

C13-Molecular absorption spectrophotometry

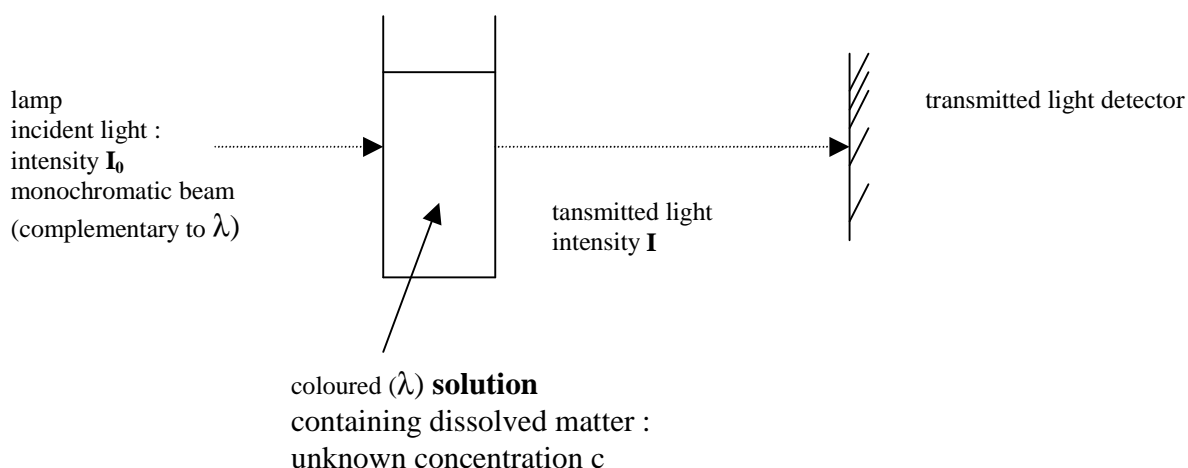
This technique is applied to assess matter concentration in solutions (not suspensions) : these dissolved matters make the solutions coloured ; colour intensity is proportional to matter concentration ; spectrophotometer measures the colour intensity.

Each colour can be characterised by its wavelength and its complementary colour :

colour	wavelength (nm)	complementary colour
red	700-650	green
orange	650-595	Blue : 490 - 465
yellow : $K_2Cr_2O_4$	595-560	Violet : 435-400
green	560-490	Red
Blue : $CuSO_4$	490-465	Orange : 650-595
indigo	465-435	Yellow - orange
Violet : $KMnO_4$	435-400	Yellow : 595 - 560

Colorimetry measurement principle : the coloured solution receives a monochromatic beam which λ is **complementary to solution colour wavelength** .

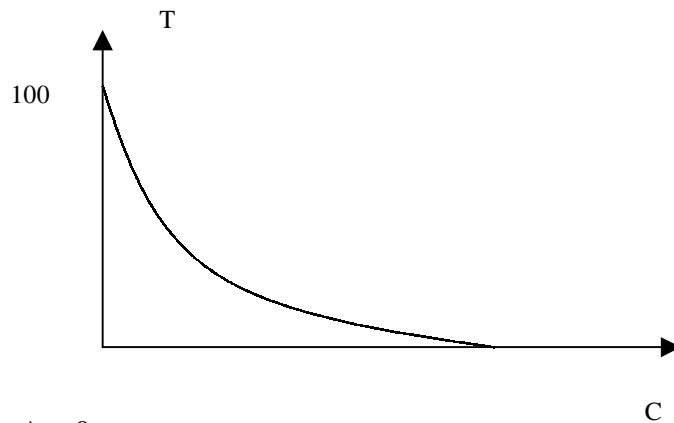
This complementary colour wavelength can be determined with a spectrophotometer, through the use of an absorption spectrum, you can determinate the absorption maximum and then the complementary colour wavelength.



