International Journal of Physics and Applications.
ISSN 0974-3103 Volume 6, Number 1 (2014), pp. 45-48

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The Study of Relaxation Times of Isoleucine Using Modulated Temperature Method

Sami M. Ali

Department of Physics Zarqa University-Jordan
E-mail: drsami_m@yahoo.com

Abstract

The Relaxation times have been measured of Isoleucine, using the changes in solution conductivity caused by modulated heating. The results are contrasted with those obtained for amino acids.

1. Introduction

In previous publications (1, 2) it has been shown how it is possible to measure rate constants for the various protonation reaction of amino acids using modulated temperature chemical relaxation.

Ultrasonic absorption studies have also been used to measure some of the protonation reaction of amino acids (3, 4, 5).

A detailed study has therefore been undertaken of the relaxation time constants of the Isoleucine protonation reactions

2. Experimental

The apparatus is as described previously (1), all measurements were taken in the Zwitterions in the range pH 7 to 7.5.

The pH of the sample was adjusted with NaoH, Hcl, as appropriate.

The concentration range of the aqueous Isolencine Solutions was 0.03125 M to 0.25 M, all measurements were at 20˚C.

3. Results and Discussion

It was found earlier that for the amino acids, plots of inverse relaxation time vs. concentration positive ion at constant PH give ratio of slope to intercept whose negative logarithm was equal to PK_1, value of the amino acid (7).

It can be assumed that Isoleucine can be described by the same model used previously in the description of amino acids (1, 2, 6). Values of the measured rate constants are show in the table below.

The values for the proline zwitterions are those obtained by us previously (7) using similar conditions to those in obtaining the values for Isoleucine. Our values are in the main similar to those of Shernbatt and Gutowaky (6) except that our values of k_3, k_4, k_5 are somewhat lower, at the lower amino acid concentrations used by ourselves.

In actual practice the choice of the values makes no difference to the discussion. The differences do not appear to be an artifact of the technique as I obtained the same values as Sheinblatt of Gutowsky's (6) at the same concentrations. k_1 for the Isoleucine Zwitterions is larger than for the proline Zwitterions, k_2 somewhat smaller, k_3 a little larger, k_4 &k_5 quite a lot smaller and k_6 a little larger.

4. Conclusion

The behavior of Isoleucine is not different in kind from that in amino acid. It seems to be well described by Sheinblatt and Gutowsky's (6) type of analysis. Specific differences in magnitude of rate constants can be explained in the cases where the reactions are entropy dominated by the acidities of the participating groups. This does not appear to be so in the case of protonation reactions dominated by the entlhapy of activation. Therefore, the measurements of rate constants of protonation reaction alone are not always sufficient to explain these reactions.

Table 1: The constants rate of Isoleucine and proline(7).

	Isoleucine	**Proline**
k1 (S-1)	3.2 ± 0.1	1.6
k2 (MS-1)	5.23 ×1011 ± 0.2	7.27 × 1011
k3 (MS-1)	74.21 ± 0.1	73.8
k4 (MS-1)	3.94 × 107 ± 0.05	2.39 × 108
k5 (MS-1)	9.32 × 107 ± 0.085	1.37 × 109
k6 (S-1)	186 ± 1	171

"This research is funded by the Deanship of Research and Graduate Studies in Zarqa University /Jordan"

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