PROCEEDINGS OF THE 20TH IFSCC CONGRESS

EVALUATION OF OIL DISPERSION AGENT BY ASSESSMENT OF COLOR STRENGTH OF ORGANIC PIGMENT

H. Young-Chan, R. Seo-Joon, L.Dong-Wook, H. Soon-Taek

Peeres Cosmetics, Ltd. R&D Center.
131, Nue up-Dong , 447-160Osan-Si, Gyeonggi-Do, Republic of Korea

Key words : Absorbance, Organic Pigment, Dispersion,

SUMMARY

This Study was performed to get the suitable oil dispersion agent by assessment of color strength of organic pigment in non-aqueous systems. Organic pigment is used as a color expression material with other body pigments in the make-up products. But occasionally aggregation or agglomeration occurs for the lack of affinity with medium.

This function is the cause of disturbing homogeneous dispersion, and then bring about an instability of products. Our study, research of dispersion mechanism between the pigment and oil phase, has been executed to solve this problem, and find a oil dispersion agent having optimum dispersion condition. Generally dispersion is related to between the solid-liquid mutual properties and electrical phenomena associated with solid-liquid interface.

This factor is determined to input energy, milling time, optical properties, particle size, rheological properties, etc. Ideal dispersion state is told that coloring primary solid particle is homogeneously dispersed in medium. Good dispersed colorants are strongly and clearly appeared.

We are already known that the particle size of organic pigment, chemical properties and viscosity of medium, refractive index. Consequently We determine the affinity of medium and organic pigment by measuring of color strength in the same mechanical condition.

UV-VISIBLE RECORDING SPECTRO PHOTOMETER is used for measuring apparatus. We can decided the dispersion level of oil dispersion agent by measuring absorbance of color strength in the visible range that diluted medium for colloid colorant particles.

Introduction

In the production of make-up products, organic pigments together with various kinds of body pigment are frequently used as color expression raw-materials. However, those phenomena such as aggregation, agglomeration, precipitation, etc. were found due to the lack of affinity with dispersing medium. These phenomena give rises the instability in final product quality by interfering with the uniform dispersion of organic pigment. *The meaning of stable dispersion of organic pigment is* that the medium in unhomogeneous phase(a particle) in mixed with homogeneous phase(solvent)and consequently produce a suspension phase.

In oil phase, when organic pigments are dispersed uniformly, the properties between solid-liquid phase in a fixed space, electrostatic phenomena between solid-liquid phase, the energy required for the dispersion, milling time, optical properties, the size of particle, rheological properties, affects the dispersion of *organic pigments* in the space.

Therefore, at present study, it can be suggested that the measuring the quantity of organic pigment(Absorbance) dispersed in the space represents the status of dispersion in the organic solvent.

The quantity of organic pigments in the space could be observed by measuring the maximum absorbance in there unique waved frequency in the UV-VISIBLE RECORDING SPECTRO PHOTOMETER. And by adopting the method using a VIDIO MICROSCOPE SYSTEM, it was able to observe the visible states of homogeneous- unhomogeneous dispersion of organic pigment.

2.Experiments.

2.1. Materials And Instruments

2.1.1 Oils

Dicaprylyl Ether (Cetiol OE, Henkel)
Octyldodecanol (Eutanl G, Henkel)
Squalane (Squalane, Kishimoto)
Phenyl Trimethicone (Dow Corning 556 Cosmetic Grade Fluid, Dow Corning)
Caprylic/Capric Triglyceride (Captex 300, Abitec)
Isopropyl Myristate (I.P.M, Inolex)

2.1.2 Organic Pigment

D&C Red No.28 Aluminum Lake (Kishi Chemical)
FD&C Yellow No.5 Aluminum Lake (Sun Chemical)

2.1.3 Apparatus

Disperser : Tokusher Kika Mode L
UV-VISIBLE RECORDING SPECTRO PHOTOMETER UV-260 : Shimadzu
VIDEO MICROSCOPE SYSTEM : Moritex

2.2. The Preparation of test samples

2.2.1 The preparation of test samples measuring absorbance for the selecting dispersion oils

The concentration of organic pigments were made in
D&C Red No.28 Aluminum Lake : 0.01%, 0.05%
FD&C Yellow No.5 Aluminum Lake : 0.01%, 0.05%
They were dispersed in Dicaprylyl Ether, Octyldodecanol, Squalane, Mineral Oil, Phenyl Trimethicone, Caprylic/Capric Triglyceride and Isopropyl Myristate at:

1. 3,000rpm/ 5min
2. 5,000rpm/10min

at room temperature.

