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Research Article

Refractive index, UV-Visible spectrum, conductivity, surface tension and viscosity of aqueous glycine zwitterion

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Abstract

The aqueous glycine zwitterion of 0.2 molar has a density 1.196g/cm^3 at room temperature 30°C. For 0.2 molar and 3 molar concentration the average refractive index of solution measured as 1.34 at 30°C. In the UV-Vis spectrum the cut off due to transitions is observed at 270nm. 1.7mV developed in Glycine zwitterion aqueous solution for 0.2molarity. The conductivity decreases with increase in temperature. The surface tension 0.118 N/m at room temperature decreases with increase in temperature. The coefficient of viscosity of the glycine zwitterion aqueous solution at room temperature measured as 2.16 Ns/m.

Key words: Zwitterion, Glycine, UV-Vis spectrum, Basic properties.

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Introduction

Biomolecules interact with water constantly with varied interactions. A hydrogen bond network with dynamic structure formed within H_2O molecules which give critical importance for the biomolecules in aqueous solution[1]. Glycine being a simplest amino acid, its solvation in aqueous solution are studied extensively both theoretically and experimentally by many researchers[2,3]. In the present work we investigate the change in density, surface tension, conductivity and viscosity of aqueous glycine zwitterion by varying the temperature. Further, the aqueous glycine zwitterion was subjected to refractive index measurement and UV-Vis analysis, measured at room temperature.

Experimental procedure

Glycine zwitterion aqueous solution prepared by dissolving 0.2 g of pure glycine in distilled

water. All the measurements carried with this 0.2 molarity of the substance.

Materials and methods

Refractive index

A hollow prism method was to study the refractive index of the aqueous glycine zwitterions using sodium vapour lamp.

UV – Vis spectrum

The UV-Vis spectrum of aqueous glycine zwitterion is measured using single beam spectrometer in the range of 200 nm to 500 nm

Conductivity

Conductivity of aqueous glycine zwitterion is measured using conductivity meter (ELICO make) having accuracy of 1% accuracy, measured at 1000 Hz frequency. It's found that the conductivity of the aqueous solution changes with increasing temperature.

Surface tension

An aqueous glycine zwitterion is taken into the burette and fixed on the stand. The flow of the liquid is adjusted for 5 drops per minute, collected in the beaker. The beaker is weighed for the collected 50 drops of the aqueous solution. This process is repeated for three times and the average mass 'm' of a drop is estimated. The surface tension of the liquid is calculated using the formula

$$ST = \frac{mg}{3.8r} \quad \frac{N}{m} \dots\dots\dots (1)$$

r = Radius of the tip of the burette.

Density

Density of the aqueous glycine zwitterion is calculated from the following relation

$$\rho = \frac{Mass}{Volume} \qquad \dots\dots\dots\dots\dots (2)$$

By pipetting and weighing 10 ml solution, the density was measured; prior to its weighing, the beaker is tare appropriately. The density of the aqueous glycine zwitterion was measured for different temperature.

Viscosity

A horizontal capillary tube connected to vertical burette containing, through a piece of rubber tubing. The pressure head is adjusted by raising or lowering the capillary tube. The liquid filling levels of 5 c.c, 10 c.c, and 15 c.c, etc and their corresponding timings are noted using stop watch. The coefficient of viscosity of the liquid is calculated from the equation,

$$\eta = \frac{\pi r^4 \rho g h t}{8 l v} \times 10^6 \frac{Ns}{m^2} \quad \ldots\ldots\ldots\ldots (3)$$

$where\ \rho = Density\ of\ the\ liquid$,

$g = 9.8\ \frac{m}{s^2}$,

$h = Height\ in\ cm,$

$l = Length\ of\ capillary\ tube,$

$v = Volume\ of\ liquid\ ml$

Result and discussion

Refractive index

The refractive index of the medium depends on the density and electromagnetic spectrum. Hence, the refractive index is found to vary with increasing of concentration, shown in fig.1, as because, the speed of light gets decreased due to the substance involved in the solution.

