Determination Of Sugur Concentration By Polarimeter

by

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Instrumental Analytical Chemistry Lab

Class Code: yjnpyaf

DISK POLARIMETER: TYPE WXG-4

- It can be used for measuring the organic substances with optical rotation.
- With the aid of the disk polarimeter, the specific gravity, purity, concentration, and content of thousands of active materials, such as sugar solution, turpentine oil and camphor, can be measureed.
- In
- the food industry: The disk polarimeter can be used to inspect the sugar content and to
- measure the asylum content of the food flavorings. In the clinic and hospital: The disk
- polarimeter can be used to measure the sugar content and protein in urine.

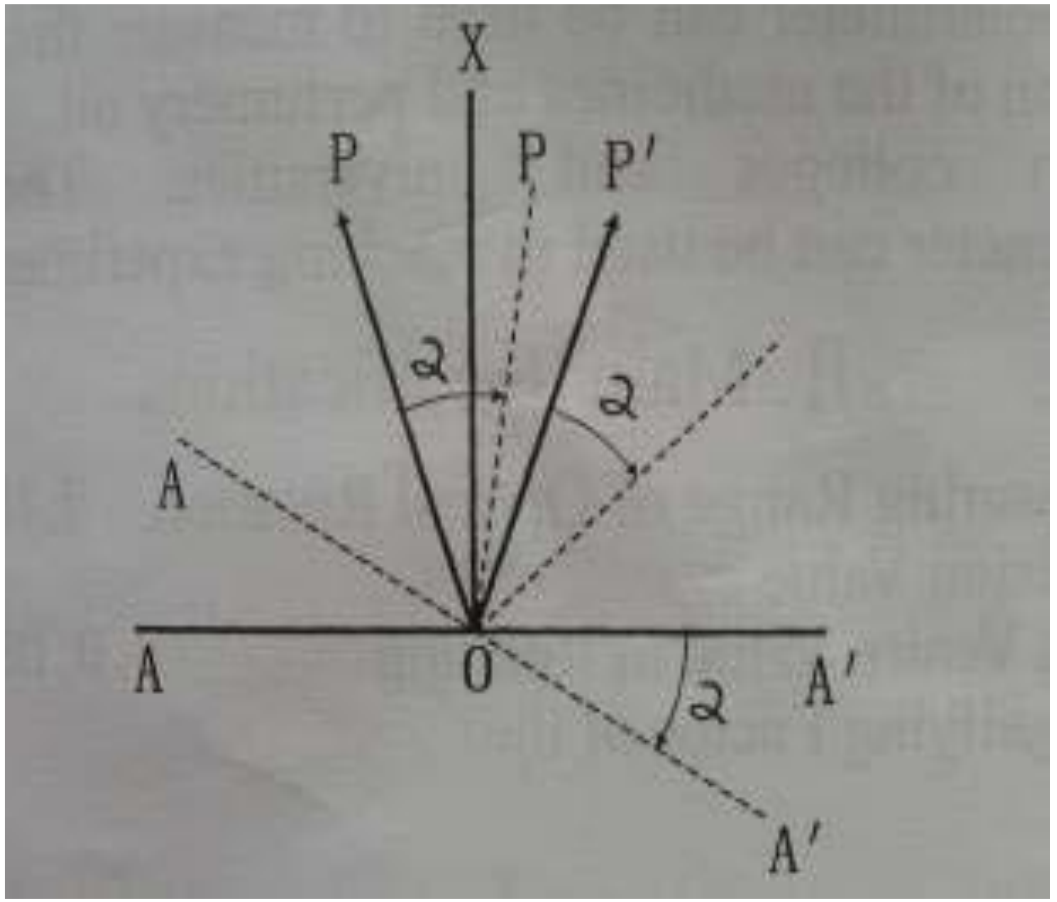
Main Specifications

- 1. Measuring Range of Optical Rotation ±180
- 2. Division Value 1°
- 3. Dial Venire Value in Reading 0.05°
- 4. Magnifying Factor of the
- Magnifying Glass 4times
- 5. Monochromatic Light Source 5893A°
- (Sodium Lamp)
- 6. Length of Test Tube 1 each
- (100mm and 200mm

- 7. Power Source of the Instrument
- Power Line Voltage 220V / 50Hz
- Working Current 1.3A
- Discharging Power 20W
- Stabilization Time a bout 5minutes
- 8. Weight of the Instrument 5 kg
- 9. Overall Dimensions 540×220×380(mm)

Principle of Operation

- The principle of operation of the polarimeter is established on the basis of thepolarized light. In addition, by use of the method of rotating the polarized plane of the polarization light, its measuring purpose can be attained. At the position of zero degree, AA´ is Perpendicular to the centerline OX.

