Concentration of MB

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I. CONCENTRATION

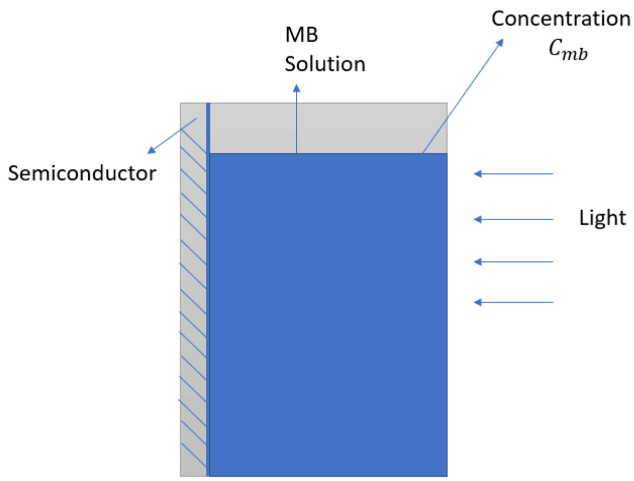

FIG. 1. The figure illustrates the Shapiro steps with a 44 GHz signal settings. The scale of vertical is $500\mu A/div$ and the horizontal is $500\mu V/div$.

We have

$$\frac{dC_{MB}}{dt} = -kC_{MB}, \tag{1}$$

where C_{MB} is the concentration of the MB solution and t is time. Thus integrating gives,

$$C_{MB}(t) = C_{MB}(0)e^{-kt}. \tag{2}$$

Now for the transmission using Beer-Lambert law we have

$$T = e^{-\alpha d}, \tag{3}$$

where d is the thickness of the cuvette and α the absorbance coefficient. Therefore

$$\alpha \propto C_{MB} = \beta C_{MB}.$$

$$T(t) = e^{-\beta C_{MB} d} = e^{-\beta d C_{MB}(t)},$$

therefore taking the natural log of the above equation approximately gives

$$-lnT(t) = \beta d C_{MB}(t). \tag{4}$$

This relationship between the concentration and absorbance should be considered when analyzing the wavelength since the higher the molar absorbance coefficient the higher the absorbance will be however this means the wavelength that has the highest molar absorbance should be used for the analysis since it gives the lowest detection limits. This wavelength can be called, λ_{max}. This is illustrated in Pradip's FIG 2. Now βd from Eq. 4 gives the slope needed to determine the concentration. From Pradip's thesis on page 79, the calibration curve for the concentration levels was obtained by observing the absorbance spectra of the MB solution which is shown in FIG 2.

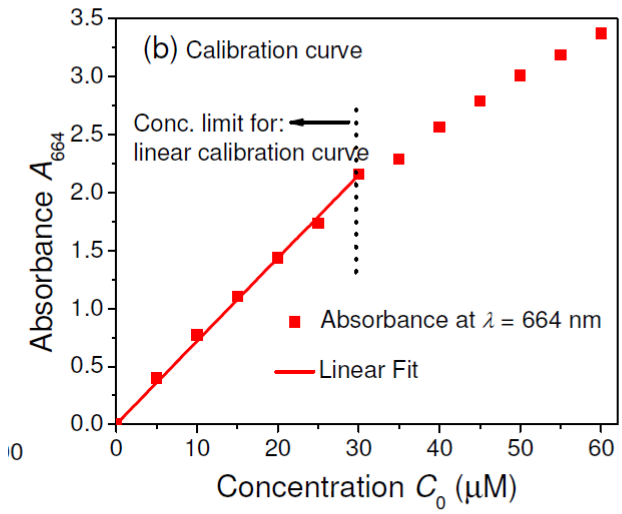

FIG. 2. The figure illustrates the Shapiro steps with a 44 GHz signal settings. The scale of vertical is $500\mu A/div$ and the horizontal is $500\mu V/div$.