Polarimetry	**GM 1.2.1.0018.15**
(*specific rotation*)	**Instead of SpH X**
	Instead of SpH XI, ed. 1
	Instead of SpH XII, p. 1, GM 42-0041-07

Optical rotation is the rotation of the plane of polarisation of linearly polarised light as it travels through a material.

Depending on the nature of optically active material the rotation of the plane of polarisation may have a different direction and range. If the plane of polarisation rotates clockwise from the observer's to whom the light passing through optically active substance is directed then the material is called dextrorotary and is marked with symbol (+); and if the plane rotates counterclockwise, then the material is called levorotary and is marked with symbol (-).

Deviation of the polarisation plane from the initial position expressed in angular degree is called rotation angle and is marked with a Greek letter α. Degree of rotation depends on the nature of optically active material, path length of polirising light in optically active medium (pure material or solution) and wave length of the light. For solutions the rotation angle depends on nature of solvent and concentration of optically active material. Rotation angle is proportional to the path length through the material. i.e. thickness of the layer of the optically active material or its solution. In the majority of cases, temperature has an insignificant effect.

For comparative evaluation of the ability of various materials to rotate the plane of polarisation, calculate specific rotation [α].

Specific rotation $[\alpha]\ \frac{20}{D}$ is the rotation angle α of the plane of polarisation of monochromatic light at average wave length of sodium *D* line (589.3 nm) expressed in degrees measured at a temperature of 20 °C calculated for 1 dm thickness of the test substance layer and concentration equal to 1 g/mL. It is expressed degrees milliliters per gram per decimeter $[(°) \cdot mL \cdot dm^{-1} \cdot g^{-1}]$.

Sometimes the green mercury line with wavelength of 546.1 nm is used.

When determining [α] in solution of an optically active material one must keep in mind that the obtained value can depend on the nature of the solvent and concentration of the optically active material.

Change of solvent may lead to change in [α] not only in value, but in its sign as well. Therefore, when indicating the degree of specific rotation, you must also indicate the solvent and the selected concentration.

Specific rotation is determined on dry basis or based on anhydrous accurate weigh, which should be indicated in the general monograph.

Determination of rotation angle is performed using a polarimeter that allows to determine the angle with precision of ± 0.02 °C at a temperature of (20 ± 0.5) °C. Measurement of optical rotation can be conducted at other temperatures as well, but in these cases the general monograph should indicate the method of temperature reporting. The scale is usually validated using certified quartz plates. Scale linearity may be validated using sucrose solutions.

Optical rotation of solutions should be measured within 30 minutes after their preparation; solutions or liquid materials must be clear. During measurement, set the zero point of the apparatus and determine correction value with a tube filled with pure solvent (when working with solutions) or with an empty tube (when working with liquid materials). After setting the apparatus at a zero point or determining the correction value, perform the main measurement, repeat at least 3 times.

In order to obtain rotation angle α summirise the obtained readings and add them to the previously determined correction value.

Specific rotation value [α] is calculated using one of the following equations.

For solutions:

$$[\alpha] = \frac{\alpha \cdot 100}{l \cdot c} \qquad (1)$$

where α – measured rotation, degrees;

l – path length, dm;

c –solution concentration, g of materials per 100 mL of solution.

For liquids:

$$[\alpha] = \frac{\alpha}{l \cdot p} \qquad (2)$$

where α – measured rotation, degrees;

l – path length, dm;

p – density of the liquid, g/mL.

Measurement of rotation degree is performed in order to assess purity of the optically measured material or for determination of its concentration in solution. To assess purity using equation (1) or (2) calculate value of its specific rotation [α]. Concentration of optically measured material in solutions is calculated using the following equations:

$$c = \frac{\alpha \cdot 100}{[\alpha] \cdot c} \qquad (3)$$

Since [α] value is constant only at a specific concentration interval, possibility to use equation (3) is limited to this interval.