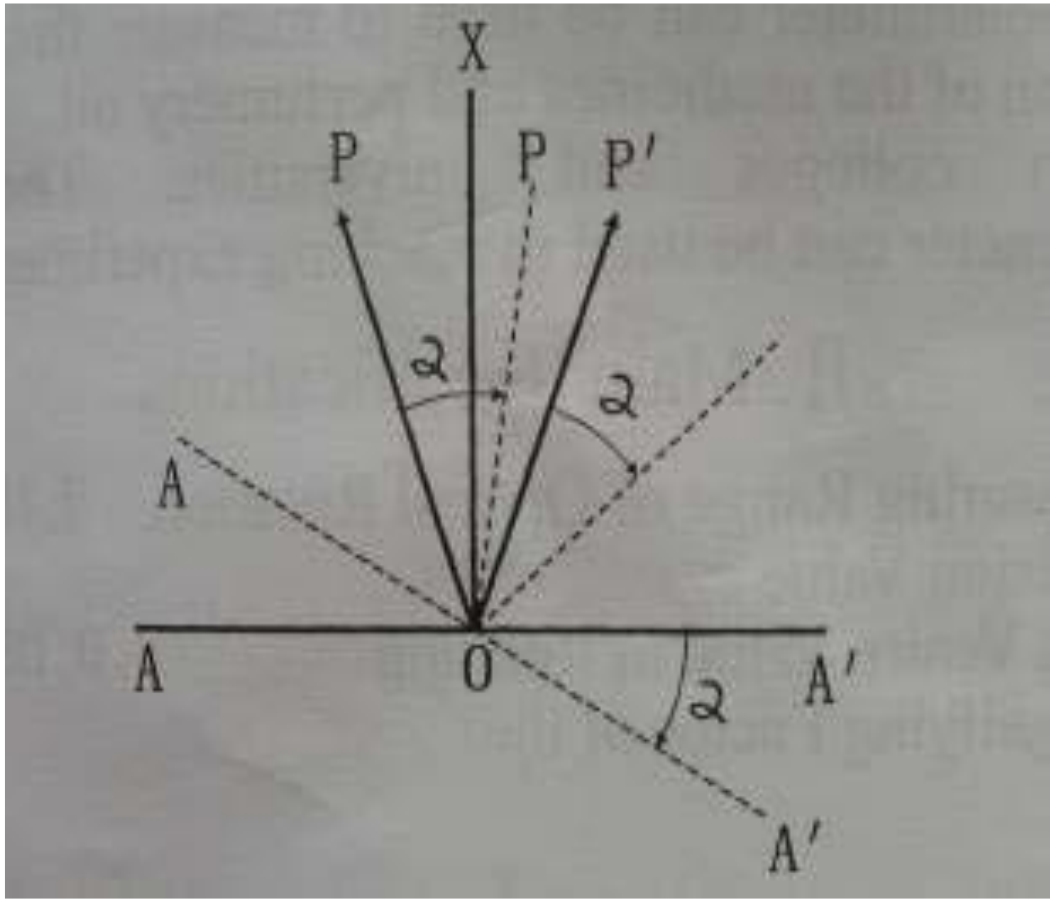


- AA’ indicates the vibration direction of the polarization analyzer
- OP and OP’ indicate the vibration directions of the polarized lights of

the two halves of the viewing field.

- When the light beam passes through the optical rotators substance, the plane of polarization is rotated by an angle of α

(dotted line)



- Now, the projections of the polarized lights of the two halves on AA’ are not identical, the right half is bright, and the left half is dark. If rotating the polarization plane AA’ of the analyzer by an angle of α in the same direction, the illumination intensity of the viewing field can be made equal again. At this time, the rotated angle of the polarization analyzer is the optical oration of the substance.

Specific Optical Rotation

$$[\theta]_t^{\lambda} = \frac{\theta}{l\,C} \times 100$$

$$[\alpha]_{\lambda}^{t} = \frac{Q}{lC} \times 100$$

Where, Q— the rotation angle (optical rotation) measured by use of light λ, when the temperature is t.

