

# Synthesis of methyl orange, The strength of acid, and The relationship with each color

## Introduction

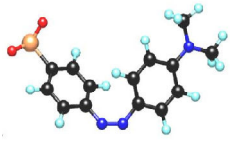
Akira Suzuki was awarded a Nobel prize in 2010. Mr. Suzuki's experiment is called Suzuki-Miyaura Coupling. This experiment becomes a key of the study called the organic synthetic study. It used lots of fields. Above all, medicine is necessary for doctors which I want to become to treat diseases. Thus, I wanted to do an experiment like this experiment in my school science laboratory, so I used the Diazo coupling reaction in my experiment. Furthermore, I focus on Methyl orange. Methyl orange which is used as a dye and indicator.

Finally, I made up my experiment purpose as follows.

- ① Synthesis and creation of methyl orange
- ② Find a relation between pH change and color of methyl orange which is influenced by the strength of the acid

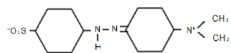
## Construction of methyl orange

Color : reddish orange

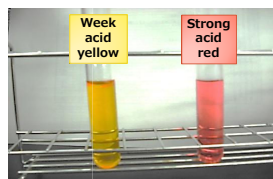


Construction form ↑

Structural formula

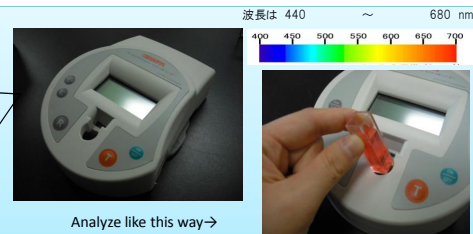
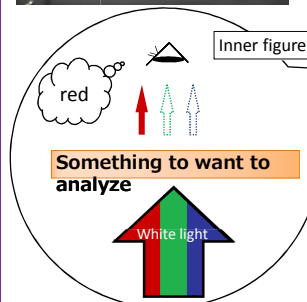


## strength of acid and relation with methyl orange color



Check performance by coloration of methyl orange I made.

Analyze optical properties by using an absorptiometer

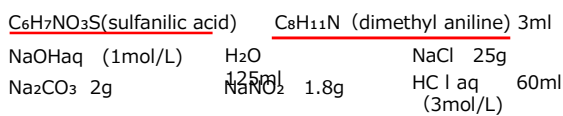


Analyze like this way →

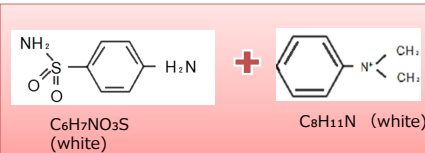
- Control pH
- pure hydrochloric acid pH2 (red)
- controlled hydrochloric acid pH5 (yellow)

## Synthesis and creation of methyl orange

preparation



Method of synthesis



← Sulfanilic acid and dimethyl aniline to make Methyl orange.

Method

Adjustment of sulfanilic acid

① Dissolve sulfanilic acid into a mixture of water and sodium carbonate, and heat the mixture.

color : transparent and colorless

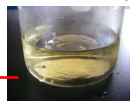
② Add sodium nitrite allowing the mixture to get cool and after that, add a mixture of hydrochloric acid and water.

color : reddish brown

Adjustment of dimethyl aniline

① Mix dimethyl aniline and hydrochloric acid in another beaker, and cool the mixture.

color : transparent and colorless



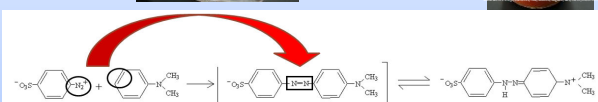
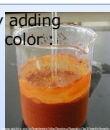
① mixed these two materials.

color : dark red



② controlled the pH by adding sodium hydroxide.

color : orange



③ Precipitation occurred by adding sodium chloride.

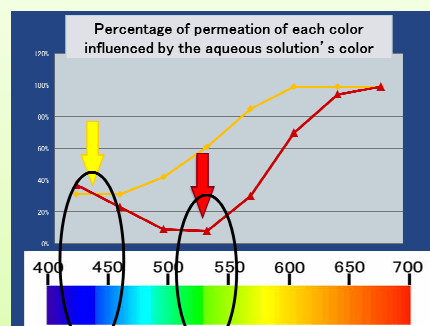
④ Performed a vacuum filtration.

Product

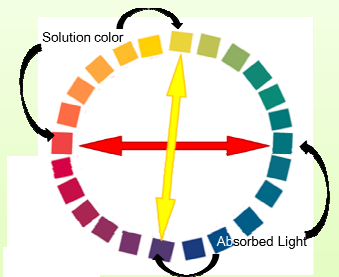
I was able to make methyl orange  
0.8g from 8.0g materials.  
(Collection rate 10%)



Results



The percentage of permeation of each color influenced by aqueous solution.



The opposite color is absorbed based on the color that we recognize.

## conclusion

- I made methyl orange by diazo coupling.
- optical property ... I made a graph of color changes according to differences of pH.

red ← acidity ← neutrality ← basicity → yellow

## References

- 1) 江藤康文 色 その科学と文化 朝倉書店 1979
- 2) L.F.フィーザー フィーザー有機化学実験 丸善 1980
- 3) 東京工業大学化学実験室 理工系大学基礎化学実験第3版 講談社サイエンティフィック 2008
- 4) 愛知エースネット メチルオレンジの合成
- 5) Nobelprize.org - All about the Nobel Prize Awarded Achievements, <http://nobelprize.org/>, (2011/02/22)
- 6) 科学技術コミュニケーション教育研究部門(CoSTEP) 鈴木・宮浦カップリング反応とは <http://costep.nucc.hokudai.ac.jp/channel/anime/index.html>