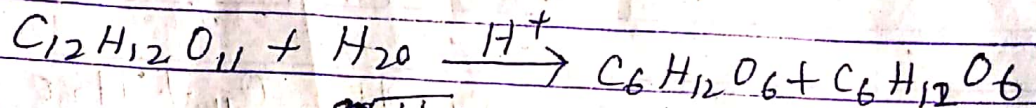


B.Sc. II Paper - III A.

Kinetics of inversion of cane sugar: —

Experimental determination of rate constant for inversion of cane sugar: —

Hydrolysis of sucrose in presence of mineral acid is given by chemical reaction.



This reaction is also called inversion of sugar. Here the compound sucrose, glucose and fructose are optically active compound. Sucrose is dextro-rotatory, glucose is also dextro-rotatory while fructose is laevo-rotatory. The fructose is more (-92°) rotatory than dextro-rotatory of glucose (+52.5°) and equimolecular mixture of glucose and fructose is laevo-rotatory.

Thus on hydrolysis, the dextro-rotatory sucrose gradually changes into laevo-rotatory. It is the reason that the reaction is called inversion of sucrose.

The reaction is studied by the rotation of at different temperature interval of time with help of polarimeter.

[P.T.O]



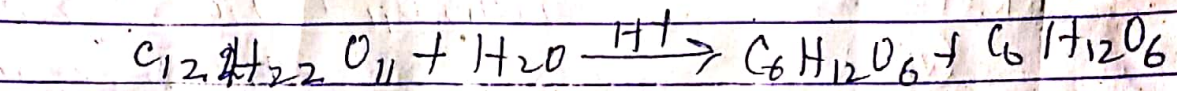
Let reading of polarimeter at  $t=0$  time =  $\gamma_0$

reading of polarimeter at time  $t = \gamma_t$

reading of polarimeter at  $t = \infty = \gamma_\infty$

Here infinity time can be taken as one day or two days so that sucrose is fully converted into glucose and fructose.

i.e.



$t=0$                        $a$      $0$                        $0$

$t = \infty$                        $(a-x)$      $x$                        $x$

Dextro  
rotatory

Laevo  
rotatory

Angle of rotation at time  $t = \gamma_0 - \gamma_t$

This is proportional to  $x$

$$\therefore x \propto (\gamma_0 - \gamma_t) \quad \text{--- (i)}$$

Angle of rotation at time  $t = \infty = \gamma_0 - \gamma_\infty$

This is proportional to concentration 'a' as at infinity whole sucrose is converted into glucose and fructose.

i.e.  $a \propto (\gamma_0 - \gamma_\infty) \quad \text{--- (ii)}$

or from equation (i) and (ii)

$$a(a-x) \propto (\gamma_0 - \gamma_t) - (\gamma_0 - \gamma_\infty)$$



$$\Rightarrow (a-x) \propto (r_t - r_\infty)$$

The value of  $a$  or  $a-x$  is substituted in integral equation of first order and  $k$  is calculated.  $k$  is found constant at different

value interval of time. Hence ~~is~~:  
Inversion of cane sugar is first order ~~kinetic~~ reaction.

$$k = \frac{2.303}{t} \log \frac{a}{a-x}$$

$$\text{or } k = \frac{2.303}{t} \log \frac{x_0 - x_\infty}{x_t - x_\infty}$$

This is equation for  
kinetics of inversion of sugar.

