Dielectric Relaxation and Dipole Moments of Four Hydrogen Bonded Heterocyclic Compounds in Chloroform

Abstract

The permittivities and dielectric losses of 2-Piperedone, ε-Caprolactam, 2-Azacyclooctanone and 2-Azacyclononanone have been studied in chloroform solutions. They have been measured using Q meter at frequency range 150KHz to 15MHz. Both 2-Piperedone and ε-Caprolactam solutions were studied at concentration range 0.05 to 0.25M and over temperatures range of -10 to 45°C and. The dielectric studies of 2-Azacyclooctanone solutions cover a concentration range 0.05 to 0.125M and over temperature range of -10 to 45°C, while that of 2-Azacyclononanone solutions were studied at concentration range 0.01 to 0.075M and over temperature range of -10 to 45°C. The permittivities at higher concentrated solutions up to 1.5M of 2-Piperedone, ε-Caprolactam and 2-Azacyclononanone were also measured at 2MHz using dipole meter DM01 over the temperature rang -10 to 45°C. The static permittivities for the four systems were discussed as the affect concentration, temperature and the number of CH2 group in the cyclic amides. All show normal behaviour except that the CH2 does not show clear affect. Single relaxation process were observed for the studied compound in the chloroform solutions (τ =10-9 sec). All cases, the presence of a relaxation process was established at frequencies higher than used here. These relaxation processes were discussed in terms of their relation to concentration and the number of CH2 group. The dielectric activation energies ΔH* were calculated using Eyring equation. The obtained values were discussed also in terms of concentration affect. A dependence of ΔH* on concentration was observed. The dipole moments for the four studied compounds in solutions were evaluated using ε∞ of Cole-Cole a semicircle plots, which considered to be associated with the relaxation process and other dipole moments were evaluated using ε∞=ε₀ solvent. This was assigned as an apparent dipole moment. All these dipole moments were discussed in terms of concentration and temperature affect. The obtained dipole moments in all studied case were much larger than those expected for planer dimers association. So they
assigned to the presence of dimers and trimer or tetramers association in the studied solutions. Kirkwood correlation factor for the studied systems were calculated and discussed as a function of concentration. All values of $g$ are less than unity and were assigned to a cyclic association form.