PHOTOPIA®
light sensitive color change

Organic Photochromic colorant **PHOTOPIA Color**

## Product Outline

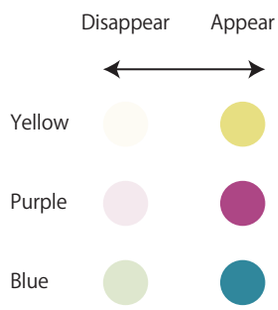
PHOTOPIA Color is an organic photochromic colorant which repeats "color exhibition" and "color disappearance" reversibly through the sunlight or ultraviolet radiation.
PHOTOPIA Color may be compounded into various synthetic resin for various processes.

## Property

| | PHOTOPIA Color |
|---|---|
| Component | Organic Photochromic colorant |
| Solubility | Non soluble to water,Highly soluble to most organic solvents |
| Melting Temp. | Yellow：162～163℃ |
| | Purple：237～238℃ |
| | Blue：257～258℃ |

### Color Types

Available Colors; 3 Colors




## Usage

・Dissolve PHOTOPIA Color into solvent or plasticizer, and then arrange inks, paints and others.

## Application

Sunglasses, Tint Film, Stationaries, Textiles, UV indicators etc.

## PHOTOPIA Color' s application onto plastics for molding

ⅰ) Kinds of plastics applicable
PP, PE, EVA and K-Resin (BS)

ⅱ) Recipe (Toward 100 parts of Natural Resin)

| | Range of optimum amount of PHOTOPIA Color used | Optimum amount of light stabilizer used |
|---|---|---|
| Yellow | 0.02 – 0.4 parts | 1/2 of PHOTOPIA Color |
| Purple | 0.01 – 0.2 parts | Equivalent amount to PHOTOPIA Color or double its amount |
| Blue | 0.01 – 0.2 parts | Equivalent amount to PHOTOPIA Color or double its amount |

* Optimum amount of PHOTOPIA Color to be used varies depending upon the thickness of the moldings. On the whole, the above range is desirable.
Even if more than the above-mentioned is used, concentration of color-exhibition through light does not become higher in proportion to that. It may cause the problem in stability of time elapse (blooming). On the contrary, if less than the above range is used, color change effect through light will be poor.
* Blooming tends to appear particularly in LDPE.
* It is possible to mix PHOTOPIA Colors mutually to be used. However, its distinctness will be decreased and the mixed color may not become the expected hue. Therefore, care should be taken.
* It is effective to use light stabilizer (HALS) together, especially for PHOTOPIA Purple & Blue. The light fastness will be improved without decreasing concentration of color exhibition through light. Yellow has excellent light fastness in its colorant itself. Too much addition of light stabilizer will weaken light fastness of PHOTOPIA Color.
* As for usage amount of light stabilizer, it is desirable to use the equivalent amount to colorant or double the amount in the cases of PHOTOPIA Purple and Blue. In the case of PHOTOPIA Yellow, it is desirable to use 1/2 amount.
* It is desirable to use Adkstab LA-52, Tinuvin T-144, etc. as a light stabilizer.
* The hue of PHOTOPIA Blue is blue with a strong reddish color. When Phenol group antioxidant such as Adkstab AO-30, Sumilizer BBM, etc. are used together in the equivalent quantity as colorant, distinct Turquoise Blue can be obtained. (However, the residual color becomes light yellow green.)
* Please do not use metallic salt such as magnesium stearate, etc. as a dispersing agent since it disturbs PHOTOPIA Color' s color change function through light. Also, it is not desirable to use zinc group white pigment such as zinc white, zinc sulfide, etc. together.
* It is preferable to use bisamide group as a dispersing agent.
* Using other white pigments together will also decrease concentration of color-exhibition through light and light fastness. To obtain a molding with a high concentration of color exhibition, it is desirable to mix the ink into a transparent plastic.
* It is possible to obtain the change of color to color using Dry Color (general color). However, if the concentration of general color is too high, color change through light is not noticeable, therefore it is not appropriate. Further, when Dry Color is used together, specks may be generated when direct molding is performed, so it is advisable to make it into Master Batch form first.
* Concentration of color-exhibition through light, hues and appearance of residual color will vary depending on kinds of resin. Testing should be performed to confirm these beforehand.
* Even if the same kind of resin is used, concentration of color-exhibition, hues and appearance of residual color will vary depending on manufacturers and grades. Testing should be performed to confirm these beforehand.

iii) Process

① Mixing
Natural resin, PHOTOPIA Color, light stabilizer, (Dry Color) etc. should be mixed thoroughly and evenly using a Henschel Mixer, a Dumbbell Mixer, V Model Mixing Machine etc.

② Molding
* There is no particular restriction for injection molding machine, blow molding machine, extrusion molding machine etc. and molding can be performed under the molding conditions in accordance with the resin to be applied. There is no specific condition.
Colorant may be decomposed if it is left to reside within the molding machine for a long period of time, therefore, after the process is completed, the inside of the molding machine should be cleaned with natural resin.
* Runners, flash etc. accompanying the moldings can be used again. For re-use, please check the condition. (color-change function, color-fading, color-change, dirty part etc.)