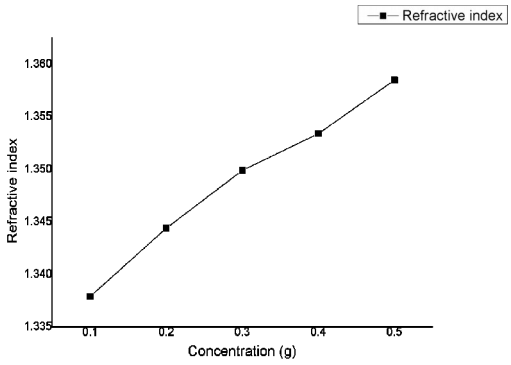


Figure 1 Concentration vs Refractive index

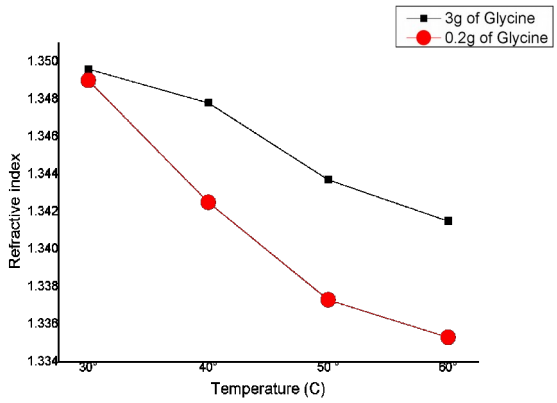


Figure 2 Temperature vs Refractive index

The refractive index varies linearly with increasing in concentration. The temperature dependent refractive index for 0.2 molarity and 3 molarity shown in Fig 2. High refractive index observed at 30°C and low refractive index at 60°C is ascribed to the change in the optical density of the aqueous solution.

UV-Vis spectrum

The UV-Vis spectral analysis of aqueous glycine zwitterion is recorded in the range of 200nm to 400nm and plotted as shown in fig 3.

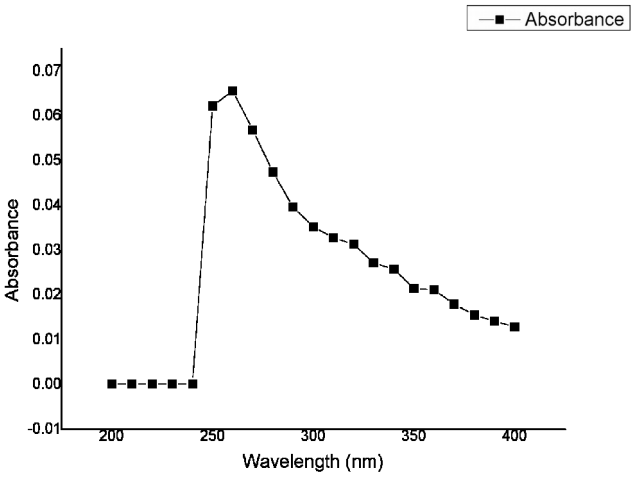


Figure 3 UV-Vis spectrum

The cut-off value at 270nm for the aqueous glycine zwitterion solution is ascribed to transition.

Conductivity

The conductivity measured for glycine zwitterion aqueous solution for different temperature and plotted as shown in fig 4.

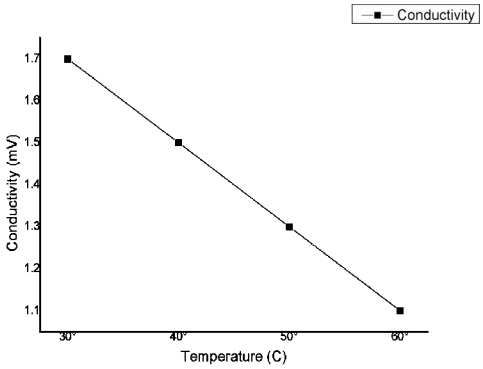


Figure 4 Temperature vs Conductivity

The conductivity decreases with increase in temperature. This confirms that the polarity changes due to dilution in the solution.