2.2.1 The preparation of the test samples measuring absorbance in the area of visible rays

The concentration of organic pigments were made in
D&C Red No.28 Aluminum Lake : 0.01%
FD&C Yellow No.5 Aluminum Lake : 0.01%
They were dispersed in Dicaprylyl Ether, Octyldodecanol, Squalane, Mineral Oil, Phenyl Trimethicone, Caprylic/Capric Triglyceride and Isopropyl Myristate at:

1. 3,000rpm/ 5min
2. 5,000rpm/10min
3. 5,000rpm/10min and then letting 24hr alone at room temperature.

2.2.3 The preparation of the test samples in VIDEO MICROSCOPE SYSTEM

The concentration of organic pigments were made in
D&C Red No.28 Aluminum Lake : 0.1%
FD&C Yellow No.5 Aluminum Lake : 0.1%
They were dispersed in Dicapryll Ether, Octyldodecanol, Squalane, Mineral Oil, Phenyl Trimethicone, Caprylic/Capric Triglceride and Isopropyl Myristate at:

1. 3,000rpm/ 5min
2. 5,000rpm/10min
3. 5,000rpm/10min and then letting 24hr alone at room temperature.

2.3 The measurement by UV-VISIBLE RECORDING SPECTRO PHOTOMETER

2.3.1 The choice of dispersion oil by using the measurement of UV-VISIBLE RECORDING SPECTRO PHOTOMETER

In order to select the dispersion oil in organic pigment, we selected a few type of oils which used in cosmetics, and observed the mean values of abserbance of these samples by measuring 5 times in the range of visible light (400nm•700nm).

2.3.2. The measurement of absorbance at the area of visible rays using a UV-VISIBLE RECORDING SPECTRO PHOTOMETER

Right after dispersing samples using disperser, We observed the mean values of abserbance of these samples using UV-VISIBLE RECORDING SPECTRO PHOTOMETER by measuring 5 times in a specific wave length. (Table.3, Table.4)

1. D&C Red No.28 Aluminum Lake : 521nm
2. FD&C Yellow No.5 Aluminum Lake : 442nm

2.4. The evaluation of VIDEO MICROSCOPE SYSTEM

We observed the dispersion station according to the absorbance of samples by VIDEO MICROSCOPE SYSTEM

3. Results and Discussion

3.1 The measurement of absorbance using UV-VISIBLE RECORDING SPECTRO PHOTOMETER at the area of visible rays

After measuring the absorbance of each oils which used in cosmetics , we categorized those oils into ether series oil, higher alcohol series oil, hydrocarbon oils, ester series oil, silicon series oil, fat and fat oil series oils. Among catalogued oils, we carefully selected 6 oils which were stand for each series oil by

considering the value of viscosity. The absorbance values of finally selected oils are shown in the Table.1 and Table.2.

Table.1. The absorbance of D&C Red No.28 Aluminum Lake (0.01%)at the area of visible rays (3,000rpm/5min)

Materials	Detection Wave length(nm)	Maximum absorbance
Caprylic/capric Triglyceride	568.4	0.380
Dicaprylyl Ether	569.8	0.336
Isopropyl Myristate	569.6	0.290
Squalane	565.6	0.304
Octyldodecanol	567.0	0.233
Phenyl Trimethicone	557.8	0.150

Table.2. The absorbance of FD&C Yellow No.5 Aluminum Lake(0.01%) at the area of visible rays (3,000rpm/5min)

Materials	Detection Wave length(nm)	Maximum absorbance
Caprylic/capric Triglyceride	460.2	0.815
Dicaprylyl Ether	492.8	0.574
Isopropyl Myristate	466.6	0.786
Squalane	442.2	0.369
Octyldodecanol	453.4	0.650
Phenyl Trimethicone	504.2	0.475

3.2 The absorbance measurement of organic pigment by UV-VISIBLE RECORDING SPECTRO at the area of the visible rays

In general, it has been supposed that, for the homogeneous dispersion of organic pigment within dispersant using disperer, the increasement of dispersion time and speed are required. We measured absorbance by changing dispersion time and speed. (Table.3, Table.4). In case of D&C Red No.28 Aluminum Lake, we were observed the data which was wanted except squalane .

