EXAMINATION OF OPTICAL ROTATION OF SOLUTIONS AND DETERMINATION OF CONCENTRATION USING A SACCHARIMETER

Equipment:

1. Lippich saccharimeter.
2. Stock solution of sucrose - 20 %.
3. Two solutions of unknown sucrose concentrations.

Course of measurements:

1. Place a glass tube filled with distilled water into the saccharimeter. The tube must be filled up to the upper meniscus to avoid air bells. ATTENTION: the tube should be placed with the thumb nut downward.
2. Point the saccharimeter towards the lighting lamp and look in the ocular. You can see an image in the monochromatic light. The image is divided into three parts of different brightness. Turn the analyzer handwheel until all parts of the image have equal brightness (they are indistinguishable from each other). This reflects the parallel orientation of polarization planes of the polarizer and the analyzer. For pure water this corresponds to the rotation angle α_0 of 0°. The correct measurement is obtained only when the light intensity of the image observed in a saccharimeter is minimal (not maximal !). Under such circumstances the measuring error is reduced to minimum. The value of angle α should be read off from the scale with an accuracy of 0.1 degree.

ATTENTION: all measurements of the angle of the optical rotation (α) should be repeated three times. After each measurement, the saccharimeter must be put out of adjustment and then re-adjusted according to the procedure described above. Calculate an average value of the rotation angle of three measurements and put it into the table.

3. Pour out the water from the tube and fill it with the stock solution of sucrose (20%).
4. Place the tube with the solution in the saccharimeter and turn the handwheel until all parts of the image are equally bright (as in # 2).
5. Read off the rotation angle measured for the stock solution.
6. Dilute the stock solution (20%) to obtain 4 solutions with sucrose concentrations of c_1 = 15%, c_2 = 10%, c_3 = 7,5%, and c_4 = 5%, respectively. Final volume of each solution should be 25 ml.
7. Analogously to # 5 measure the rotation angle for each of the solutions.
8. On the basis of the measurements performed in #5 and #7 plot the rotation angle as a function of sucrose concentration (calibration curve) on the plotting paper.
9. Measure the rotation angles, for both solutions of unknown sucrose concentrations.
10. Using the calibration curve and read off the sucrose concentration in both solutions.

Required theoretical knowledge:

1. Light polarization and definition of a polarization plane.
2. Linear polarization phenomena:
   a) reflection from a dielectric surface (Brewster's angle),
   b) double refraction in some crystals.
3. Nicol prism, ordinary ray and extraordinary ray.
4. Optically active substances, specific rotation, dispersion of optical rotation.
5. Principle of operation of the Lippich saccharimeter.

Wrocław Medical University Department of Biophysics and Neuroscience	**Practical No 3** **Examination of optical rotation of solutions and determination of concentration using a saccharimeter**
…… ……..…….. ……..……. Student names	Faculty: ……. Group number: …… Date: ……
Grade:	Tutor's signature:

1. Measure the angle of optical rotation for distilled water (α_0 – average of three measurements).

α_0 =

2. Dilute the stock solution to obtain four solutions as described in the instruction.

3. Measure the angles of optical rotation for the solutions. Fill in the table below.

Examined liquid	Angle of rotation α	Average value of the angle α_{av}	Saccharose concentration [%]
Stock solution			20
Dilution No 1			
Dilution No 2			
Dilution No 3			
Dilution No 4			
Examined solution No 1			
Examined solution No 2			

4. Plot the rotation angle as a function of sucrose concentration (calibration curve) on the plotting paper.

5. Measure the angles of optical rotation for both solutions of unknown concentrations. Insert the values on the graph and read off the concentrations of the solutions from the curve.