We can see “active carbon” at a DIY shop.
We examine how effective it is for purifying water.

In this experiment we use **①river water(the Ostu River near our school)**
②miso soup
③methylene blue

In ③methylene blue, we examine the purification by **photocatalyst of titanium oxide**.

To see the contamination level in the water, we used **COD(chemical oxygen demand)** in ①②and **Absorptiometric method** in ③.

First, we will show you how the experiment is done and the results ①②.

～Exposition～ COD(chemical oxygen demand)

COD is the value of the oxygen mass[mg/l] equivalent to the oxidant consumed when it reacts on the sample solution.

JIS (Japanese Industrial Standards) water quality test method

(1)Add potassium permanganate AS (oxidant) into the sample solution in surplus and add sulfuric acid AS in order to acidize.
(2)Heat for 30 minutes in boiling water.
(3)Add sodium oxalate AS (reductant) to reduce the surplus potassium permanganate, and decolorize.
(4)Add potassium permanganate AS again. (back titration)

①$KMnO_4$	③KMnO4
Organic matter	②$Na_2C_2O_4$

～Experiment～ sample : **①river water , ②miso soup**

[Preparation]

Prepare two beakers with 100ml sample each.
Add active carbon into one of the two.
Then, leave them out at room temperature with a plastic wrap cover.

[Procedure]

(1)Prepare a conical beaker with 100ml sample and add silver nitrate AS 5ml to precipitate Cl^- as silver chloride.

(2)Add 3.0mol/l sulfuric acid AS 10ml and then add 5.0×10^{-3}mol/l $KMnO_4$aq 10ml with a whole pipette.

(3)Add boiling stones and heat for 30 minutes, keeping the temperature around 80℃.

(4)Add 12.5×10^{-3}mol/l $Na_2C_2O_4$aq 10ml with a whole pipette.

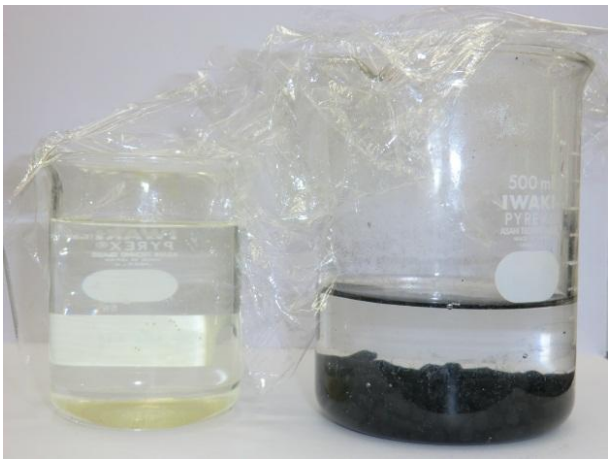
(5)Keep dripping 5.0×10^{-3}mol/l $KMnO_4$aq with a burette until the end point.

[Result]

Exp① : **river water(the Ostu River)**

before treatment →COD : 47.6mg/l

after treatment →COD : 29.2mg/l ●39% of impurities are cleaned up.

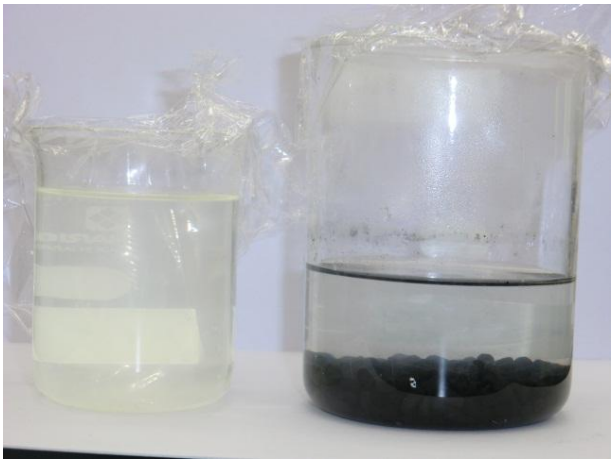


(From the left, before treatment and after treatment)

Exp② : **miso soup**

before treatment →COD : 5.3×10^{3}mg/l

after treatment →COD：5.6×10^{2}mg/l　●89% of impurities are cleaned up.