L— the length of solution column (test tube), using decimeter (dm) as the unit of the length.

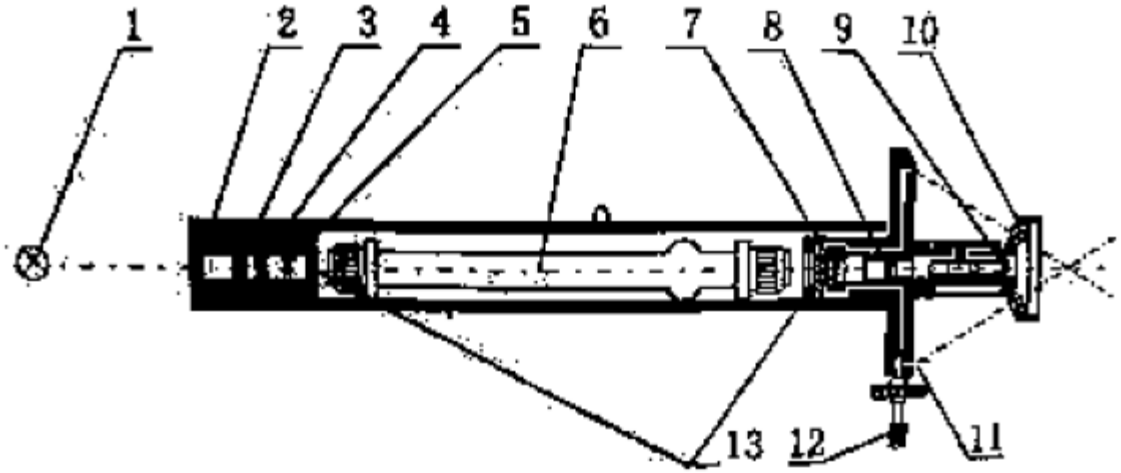
C— concentration, i.e. the gram quantity of the solute in 100mm of solution.

- $Q=[\alpha]LC$

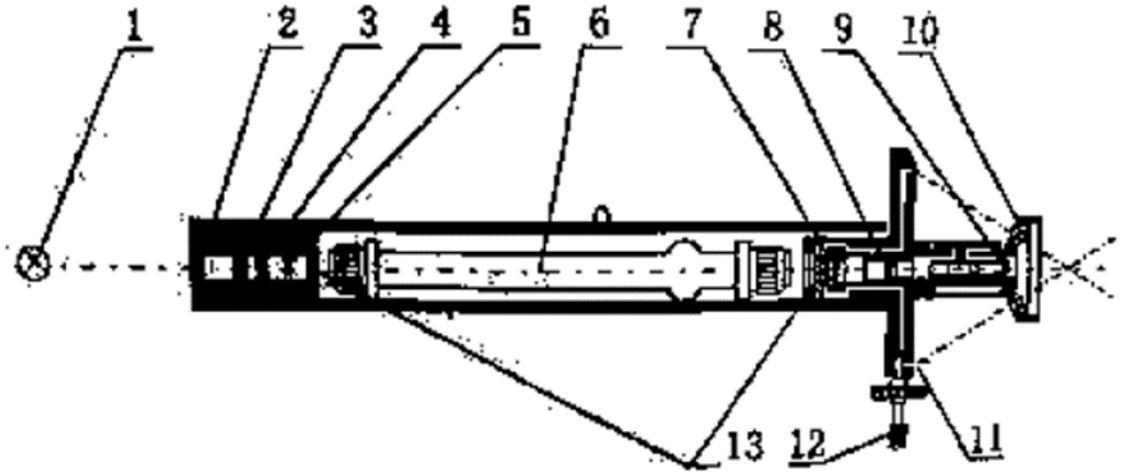
the optical rotation has relations with the temperature. As for most substances, $\lambda=589.3nm$ (sodium light)can be used in the measurement, when the temperature rises by 1ºC, the optical rotation will reduce by 0.3%. Thus, for the measurement with higher requirements, it had better to make the measurement under a working circumstance of 20±2ºC

System diagram of the instrument.

