

For General Medicine

Topic of section: Light absorption and scattering

Topic of lab work: Determination of the solution concentration with photoelectrocolorimeter

Aim: determine the unknown solution concentration with photoelectrocolorimeter.

Theory:

1. What is the light absorption? Describe fundamental laws of the light absorption. What is the light absorption spectrum?
2. Write down the Lambert-Beer-Bouguer Law. What does the molar extinction coefficient depend on?
3. What are transmittance and optical density? Describe their dependence on the wavelength and solution concentration.
4. What is the light scattering? Explain differences between Tyndall scattering and Rayleigh scattering. Write Rayleigh scattering Law.

Practical part:

1. Determination of the absorption spectrum of the solution

Table 1. Dependence of the optical density and transmittance on wavelength

Number of absorber	Wavelength λ , nm	C=	
		T	D
1	415		
2	500		
3	530		
4	600		
5	630		

2. Determination of the dependence of the optical density on solution concentration

Table 2. Dependence of the optical density and transmittance on concentration

C, %	T, %	D	α
$C_1 =$			
$C_2 =$			
$C_3 =$			
$C_x =$			$\alpha_{\text{aver}} =$

Solve the problems:

1. The intensity of light with a wavelength λ_1 and absorption coefficient $k_1 = 0.02 \text{ cm}^{-1}$ reduced due to absorption by 4 times. The intensity of light with a wavelength λ_2 for the same reason reduced by 3 times. Find a thickness of substance and the absorption coefficient for light with a wavelength λ_2 .

Answer: 69 cm, 0.016 cm⁻¹

2. Transmittance of the solution T is equal to 0.3. What is the optical density of this solution?

Answer: 0.52

3. Optical density of the solution D is equal to 0.8. Find the transmittance of this solution.

Answer: 15.8 %

4. A half of incident light passes through transparent substance with thickness of 6.9 cm. Calculate the coefficient of light absorption for this substance (in cm^{-1}).

Answer: 0.1 cm⁻¹

Literature

1. Medical and biological physics for medical students (pages 181-187)