Table.3. The absorbance of D&C Red No.28 Aluminum Lake at the wave length of 521nm

Materials	5,000rpm/10min	3,000rpm/5min	After 24 hr
Caprylic/capric Triglyceride	0.307	0.288	0.219
Dicaprylyl Ether	0.288	0.181	0.105
Isopropyl Myristate	0.241	0.184	0.145
Squalane	0.250	0.288	0.137
Octyldodecanol	0.279	0.184	0.145
Phenyl Trimethicone	0.132	0.079	0.041

And in the event of FD&C Yellow No.5 Aluminum Lake, we found that absorbance was categorized;

1. Caprylic/capric Triglyceride, Octyldodecanol and IsopropylMyristate
2. Dicaprylyl Ether
3. Squalan and Phenyl Trimethicone

Table.4. The absorbance of FD&C Yellow No.5 Aluminum Lake at the wave length of 442nm

Materials	5,000rpm/10min	3,000rpm/5min	After 24r
Caprylic/capric Triglyceride	0.748	0.680	0.771
Dicaprylyl Ether	0.584	0.515	0.221
Isopropyl Myristate	0.554	0.413	0.459
Squalane	0.072	0.275	0.083
Octyldodecanol	0.608	0.563	0.578
Phenyl Trimethicone	0.275	0.443	0.321

3.3. The results of measurement by VIDEO MICROSCOPE SYSTEM

As shown in Table.3 and Table.4 , for the most of oils tested , we observed absorbance was proportional to dispersion time and speeds.

In order to compare the color strength as a visible meaning with the absorbance and dispersion status, 250 times extended microscope photograph were taken for each samples using a VIDEO

MICROSCOPE SYSTEM as shown in Fig.1,2,3,4. And the images of those photographs were compare with the data on absorbance shown in Table.3,4. From those results, it was able to confirm that the condition of high value of absorbance is equivalent to the status of even dispersion of pigment particles in space, and consequently it shown high color strength.

considering the value of viscosity. The absorbance values of finally selected oils are shown in the Table.1 and Table.2.

Table.1. The absorbance of D&C Red No.28 Aluminum Lake (0.01%)at the area of visible rays (3,000rpm/5min)

Materials	Detection Wave length(nm)	Maximum absorbance
Caprylic/capric Triglyceride	568.4	0.380
Dicaprylyl Ether	569.8	0.336
Isopropyl Myristate	569.6	0.290
Squalane	565.6	0.304
Octyldodecanol	567.0	0.233
Phenyl Trimethicone	557.8	0.150

Table.2. The absorbance of FD&C Yellow No.5 Aluminum Lake(0.01%) at the area of visible rays (3,000rpm/5min)

Materials	Detection Wave length(nm)	Maximum absorbance
Caprylic/capric Triglyceride	460.2	0.815
Dicaprylyl Ether	492.8	0.574
Isopropyl Myristate	466.6	0.786
Squalane	442.2	0.369
Octyldodecanol	453.4	0.650
Phenyl Trimethicone	504.2	0.475

3.2 The absorbance measurement of organic pigment by UV-VISIBLE RECORDING SPECTRO at the area of the visible rays

In general, it has been supposed that, for the homogeneous dispersion of organic pigment within dispersant using disperer, the increasement of dispersion time and speed are required. We measured absorbance by changing dispersion time and speed. (Table.3, Table.4). In case of D&C Red No.28 Aluminum Lake, we were observed the data which was wanted except squalane .

