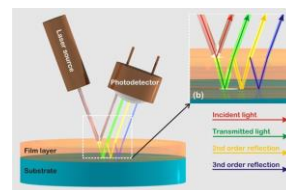


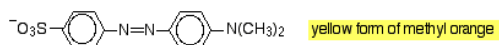
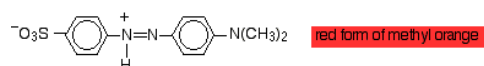
ThetaMetrisis APPLICATION NOTE #011

Absorption & concentration measurements in liquids

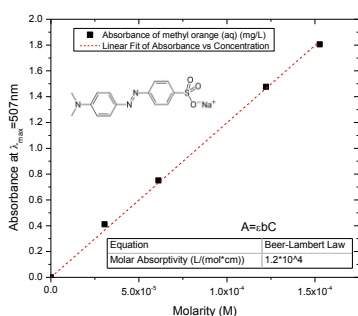
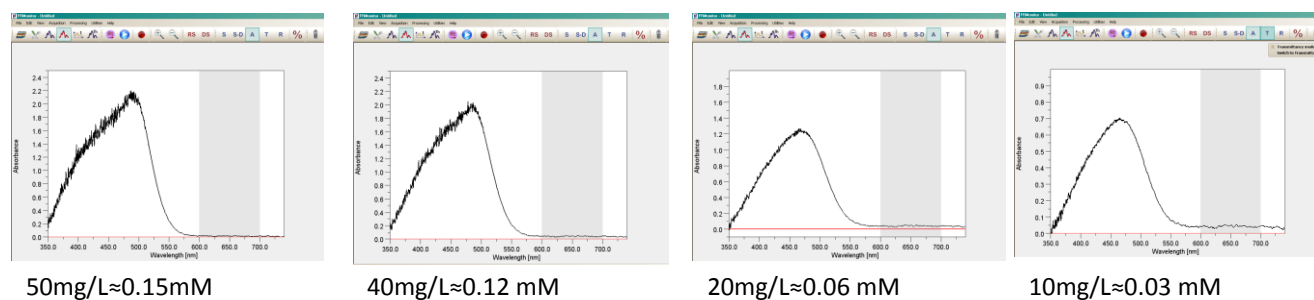


Goal: The real time measurement of the absorption & concentration of liquid samples.

Means & Methods: FR-Basic VIS/NIR is combined with the FR-Film/Cuvette holder for the accurate real time monitoring of the absorption or transmittance of liquids in standard quartz cuvettes. All measurements were performed with an FR-Basic tuned to operate in the 3600-1000nm spectral range. Methyl orange aqueous solutions were examined. Methyl orange is a pH indicator and has a pKa of 3.47 in water at 25°C. Methyl orange is an azo dye which exists in two forms depending on the pH:



Results: The absorption spectra as they recorded through FR-Monitor are illustrated in the figure below for four different concentrations. As the hydrogen ion is lost or gained there is a shift in the exact nature of the delocalisation in the molecule, and that causes a shift in the wavelength of light absorbed resulting in a colour change. Dilution in deionized water, where equal amounts of the red and yellow forms are present and so methyl orange looks orange, doesn't affect its initial chromophore. The examined concentration range, below 10^{-3} M, is following the Beer-Lambert Law where Absorbance is a linear function of the molar concentration ($A=εbc$). Thus, calculation of the molar absorptivity (or molar absorption coefficient, $ε$) of the examined chemical compound is attainable. The measurements are performed at 507nm according to Sigma-Aldrich specifications and the results are in good agreement with the literature¹.



Absorbance calibration curve of methyl orange at 507nm at 25°C.

Conclusions:

- Determination of A_{max} wavelength.
- Determination of concentration via Beer-Lambert law with high sensitivity and Limit of Detection (LOD), i.e. for methyl orange solutions, $LOD=1.5 \cdot 10^{-6}$ M.
- The described procedure is reliable, very simple and conveniently applicable in most laboratories with low time of analysis.

¹ [1] K. L. Kendrick et.al, *Journal of Solution Chemistry*, 16 (4), 1987, p: 258. [2] J. F. Boily et.al, *Journal of Solution Chemistry*, 34 (12), 2005, p: 1387