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The study of acid catalysed hydrolysis of Benzyl Methanoate ester in Aqua-EtOH Solvent Solution

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Abstract:- The acid catalysed hydrolysis of Benzyl methanoate has been carried out in aqua-EtOH media prepared by adding from 30 to 80% of EtOH by volume in the reaction media at temperatures ranging from 293K to 313K.

By explaining the effect of $[H^+]$ on the hydrolysis of Benzyl methanoate in Aqua-EtOH solvent Solution by providing appropriate value which is placed below.

Keyword:- Benzyl Methanoate, Ethyl alcohol, hydrolysis, Solvation, Iso-Composition activation energy.

Introduction:- Several researchers and scholars[1-4] have been worked on the study of hydrolysis of Benzyl methanoate but the effect of $[H^+]$ on Benzyl methanoate ester in Aqua-EtOH has not been paid so far. It was thought essential also because the study of such reactions seems very important and much useful from the medicinal as well as biological values.

So, in order to highlight the above noted idea it has been proposed to make the effect of $[H^+]$ in Aqua-EtOH solvent solution.

Experimental:- Purified ethyl alcohol of BDH grade and Benzyl methanoate was taken. Glass apparatuses were also of corning brand. The solution was used with appropriate precautions.

The kinetics of acid catalysed hydrolysis of the ester was studied as usual by adding 1ml of ester in 100ml of 0.02M HCL solution. The acid of the solution was titrated as soon as possible by means of the standard baryta solution using phenolphthalein as a indicator.

Discussion:-

Solvent effect of $[H^+]$ on the Benzyl Methanoate ester:-

As from the reaction the K values have been expressed in min^{-1}. The rate constant values appear to decrease with increase in ethyl alcohol content of the reaction media. And similar trend is being observed almost at all the temperatures at which the study has been made.

In order to study the variation in K values with change in mole % of the organic co-solvent (EtOH), the logarithm of K values were evaluated which has been placed in Table –I.

For explaining the decrease in the rate of reaction is sharp and becomes slow after 30 mole % concentration in the reaction media. The view of Hughes and Ingold[5] and the prediction of Laidler and Landskroener[6] come to rescue.

Solvent effect on Iso-composition activation energy [E_c or E_{exp}] :-

The acid catalysed hydrolysis of Benzyl Methanoate was found to obey Arrhenius law during the range of temperature in which the study was made.

The E_c(Iso-composition or Arrhenius activation energy, E_{exp}) values have been calculated from the data. The E_c values thus obtained from table-II.

And the increase in E_c values can also be explained on the following three situations:-

(i) When the transition state is desolvated more than the initial state.
(ii) When the initial state is solvated more than the transition state and,
(iii) When the initial state is solvated and the transition state is desolvated.

Solvent participation in the formation of Activated complex:-

The effect of solvent concentration on reaction rates in mixed aquo-organic solvent has often resulted in some interesting conclusion. According to Tommila et.al.[7] and Lane[8], it gives an idea about the number of water molecules as associated with the transition state of the reaction in the medium. Therefore in the present study also, the influence of water concentration was tried to be worked out by plotting log K versus log $[H_2o]$. The plots have been depicted in fig. 1 and the relevant data of variation of log K with log $[H_2o]$ has been provided in Table-III.

It is interesting to note here that at each temperature two intercepting straight lines are obtained, both having the positive slope. At each temperature, the nature of slope changes at about 41.2% (v/v) water which corresponds to 59.80% of EtOH in aquo-organic covalent medium. The values of slopes of the plots of log K versus log [H_2o] have been included in Table-IV.

In this connection, Robertson et.at.[9] have defined solvation number ‘n’ as follows

$\text{Log } K = \log K' + n \log [H_2o]$

Here K is the measured pseudo first order rate of reaction.

Log K versus Log [H_2o]

