POLARIMETER (BIQUARTZ)

OBJECT:

To determine the specific rotation of cane sugar solution using Polarimeter.

SPECIFIC ROTATION:

Specific rotation is the rotation produced by a column in a solution of an optically active substance one centimeter long, the concentration of the substance being one gram per c.c.

APPARATUS USED:

Polarimeter, Electric bulb with housing, sugar, balance, graduated cylinder and thermometer.

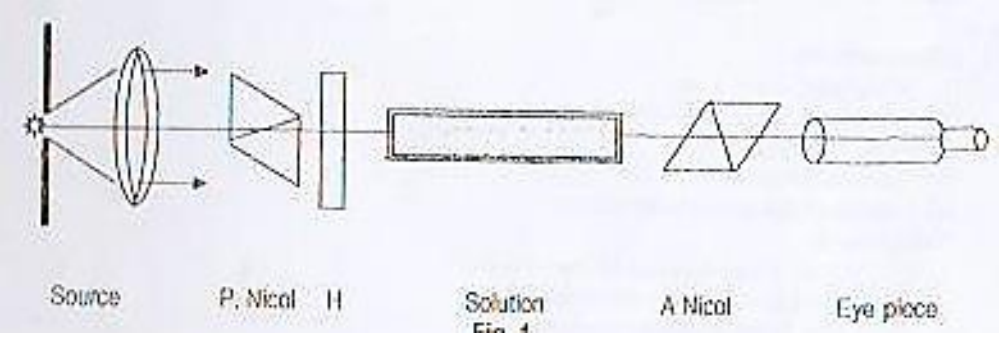

Fig-1

DESCRIPTION:

As shown in fig.1, **Source** is the Sodium Vapor lamp fitted in housing, **P.Nicol**, the polarizing Nicol, **H**, the Half shade device, **A Nicol**, the analyzing Nicol and **Eye piece** is the observing eye piece and **solution** is contained in the tube with glass end.

FORMULA:

The specific rotation S of the plane of polarization of sugar dissolved in water.

$$S = \frac{\theta}{lxc} = \frac{\theta\, x\, v}{l\, x\, m}$$

Where,

c = Concentration of the solution m/v = ….gm/cc
θ = Rotation produced in degree
l = Length of the tube in cm
m = Mass of sugar in gm dissolved in water
v = Volume of sugar solution

METHOD:

1. Weigh 5 gm of sugar and carefully dissolve it is water to make up to 100cc of solution. The solution should be well mixed by pouring it from one jar to another so that it becomes of one uniform concentration. This gives a 5% solution of sugar.
2. Clean the glass tube, fill it with water and close the end, see that there are no air-bubbles in the tube and no water is sticking on the outside of the end glasses. Put the tube in position and rotate the analyzer. A till the field of view is completely and uniformly dark i.e. both halves are equally dark. Read the position of analyzer on the circular scale, provided for the purpose. A further rotation through 180^o will again produce an extinction.
3. Remove the tube, empty it, rinse it with solution and then fill it completely, removing all bubbled. Clean the ends and put the tube in position. The two halves of the field will appear unequally dark.
4. Rotate the analyzer to produce extinction again and read the scale. This difference gives the rotation produced. Get a second position of extinction (equal darkness) by a further rotation of 180^o and take mean for the rotation produced.
5. Now, to 50 c.c. of solution add 50 c.c of water and mix thoroughly. This gives a 5% solution and mix thoroughly. This gives a 5% solution. Take readings with it and then mix 50 c.c. of this solution with 50 c.c. of water again. This gives a 2.5% solution. Take readings with this also. Repeat with 1.25% solution.

OBSERVATION:

(i)	Weight of watch glass	=	gm.
(ii)	Weight of watch glass and sugar	=	gm.
(iii)	Weight of sugar	=	gm.
(iv)	Volume of solution	=	c.c.
(v)	Length of the polarimeter tube 1	=	cm.

Table for θ

Value of one division of mains scale	=
No. of division on Vernier scale	=
Least count of Vernier analyzer	=

Table -1

S.NO.	% solution i.e. reading of analyzer with water						Mean $a = \frac{X+Y}{2}$
	Clockwise			Anticlockwise			
	M.S.	V.S.	Total 'X'	M.S.	V.S.	Total 'Y'	
1.							
2.							
3.							

Table – 2

S.NO.	Concentration of solution	% solution i.e. reading of analyzer with water						Mean $b = \frac{X'+Y'}{2}$	$(\theta) = a - b$
		Clockwise			Anticlockwise				
		M.S.	V.S.	Total 'X'	M.S.	V.S.	Total 'Y'		
1.	5% solution								
2.	2.5% solution								
3.	1.25% solution								

CALCULATIONS:

1. Draw a graph between θ and concentrations. The graph will be a straight line as shown in Fig.2.
2. Find out the value of θ for particular value of concentrations.
3. Calculate the value of specific rotations S as

   S = $\frac{\theta \, x \, v}{l \, x \, m}$ $\ldots^0$/cm/gm/cc.

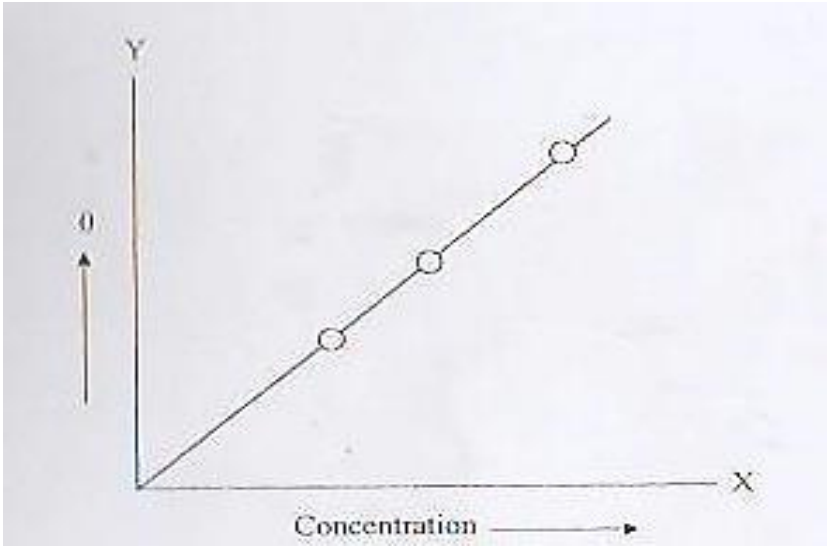

Fig. 2

RESULT:

1. The specific rotation of sugar solution (Solvent water) = …^{o}/cm/gm/cc at ^{o}C at λ = 5880 A^{o}.
2. Standard value of specific rotation of water = 66.5^{o}.
3. Standard value of specific rotation of Glucose (Solvent water) = 52^{o}.

Precautions and Source of Error:

1. The polarimeter tube should be well cleaned.
2. Water and sugar used should be dust free.
3. Whenever a solution is changed, risen the tube will new solution under concentration or clean the tube will water and dry it.
4. There is should be no bubble inside the tube.
5. The position of analyzer should be set accurately.
6. Readings should be taken when halves of the field of view becomes equally illuminated.