

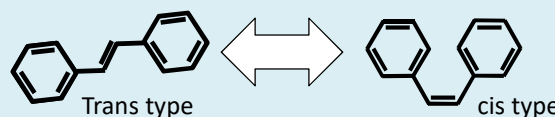
# Comparison of the amount of stilbene contained in optical brighteners

## What is brightening

Whiten cloth or paper and fluoresce blue – violet when exposed to ultraviolet rays. Since it looks white to the human eye. They can make cloth or paper look white. They can also remove the yellowing.

## Stilbene Luminous

Exchange the trans type and cis type with ultraviolet energy



## Motivation

We find when hit UV at stilbene, stilbene absorb and out blue light. Since the amount of stilbene is not written on the detergent, I wanted to know the amount contained.

## Hypothesis

- The higher the amount of stilbene Absorb ultraviolet rays.
- The more stilbene a liquid contains, the more light it absorbs and higher absorption, greater the amount of detergent contained in that detergent.

## Absorptiometry

The concentration of the substance is quantitatively analyzed by irradiating the solution with light and measuring the absorbance when the light reflects the reagent.

## Lambert-Beer's law

The law that the absorbance of a substance at a specific wavelength is proportional to the concentration of the substance and the thickness of the absorption layer.

$$Abs = \epsilon \cdot c \cdot l$$

(Absorbance = molar extinction coefficient x concentration x optical path length)

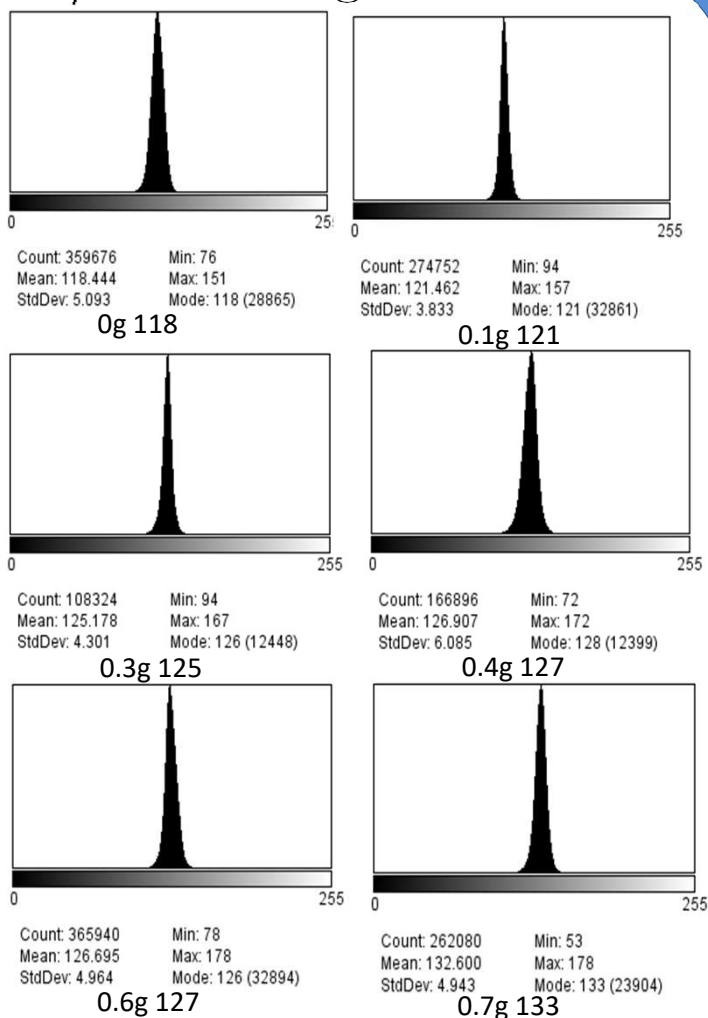
## Experiment method①

- Grind stilbene.
  - Stilbene melt in benzene. It's because stilbene doesn't melt in water.
  - Cloth put on the solution and mix until penetrate.
  - Wash away in water at 3 times.
  - hit UV light inside the cardboard so that it is not exposed to light from the outside.
  - Take picture of the cloth and analysis with ImageJ.
- Constant conditions  
④ Water is 300mL and wash 3 minutes a once

## Experiment method②

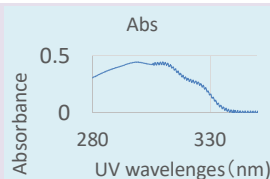
- Grind stilbene.
- Dissolve stilbene with the minimum amount of benzene.
- Put the solution of ② into a volumetric flask and dilute with benzene.
- Put only benzene into the cell and base correct with a spectrophotometer
- \*Because benzene also absorbs ultraviolet rays
- Put the solution of ② into the cell.
- Measure with a spectrophotometer.
- Make a graph by combining the numerical values.
- Dissolve the detergent in benzene and measure with a spectrophotometer.
- Find the amount of stilbene contained in the detergent from the measured values using the graph.

## Experimental Result①



It was found that the larger the amount of stilbene, the more bright

## Experimental Result②



The wavelength of ultraviolet rays absorbed by stilbene was examined with a spectrophotometer. Measure using the maximum absorbance wavelengths 310.

Five concentrations were created and measured, and a calibration curve was created. High reliability because the correlation coefficient is close to 1.

| Molarity (mol/L)     | Abs (-) |
|----------------------|---------|
| $1.0 \times 10^{-6}$ | 0.031   |
| $2.0 \times 10^{-6}$ | 0.065   |
| $3.0 \times 10^{-6}$ | 0.097   |
| $1.0 \times 10^{-5}$ | 0.309   |
| $2.0 \times 10^{-5}$ | 0.607   |

Calibration curve:  $y = 25698x$ ,  $R^2 = 0.9997$

0.1g detergent was added to 10ml and measured with a spectrophotometer, and the amount of stilbene contained in 10ml was compared with four kinds of detergent. There was a difference of about 10 times depending on the type of detergent.

| Detergent type    | Content(g)            | Content rate (ppm) |
|-------------------|-----------------------|--------------------|
| toppu             | $2.07 \times 10^{-6}$ | 20.5               |
| Laundry detergent | $1.12 \times 10^{-5}$ | 112                |
| Haidoro D haita-  | $1.36 \times 10^{-5}$ | 134                |
| Attaku            | $3.25 \times 10^{-5}$ | 321                |

## Future Outlook

- Take the most data and complete a more accurate graph
- I would like to investigate the amount of stilbene included in the detergent other than the one I used
- We will investigate the relationship between the amount of stilbene and ultraviolet rays in the future and summarize it in a graph.

## References

- Rasband, W.S., ImageJ, U.S. National Institutes of Health, Bethesda, Maryland, USA, <http://image.nih.gov/ij/>, 1997-2021
- Schneider, C.A., Rasband, W.S., Eliceiri, K.W. "NIH Image to ImageJ: 25 years of image analysis". Nature Methods 9, 671-675, 2021.