## PHOTOPIA Color' s application to vinyl chloride / plasticizer

ⅰ) Applicable uses

Semihard moldings, soft moldings, plastisol moldings, rotational moldings, plastisol ink

ⅱ) Recipe

| | Range of optimum amount of PHOTOPIA Color to be used | Light stabilizer' s amount to be used |
|---|---|---|
| Yellow | 0.02 – 0.1 parts | 1/2 of PHOTOPIA Color' s amount |
| Purple | 0.01 – 0.3 parts | 2 – 10 times of PHOTOPIA Color' s amount |
| Blue | 0.01 – 0.2 parts | 2 – 10 times of PHOTOPIA Color' s amount |

* Optimum amount of PHOTOPIA Color to be used varies depending on the thickness of the moldings and thickness of Ink. However, on the whole, the above stated range is desirable. Even if more than the above mentioned amount is used, concentration of color exhibition through light does not become higher in proportion to that and it may cause the problem in stability of time elapse (blooming). On the contrary, if less than the above stated range is used, color change effect through light will be poor.
* Solubility of PHOTOPIA Color towards DINP (plasticizer) 100 parts (7℃)
  PHOTOPIA Color Yellow: 3%
  PHOTOPIA Color Purple: 1%
  PHOTOPIA Color Blue: 0.8%

N.B.) If you use a different plasticizer, please check its solubility, concentration of color exhibition, hue, residual color etc. before use.
* Compounding with small quantity of plasticizer toward PVC resin (semi-hard – hard) tends to generate strong residual color.
* Using light stabilizer (HALS) together is remarkable especially in the colorants of Purple and Blue, and the light fastness will be improved without decreasing concentration of color exhibition through light. (Yellow has excellent light fastness in its colorant itself.)
* Further, compounding light stabilizer makes the colorant of Purple and Blue discinct reddish color in accordance with its amount.
* Adkstab LA-52 is desirable as a light stabilizer.
* The hue of PHOTOPIA Blue is blue with a strong reddish color. When phenol group antioxidant such as Adkstab AO-30, Sumilizer BBM etc. are used together in the equivalent quantity as colorant, distinct turquoise blue can be obtained.
* Tin group is desirable as a stabilizer for vinyl chloride resin and other kinds of stabilizers may affect the residual color depending upon its kind. If you use other kinds of stabilizers, please conduct a pre-test before use.
* It is not desirable to use white pigment such as titanium dioxide, zinc white, zinc sulfide, etc. because they decrease concentration of color exhibition through light and light fastness.
* It is possible to obtain the change of color to color using Toner Color (General Color). However, if the concentration of General Color is too high, color change through light is not noticeable. Also, if fluorescent pigment is used together, it affects the color change through light tremendously, therefore it should be avoided.
* Concentration of color change through light and hue will vary depending on kinds of resin, plasticizer, stabilizer as well as the amount of each one. Testing should be performed beforehand for confirmation.
* Since a vinyl chloride product compounded with PHOTOPIA Color causes migration if it is piled up with other vinyl chloride products. Therefore, care should be taken and it is preferable to wrap the products in PP film separately.

iii) Process

①Solubility of PHOTOPIA Color

After mixing a part of plasticizer to be used, the entire amount of PHOTOPIA Color and light stabilizer, heat it to 120 – 180℃ to dissolve PHOTOPIA Color. Then, mix the dissolved PHOTOPIA Color solution with the remaining plasticizer.

②Mixing

* Preparation summary of compound for injection and extrusion molding

Mix vinyl chloride resin, the solution of ①, stabilizer, (toner color) etc. thoroughly using a Henschel mixer. After that, obtain the pelletized compound by using a normal extrusion machine and pellet cutter.

* Preparation summary of plastisol ink

Add the solution of ①, stabilizer, (toner color) into vinyl chloride resin (for paste) and mix thoroughly using a disperse model stirrer. Then, perform uniform dispersion through a three-roller-mill.

③Molding

* Injection and extrusion molding

There is no particular restriction for injection molding machine, extrusion molding machine etc. and molding can be performed under the molding conditions in accordance with compounding of the resin to be applied. Colorant may be decomposed if it is left to reside within the molding machine for a long period of time. Therefore, after the process is completed, the inside of the molding machine should be cleaned with natural resin.

*Plastisol ink (printing)

For screen printing, use 100 – 120 mesh screen plate since the coloring power is low. For screen printing on colored fabric, print with white ink (hiding layer) and then print with PHOTOPIA Ink. After that, perform heat treatment, as performed for a standard ink, to have a final production. Care should be taken to avoid colorant migration. Wrap the products in PP film separately. The designs should be keep apart from each other.

* Plastisol ink (molding)

There is no particular restriction for normal slush molding and rotational molding. Care should be taken to avoid colorant migration. Wrap the products in PP film separately.

*Carefully test to see the applicability before bulk use.

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