Table.3. The absorbance of D&C Red No.28 Aluminum Lake at the wave length of 521nm

Materials	5,000rpm/10min	3,000rpm/5min	After 24 hr
Caprylic/capric Triglyceride	0.307	0.288	0.219
Dicaprylyl Ether	0.288	0.181	0.105
Isopropyl Myristate	0.241	0.184	0.145
Squalane	0.250	0.288	0.137
Octyldodecanol	0.279	0.184	0.145
Phenyl Trimethicone	0.132	0.079	0.041

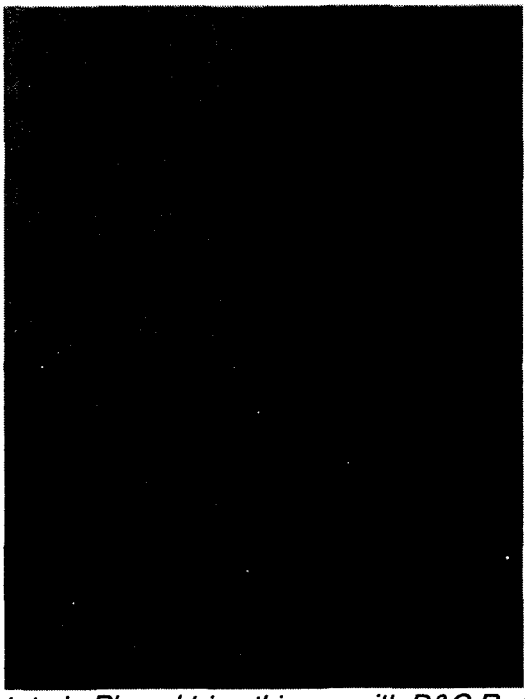

Fig 3) The dispersion state in Phenyl trimethicone with D&C Red No.28 Aluminum Lake (upper), FD&C Yellow No.5 Aluminum Lake (lower)

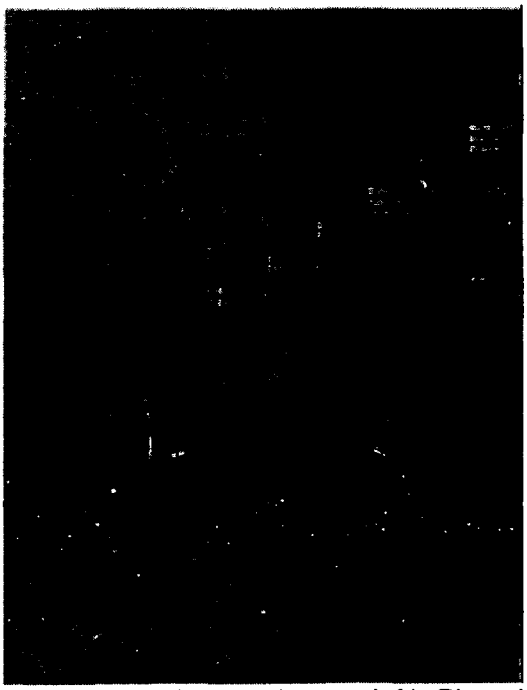

Fig 4) The dispersion state in Octyl dodecanol (upper, left), Phenyltrimethicone (Upper, right), Caplylic/capric triglyceride(Below, left), and Squalane (Below, right) with D&C Red No.28 Aluminum lake

4. Conclusion

In color cosmetics, the high quality production could be achieved when the particles of organic pigment are well distributed in oils for a longtime. Therefore, if it were able to find a reasonable way of experimental test method on the status of dispersion of organic pigment in oil, it could be a great merit for the manufacturing of cosmetics.

The dispersion status of organic pigments in oil phase strongly depends on qualitative factors such as the mutual properties of solid-liquid phase, electrostatic effects, milling time, optical properties, size of particles and rheological properties etc. Therefore, the absorbance measurement, which is equivalent to quantitative analysis, is not supposed to be an effective means for the understanding of dispersion status of pigments in oils. However, when the status of dispersion were measured in a visible method using a VIDEO MICROSCOPE SYSTEM, it was able to find that the better the results of visible means, the higher the resolution of spectra in UV-VISIBLE RECORDING SPECTRO PHOTOMETER.

Reference

1. *G. Mie : Ann. Phusik, 25, 377 (1908)*
2. *R. Patrick : J. Am. Ceramic Soc., 34, 96 (1951)*
3. *Yoshiaki Oyabu. Pigment Disperions and their Interface Science., J.Jpn.Soc.Colour Materials, 59 (1986) 75-76*
4. *Kazuo Igarashi and Nobuo Masui. Progress in Pigment Dispersion Technology., J.Jpn.Soc.Colour Materials, 59 (1986) 103-104*