(From the left, before treatment and after treatment)

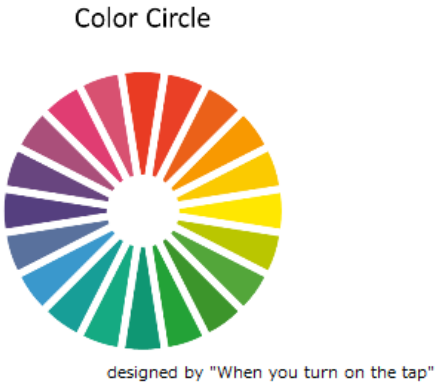
Secondly, we will show you how the experiment is done and the results ③.

～Exposition～ Absorptiometric method

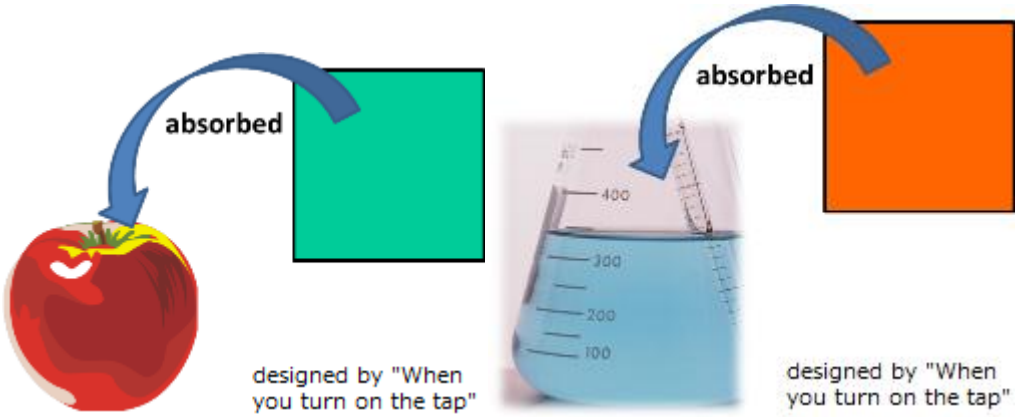
Absorptiometric method is a method to compute the concentration of a target material by metering the degree of light it absorbed when you shine a light on the sample solution (the absorbance).

[Theory]

The color we see in things is a complementary of the color it absorbs, or the one seated on right opposite of the color circle.



For example, when you see an apple in blue-green light, all lights are absorbedand it looks black.

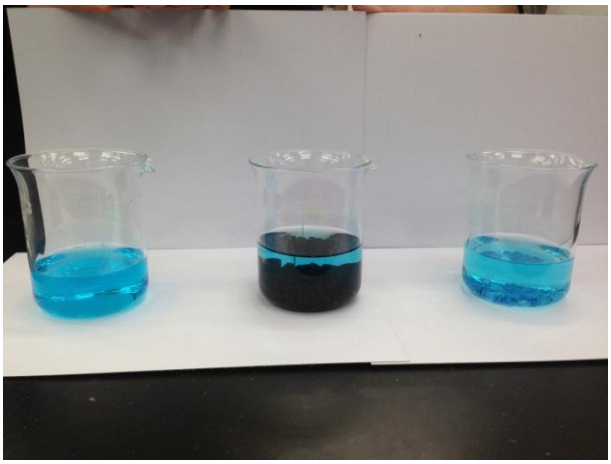


And in the case of this sample solution, the thicker the concentration of the solute is, the darker the color is.
This was proved mathematically, and it called Beer-Lambert law.

～Experiment～ sample : **③methylene blue**

[Preparation]

Prepare three beakers with 100ml sample each.
Put active carbon into one, titanium oxide into another, and add nothing to the other.
Cover all three beakers with plastic wrap.
Then, leave the one with titanium oxide out in the sun light (to shine ultraviolet on), and the others out at room temperature without sun light.



(From the left, before treatment, after active carbon treatment, and after photocatalytic treatment)

[Procedure]

Put the sample solution into a quartz cell, and examine the concentration by using a

spectral photometer.

At this time, we level the wavelength of the shined light at 660nm.

(the spectral photometer)

[Result]

Exp③：**methylene blue**

before treatment → concentration：0.5817mol/l

after active carbon treatment → concentration：0.3259mol/l

●44% of impurities are cleaned up.

after photocatalytic treatment →concentration：0.3370mol/l

●42% of impurities are cleaned up.

(From the left, before treatment, after active carbon treatment, and after photocatalytic treatment)

Reference

●理系大学受験　化学Ⅰ・Ⅱの新研究　[Author] Yoshinobu Urabe