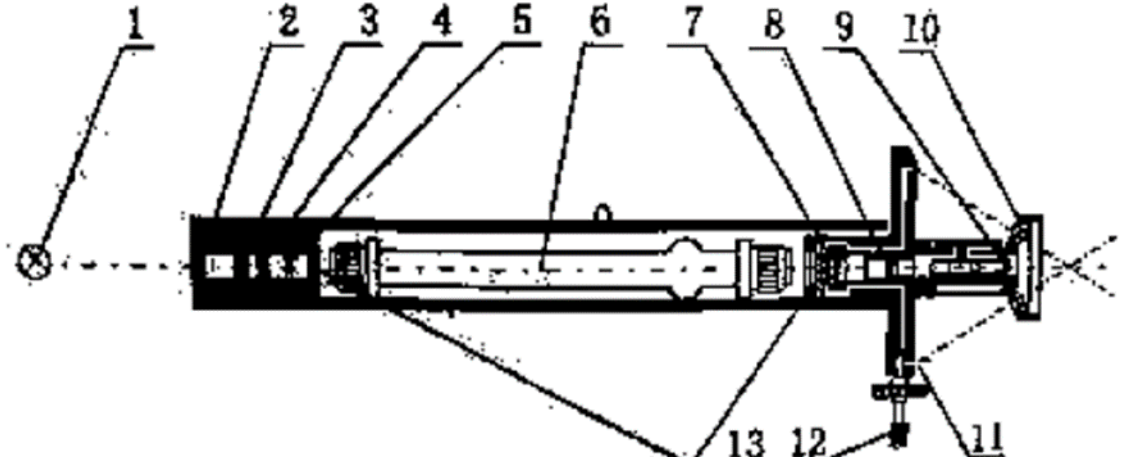
1. Light Source(Sodium Light)
2. Collector lens
3. Color Filter
4. Polarizer
5. Half-wave Plate
6. Test Tube
7. Polarization Analyzer



8. Object Lens
9. Eye Lens
10. Magnifying Glass
11. Dial Venire
12. Dial Rotary Hand-wheel
13. Protective Plate



After the light coming from the light source (1) has been projected on the collector lens (2). Color filter (3), and Polarizer (4),it becomes a plane linear polarized light, and after the polarized light passes through the half-wave plate(5) and is decomposed into normal light and abnormal light, a triplex view-aspect will occur in the viewing field. The test tube (6) containing the optical rotatory substance is put into the sample chamber for measurement. Since the solution has optical activity, the plane-polarized



light is rotated by an angle, so that the polarization analyzer (7) can play a role of analysis. Observing through the eye lens (9), we can see a mid-bright (or dark) and left/right-dark (or bright) triplex viewing field of unequal intensity of illumination

- Rotate the dial rotary hand-wheel (12) so as to drive the dial (11) and the polarization analyzer (7), until the illumination intensity of the viewing field (dark viewing field) becomes equal

