

**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. Insert the metal tube completely filled with distilled water (no air bubbles are allowed inside the tube) into the saccharimeter chamber. The tube should be placed in the saccharimeter with the cap facing upward.
2. Turn on the illumination lamp of the saccharimeter. A monochromatic image is obtained.
3. By rotating the analyzer, bring both halves of the field of view to equal illumination level. This corresponds to the parallel position of the polarization planes of the polarizer and the analyzer. Read the value of the angle  $\alpha_w$  from the scale. For distilled water it should be  $0^\circ$ .  
The measurement is based on **equal illumination** at **minimum** intensity as this yields the smallest measurement uncertainty (a uniformly grey field of view is observed).
4. Read the value of the angle  $\alpha_0$  on the graduated scale with an accuracy of  $0.1^\circ$ .
5. All measurements of the rotation angle should be repeated **three times**. Each time deliberately misalign the setup and return again to the equally illuminated field. Use the arithmetic mean of the three readings in the calculations.
6. Empty the measuring tube.
7. Fill the metal measuring tube completely with the **20%** stock solution of sucrose.
8. Place the tube with the solution in the polarimeter, then rotate the analyzer to find the position of equal illumination of both halves of the field of view (as in step 3).
9. Read the angle  $\alpha_z$  by which the plane of polarization was rotated after passing through the stock solution ( $C_{z0}$ ). Perform all measurements three times, as in step 5.
10. From the **20%** sucrose stock solution, prepare four solutions (25 ml each) of the following concentrations:  
 $C_{z1} = 15\%$ ,  $C_{z2} = 10\%$ ,  $C_{z3} = 7,5\%$ ,  $C_{z4} = 5\%$ .

**ATTENTION!** If you use a pipette, set the required volume using the upper knob. Before drawing the solution, fit a plastic tip from container **3** onto pipette **3**.

11. Determine the rotation angles  $\alpha_z$  for each of the prepared solutions and enter their values into Table 1 of the report form. Repeat every measurement three times, as in step 5.
12. Based on the measurement results for the solutions of known concentrations, plot the dependence of the rotation angle of the plane of polarization ( $\alpha_z - \alpha_w$ ) on the sucrose concentration using plotting paper.
13. For each of the solutions of unknown concentration (bottles labelled **Sucrose No. 1** and **Sucrose No. 2**) determine the rotation angles of the plane of polarization:  $\alpha_{x1}$  and  $\alpha_{x2}$ . Enter the data into Table 1.
14. Using the calibration curve (from step 12), determine the concentrations of the unknown solutions:  $c_{x1}$  and  $c_{x2}$ .

### **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.

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| <b>Wrocław Medical University</b><br><b>Department of Biophysics</b><br><b>and Neuroscience</b> | <b>Practical No 2</b><br><br><b>Examination of optical rotation of solutions and determination of concentration using a saccharimeter</b> |  |
| .....<br>.....<br>.....<br>Student names                                                        | Faculty: .....<br>Group number: .....<br>Date: .....                                                                                      |  |
| Grade:                                                                                          | Tutor's signature:                                                                                                                        |  |

1. Measurement of the rotation angle of the plane of polarization by distilled water.  
( $\alpha_0$  – average of three measurements).

|              |
|--------------|
| $\alpha_w =$ |
|--------------|

2. Measurement of the rotation angle of the plane of polarization by the initial solution and its dilutions.

| Examined liquid            | Angle of rotation<br>$\alpha_z$ | Average value of the<br>angle<br>$\alpha_{av}$ | Saccharose<br>concentration<br>[%] |
|----------------------------|---------------------------------|------------------------------------------------|------------------------------------|
| Stock solution<br>$C_{z0}$ |                                 |                                                | 20                                 |
| Dilution No 1<br>$C_{z1}$  |                                 |                                                |                                    |
| Dilution No 2<br>$C_{z2}$  |                                 |                                                |                                    |
| Dilution No 3<br>$C_{z3}$  |                                 |                                                |                                    |
| Dilution No 4<br>$C_{z4}$  |                                 |                                                |                                    |
| Examined solution No 1     |                                 |                                                |                                    |
| Examined solution No 2     |                                 |                                                |                                    |