Surface tension

Surface tension of the aqueous glycine zwitterion measured for different temperature is shown in the fig 5. The surface tension decreases quasi-linearly with increase in the temperature.

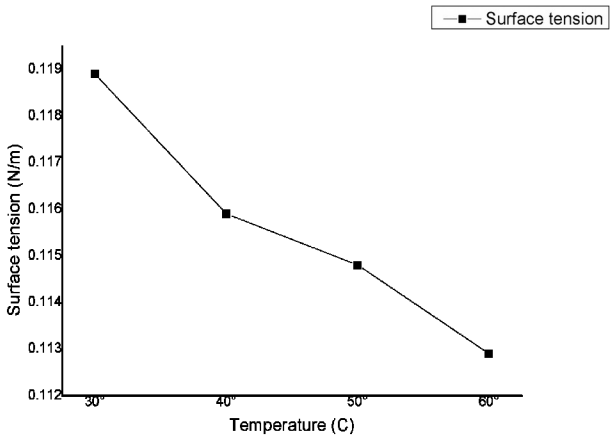


Figure 5 Temperature vs Surface tension

Density

The calculated molecular weight of glycine zwitterion aqueous solution is 75.07g/mol and density measured for various temperature is shown in fig. 6

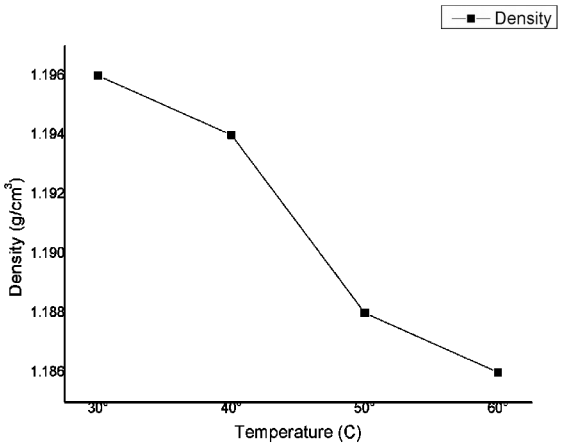
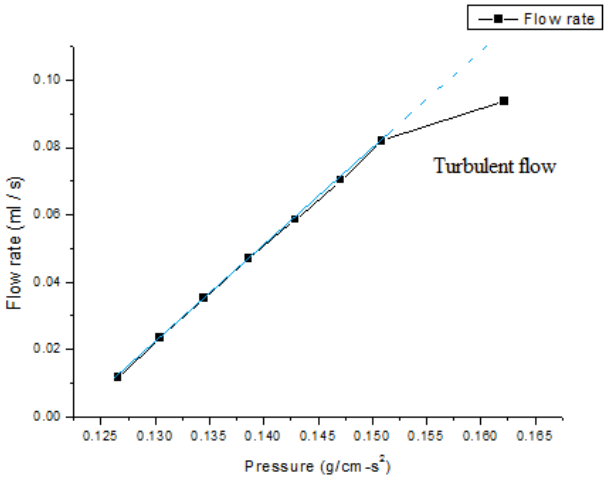


Figure 6 Temperature vs Densiy

The measured density decreases with increase in temperature.

Viscosity

40 ml of aqueous glycine zwitterion was taken in burette. When the knob is released, the fluid starts to move from higher pressure side to the lower pressure side. Time is noted for every ml of release. The rate of flow is calculated and the corresponding state fluid pressures at various points are estimated. The calculated flow rate and corresponding calculated static fluid pressure shown in fig. 7.



At 0.1509 ml/s, the flow rate becomes faster, and laminar flow gets disturbed and becomes turbulent because the glycine zwitterion aqueous solution does not flow linearly and smooth in adjacent layers. The coefficient of viscosity of the liquid is calculated to be 2.16 Ns/m.

Conclusion

Based on the fundamental science, the refractive index, UV-Vis spectrum, conductivity, surface tension, density and viscosity of aqueous glycine zwitterion was investigated and it's found that they vary almost linear with respect to concentration and temperature.

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