clearly.

<u>**Conclusions:**</u>

Abyssinian oil is an excellent dispersion medium for pigments such as titanium dioxide. The dispersion of pigment in castor oil can be improved by the addition of Abyssinian oil to the system. Abyssinian oil can be used in the formulation of decorative cosmetics to assist in the dispersion of pigments generating a finished product with a fine, stable, even distribution of color.