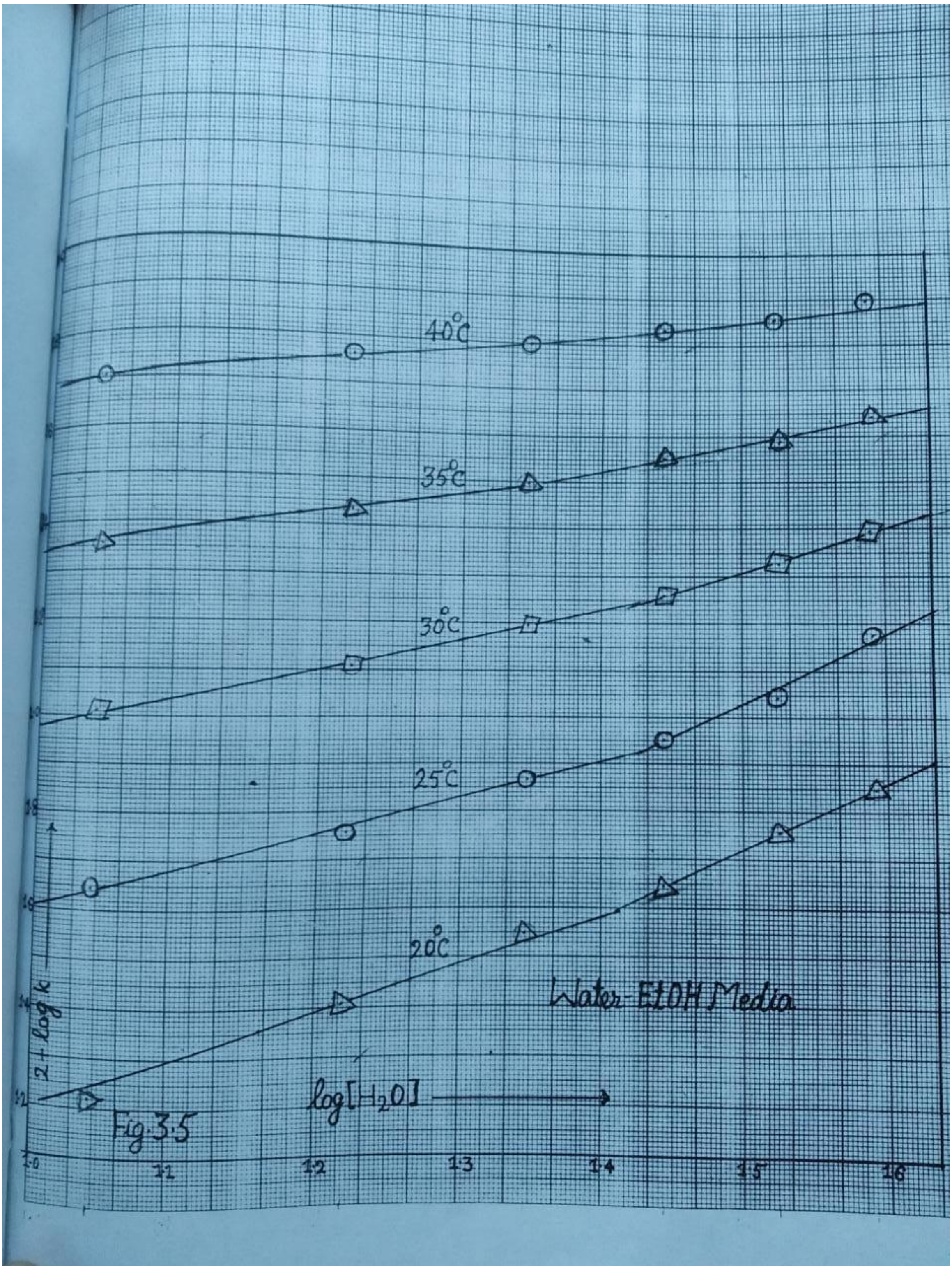

Fig. 1

Table-I

Variation of log K values with mole % of EtOH in water EtOH media

% of EtOH	Mole %	20^{0}C	25^{0}C	30^{0}C	35^{0}C	40^{0}C
30%	11.69	1.853	2.178	2.388	2.640	2.898
40%	17.07	1.757	2.045	2.326	2.592	2.857
50%	23.59	1.645	1.951	2.261	2.250	2.835
60%	31.06	1.546	1.870	2.197	2.498	2.800
70%	41.87	1.409	1.762	2.110	2.436	2.761
80%	35.25	1.270	1.642	2.016	2.364	2.708

Table-II

Values of Iso- composition Activation Energy of the reaction in water- EtOH media

% of Ethyl Alcohol	30%	40%	50%	60%	70%	80%
E_c in kJ/mole	87.95	96.59	104.28	109.64	119.20	125.95

Table-III

Variation of log K values with log [H_2O] values in

% of EtOH	% of water	Log [H_2O]	2+ log K values				
			20^{0}C	25^{0}C	30^{0}C	35^{0}C	40^{0}C
30%	70%	1.5898	1.853	2.178	2.388	2.640	2.898
40%	60%	1.5229	1.757	2.045	2.326	2.592	2.857
50%	50%	1.4437	1.645	1.951	2.261	2.550	2.835
60%	40%	1.3768	1.546	1.870	2.197	2.498	2.800
70%	30%	1.2218	1.409	1.762	2.110	2.436	2.761
80%	20%	1.0458	1.270	1.647	2.016	2.364	2.708

Table-IV

Values of the slopes of the plots of log K versus log [H_2O] at different temperature

Temperature in ^{0}C	Slope-I, Before log [H_2O] = 1.36	Slope-II, After log [H_2O] = 1.36
20^{0}C	0.974	1.468
25^{0}C	0.745	1.442
30^{0}C	0.616	0.944
35^{0}C	0.433	0.615
40^{0}C	0.348	0.348

References:-

1. Pandey, A.B., Rai, S.K., Singh, R.K. and Singh, R.T. : NIRJ Sci., 1, No. 1, 67-73, 2008
2. Kumari Vibha, Kumari Shobha and Singh R.T. : ARJ PHYS. Sci., 10, No. (1-2), 197- 200
3. K.J. Laidler and P.A. Landskroener : Trans. Faradey Soc., 1956,52,200
4. Singh Lallan, Singh R.T. and Jha R.C. : J. Indian Chem. Soc., 57,1089,1980
5. Hughes E.D. and Ingold C.K. : J. chem. Soc, 255,1935
6. Laidler K.J. and Landskroene P.A. : Trans Farday, Soc, 52,200,1956
7. E. Tommila. : Acta. Chem. Scand.1955, 9,975
8. C.A. Lane : J.Am. Chem. Soc, 1964
9. R.E. Robertson : Canad.J.Chem.Soc, 1959,3, 803