$T = I / I_0$ is transmittance (%)

$A = \text{Log}_{10} (I_0 / I)$ is absorbance (no unit)

$A = - \text{Log } T$

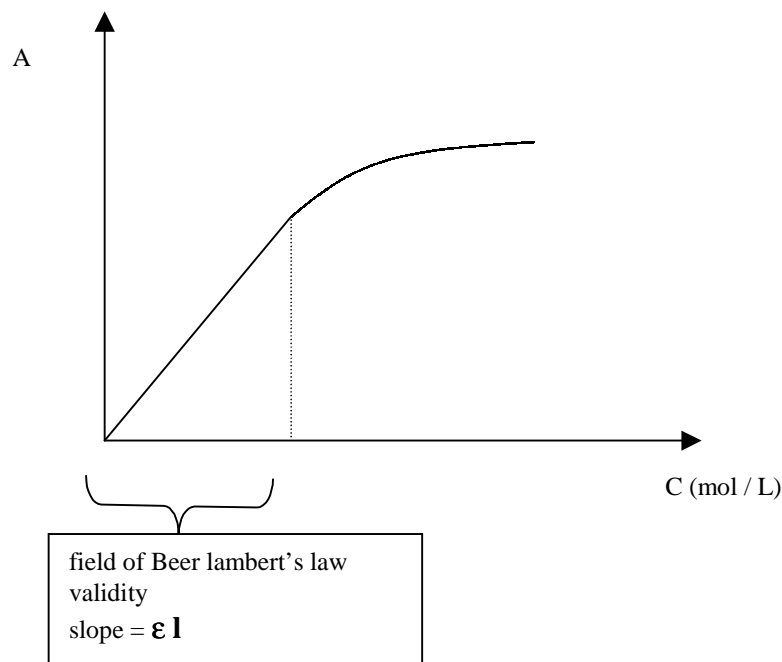


If $T = 100\%$, $A = 0$
 and if $T = 0.01\%$, $A = 4$

Beer Lambert's law : $A = \log I_0/I = -\log T = \epsilon l c$

L in cm, c in mol.L^{-1}

ϵ is the molar extinction coefficient : $\text{L.mol}^{-1}.\text{cm}^{-1}$



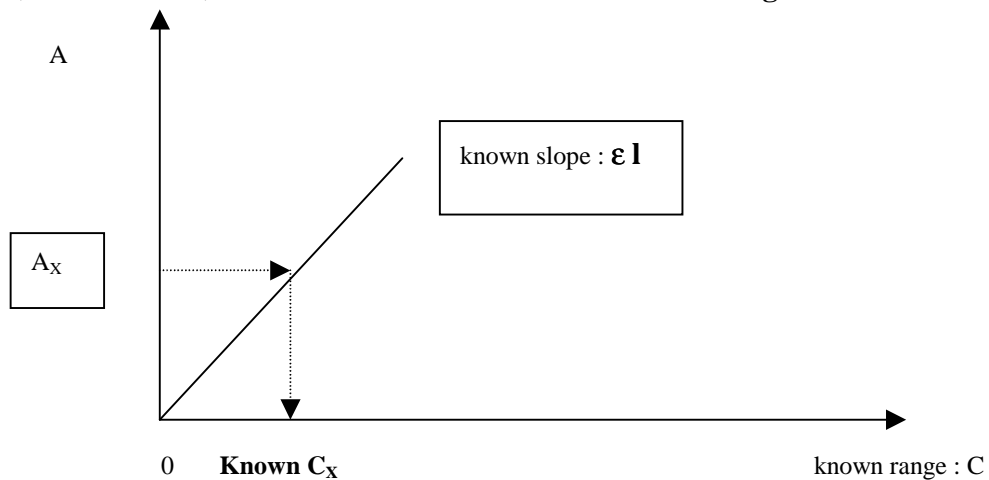
☞ there are two main experiments to carry out :

- wavelength determination
- field of law linearity

☞ this law can't be applied for concentrated solutions (generally, $C < 10^{-3} \text{ mol / L}$)

☞ if the original solution is colourless, add a chromogen : substance which reacts **specifically** with the measured matter (orthophenantroline with iron, phosphomolybdat with phosphorus, DPD with chlorine...)

☞ a calibration range allows to know ϵl ; then, it is possible to know an unknown matter concentration ; let's call it X , **if its concentration is included in this range** :



☞ portable spectrophotometers (Hach DR2000...) : slopes l and wavelength (absorption spectrum) are already programmed

☞ range preparation is useless

☞ only 2 flasks : blank and test

☞ read the notice : reaction times and above all the range : **the test concentration must be included in the indicated range ; pay attention to the units and the security**

Field of application :

- normalised dosages of iron, Mn, Cl_2 , NO_3^- , NO_2^- , NH_4^+ ...
- rapid dosages with portable spectrophotometers : read the notices.