TO DETERMINE MOLAR REFRACTION (RM) POLARAZABILITY CONSTANTS (A) & REFRACTIVE INDEX OF SOME PEPTIDES SUCH AS CARNOSINE, GLUTATHIONE DL-PHENYLALANINE & PENTAGLYCINE IN DIFFERENT PERCENTAGE OF METHANOL-WATER MIXTURE BY ANALYTICAL METHOD.

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ABSTRACT

The molar refraction (Rm) of the solvent methanol-water mixtures in different percentage and solution of peptides ie.

i) Carnosine (L1) (M.W.225.20) {$C_9H_{13}N_4O_3$}
ii) Glutathione (L2) (M.W.307.33) {$C_{10}H_{17}N_3O_3S$}
iii) DL.Phenylalanine (L3) (M.W. 165.19) {$C_9H_{11}NO_2$}
iv) Penta glycine (L4) (M.W. 303.30) {$C_{10}H_{17}N_5O_6$}

Are used to determined refractive index & the polarazability consants (α) by Abbe's refractometer

Key Words: *Peptides, Refractive index, The polarizability constant (α), Molar refraction.*

Introduction

Refractive index is one of the important properties of liquid. When a ray of light passes from one medium to another, it suffers refraction, that is a change of direction. If it passes from a less dense to a more dense medium, it is refracted towards the normal so that the angle of refraction (r) is less than angle of incidence (i) The refractive index (n) of the medium is the ratio of the velocity of light in vacuum to that in the medium. Refractive index can be measured easily with a high degree of accuracy. The values depend upon the temperature as well as the wavelength of light used. Generally the d-line of sodium is used for standard measurements.

In the present investigation refractive indices of liquid mixtures were measured with the help Abbe's refractometer specially designed to measure the refractive indices of the transparent liquids, solutions and solids ranging from 1.300 to 1.700 by direct reading. The principle of the instrument is illustrated as below.

A beam of light from a suitable source is reflected by the mirror and then it passes through the lower prism and illuminates its upper surface. As this surface is ground, it serves as diffusing screen providing rays in every direction. The small space between the lower prism and upper prism contains a thin layer of the liquid under examination. The refractive index of the liquid should be smaller than of the lower prism, so as to allow for the critical angle of phenomenon. The rays after passing through the diffused surface of lower prism, enter into the liquid medium at different angle of incidences. A particular ray going the grazing incidence will pass through the upper prism at an angle which is equal to critical angle. The telescope is fixed and the prism box is rotated so as to get the coincidence of the critical ray with the crosswire of the eyepiece. The setting of the prism at this position corresponds to a definite critical angle and therefore, to a definite value of refractive index. This is read directly on a scale engraved on the instrument. There is also a provision for adjusting the temperature of the liquid by flowing water at the required temperature through the jacket surrounding the prism box.

The properties of liquid such as viscosity, refractive index and ultrasonic velocity of binary mixtures are studied by many workers[1-6]. Oswal et al[7] have studied dielectric constants and refractive indices of binary mixtures of ethyl acetate with toluene, ethyl benzene, O-xylene, p-xylene and p-dioxane. Studies of refractive indices of electrolyte in mixed solvents are scanty. Work deals with study of molar refraction and polarizability constant of 2A-5CI-BSA in different percentages of dioxane-water mixture have been calculated by Mahajan[8]. The present work deals with the study of peptides in different percentages of ethanol-water mixtures.

Experimental

Methanol-Water mixtures of varying compositions as well as solutions of peptides such as Carnosine (L_1), Glutathione (L_2), DL-Phenylalanine (L_3) and Pentaglycine (L_4) in different percentages of Methanol-water mixtures were prepared by weight within accuracy of 0.02 mg.

The densities of solvent mixtures and solutions were determined by a pyknometer. The refractive indices of the solvent mixtures and solutions were measured by Abbe's refractometer, at 27°C. The temperature of the maintained at 27°C. Initially the refractometer was calibrated with glass piece (n=1.5220) provided with the instrument.

Result and Discussion

The molar refraction (Rm) of the solvent Methanol-water mixtures and solutions of peptides i.e. L_1, L_2, L_3, L_4 mixtures are determined from.

$$\mathbf{Rm= [(n^2-1)/(n^2+2)]\ \{[X_1M_1 + X_2M_2]/d\}} \quad \text{----- (1)}$$

Where n is refractive index of solution, X_1 is molefraction of solvent, X_2 is molefraction of solute, M_1 and M_2 are molecular weights of solvent and solute respectively and d is density of solution. The molecular weight of the solvent, for mixture of two solvents is replaced by molefraction average molecular weight.

The molar refraction represents actual or true volume of the substance molecules in 1 mole. The molar refraction of peptides L_1, L_2, L_3, L_4 is determined from

$$\mathbf{R = x_1R_1 + x_2R_2} \quad \text{----- (2)}$$

Where R_1 is molar refraction of solution, R_1 and R_2 are molar refractions of solvent and solute respectively. X_1 and X_2 are molefractions of solvent and solute respectively.

The polarizability constant (α) of peptides i.e. L_1, L_2, L_3, L_4 is calculated from following relation.

$$\mathbf{R_2 = 4/3 \times \pi \times N_0\alpha} \quad \text{----- (3)}$$

where N_0 is Avogadro's number

The values of molar refractivity of solution, solvent, peptides L_1, L_2, L_3, L_4 and polarizability constant of peptides solution represented in Tables 1 to 2.

Table 1 and 2 shows that, with increase in percentage of Methanol, the molar refractivity (true molar volume) as well as the polarizability constant of peptides decreases or increases. This may be attributed to the fact that the dipole in peptides lies perpendicular to the longer axis of the molecule and with increase in percentage of Methanol causing decrease in dielectric constant of medium, considerable dipole association (inter molecular attraction) takes place which would be accompanied by decrease in polarizability as well as molar refractivity because of mutual compensation of the dipoles.

Table - 1
Molar Refraction and polarisability Constant for L_1, L_2 at Different Percentage of Methanol

% of Meth-anol	Ligand - L_1		Ligand - L_2	
	[R] cm^3 $mole^{-1}$	α x 10^{-23} $mole^{-1}$	[R] cm^3 $mole^{-1}$	α x 10^{-23} $mole^{-1}$
60	2.837237	0.112525	2.903033	0.115134
65	2.453039	0.097287	2.937036	0.116483
70	2.473238	0.098089	2.504352	0.099323
75	2.493120	0.098877	2.517703	0.099852
80	2.439021	0.096732	2.637172	0.104590
85	2.480037	0.098358	2.449018	0.097128
90	0.389208	0.094756	2.526370	0.100196
95	0.401417	0.095240	2.547782	0.101045

Table – 2
Molar Refraction and polarisability Constant for L_3, L_4 at Different Percentage of Methanol

% of Meth-anol	Ligand - L_3		Ligand - L_4	
	[R] cm^3 $mole^{-1}$	α x 10^{-23} $mole^{-1}$	[R] cm^3 $mole^{-1}$	α x 10^{-23} $mole^{-1}$
60	2.893307	0.114749	2.927179	0.116092
65	2.802239	0.111137	2.798233	0.110978
70	2.701317	0.107134	2.493040	0.098874
75	2.469087	0.097924	2.383930	0.094547
80	2.639828	0.104696	2.403288	0.095314
85	2.499108	0.099115	2.514527	0.099726
90	2.910409	0.115427	2.803073	0.111170
95	2.442948	0.096887	2.671829	0.105965

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