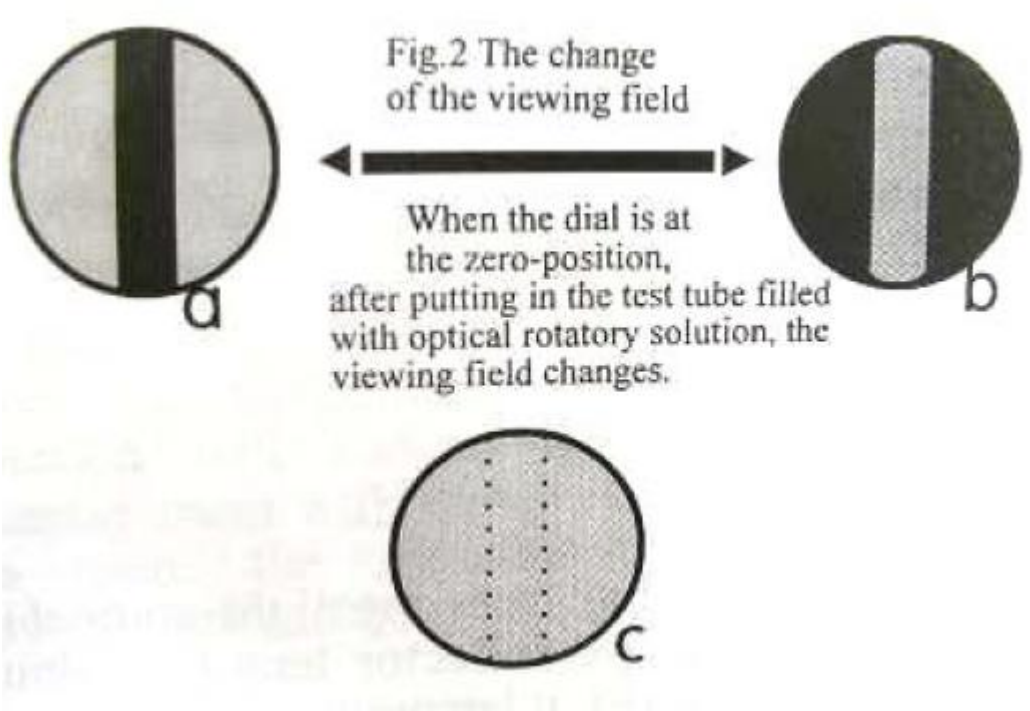


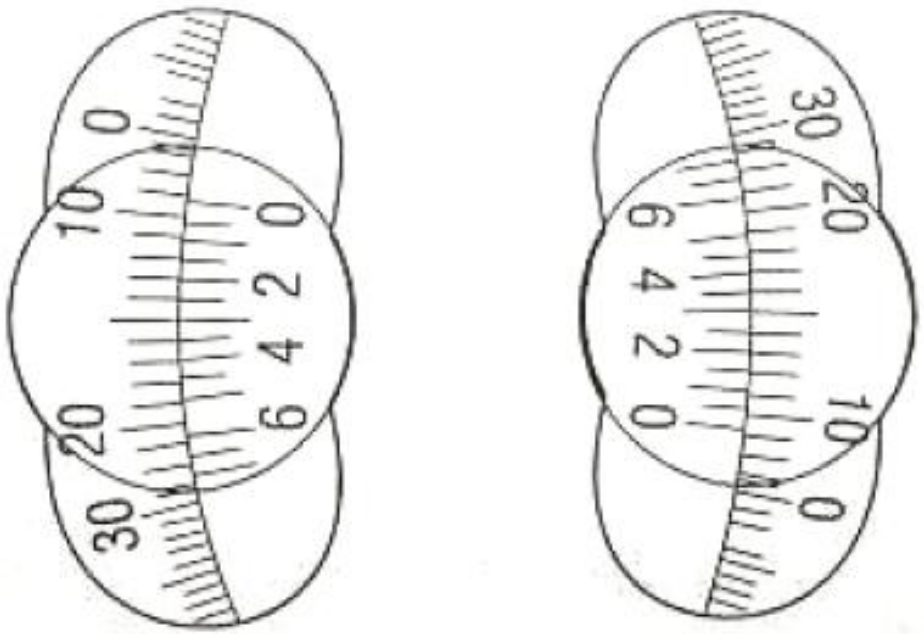
Fig.2 The change of the viewing field

- When leaving the factory, the above-mentioned shadow angle is regulated to about 3.5°
- In order to eliminate the eccentric difference, the **Instrument** uses double-vernier in reading, the dial is divided is divided into 360 divisions and each division indicates 1°. The vernier is divided into 20

divisions which are equal to 19 divisions of the dial, and the vernier can be used to obtain a direct reading to the extent of 0.05°

Magnifying Glasses

analyzer are fixed integrally. The hang-wheel (12) can be used to make coarse and fine rotation. Two pieces of magnifying glasses (the magnifying factor is 4 times) are mounted in front of the vernier window, which can use in reading.



Q=9.30°

Procedure

1. Compound the solutions to be measured, then have the solution stabilized.
2. Pour the solution to be measured into the test tube for measurement.

Caution: the screws at the both ends of the test tube should not be screwed in too tightly (usually screw down the screws with hand conveniently until no water leak occurs) so as toprevent the protective plate from producing strain which may cause the illumination change of the viewing field and affect the accuracy in measurement. Then, wipe theremained liquid at the both ends clean.

V ml	θ	C g/ 100 ml
5	1.4	0.7
10	2.3	1.8
15	3.5	1.8
20	4.6	2.14
Uknown	2.9	1.5

3. Connect the power source, and turn on the sodium lamp for about 10 minutes. Only when the lamp gives out yellow sodium light, the observation can be made.
4. Check for the zero-position of the dial. If the zero-position is not correct,
5. Tabulate the results
6. Draw the Calibration Curve. Calculate the specific rotation (estimate the slope)
7. Measure for unknown.
8. Calculate the Molecular rotation(multiply θ by molecular weight.