Table 2: Viscosity (Pa.s) at different temperature and concentration at 1MHz for PEG

Temperature → Concentration(v/v) ↓	30^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
1.0%	.064	.060	.053	.046	.039	.034	.024	.020
0.80%	0.066	0.035	0.032	0.029	0.022	0.019	0.016	0.016
0.60%	0.049	0.035	0.020	0.018	0.016	0.014	0.013	0.011
0.50%	0.029	0.023	0.011	0.010	0.011	0.009	0.009	0.009
0.40%	0.026	0.015	0.011	0.010	0.009	0.008	0.007	0.005
0.30%	0.012	0.009	0.008	0.007	0.007	0.006	0.006	0.005

Table 3: Ultrasonic velocity (ms^{-1}) at different temperature and concentration at 1MHz for PEG

Temperature → Concentration (v/v) ↓	30^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
1.0%	1264.8	1260.6	1253.3	1249.6	1246.5	1239.8	1236.4	1230.5
0.80%	1262.8	1258.4	1250.4	1245.2	1241.8	1236.8	1230.9	1225.7
0.60%	1257.6	1252.8	1246.8	1241.9	1237.9	1233.8	1228.7	1219.7
0.50%	1234.7	1220.4	1195.8	1189.6	1185.7	1181.9	1176.1	1174.8
0.40%	1187.6	1177.6	1167.2	1162.4	1157.6	1155.3	1151.2	1140
0.30%	1155.1	1142.5	1133.7	1120.4	1114.6	1098.1	1095.7	1087.2

Table 4: Intermolecular Free Length (x10^{-10}m) at different temperature and concentration at 1MHz for PEG

Temperature → Concentration(v/v) ↓	30^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
1.0%	0.0028	0.0027	0.0028	0.0028	0.0029	0.0028	0.0028	0.0028
0.80%	0.0028	0.0028	0.0029	0.0029	0.0029	0.0029	0.0030	0.0029
0.60%	0.0034	0.0034	0.00344	0.0035	0.0035	0.0036	0.0036	0.0036
0.50%	0.0035	0.0036	0.0037	0.0037	0.0038	0.0038	0.0039	0.0039
0.40%	0.0036	0.0037	0.0037	0.0037	0.0038	0.0038	0.0039	0.0039
0.30%	0.0037	0.0038	0.0038	0.0039	0.0039	0.0040	0.0041	0.0042

Table 5: Adiabatic compressibility(x10^{-10}Kg^{-1}ms^2) at different temperature and concentration at 1MHz for PVA

Temperature → Concentration(v/v) ↓	30^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
1.0%	4.14	4.17	4.22	4.25	4.27	4.32	4.35	4.40
0.80%	6.19	6.23	6.28	6.32	6.38	6.52	6.67	6.79
0.60%	6.24	6.28	6.38	6.45	6.51	6.63	6.81	6.9
0.50%	6.38	6.53	6.65	6.72	6.85	6.94	7.12	7.39
0.40%	6.63	6.72	6.94	7.08	7.25	7.34	7.54	7.78
0.30%	7.24	7.33	7.75	7.75	8.07	8.23	8.67	8.88

Table 6: Relaxation time (x10^{-12}s) at different temperature and concentration at 1MHz for PVA

Temperature → Concentration ↓	30^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
1.0%	3.54	3.34	2.98	2.61	2.24	1.99	1.41	1.17
0.80%	3.93	2.05	1.93	1.78	1.32	1.20	1.02	1.02
0.60%	4.09	2.95	1.72	1.59	1.41	1.32	1.20	1.02
0.50%	2.33	2.13	1.06	1.04	0.93	0.94	0.91	0.91
0.40%	2.45	1.45	1.08	0.97	0.88	0.82	0.77	0.59
0.30%	1.19	0.97	0.85	0.79	0.76	0.74	0.68	0.67

3. Result and Discussion

In the present work density, viscosity and ultrasonic velocity have been measured at different temperature and concentration of polyethylene glycol, which is shown in Table-1, 2, and 3 respectively. By using these values for PEG-200, intermolecular free length, relaxation time and adiabatic compressibility have been calculated by using well known relations and the results have been presented in Table-4, 5 and 6, respectively. The variations of these parameters with temperature and concentration have been shown in Fig.1-Fig.6 respectively.

Table-1 and Fig.1& 2 represent the variation of density with temperature and concentration respectively. Density decreases with increase in temperature and increases with increase in concentration. It may be due to electro striction in that solution. This electro striction decreases the volume

and hence increases the density as a number of solute molecules increase the electro striction and density. It is evident from Table-2 and Fig.3 & 4 that, viscosity decreases with increase in temperature and increases with increase in concentration of PEG-200. The variations of ultrasonic velocity with temperature and concentration have been shown in Table-3 and Fig. 5 & 6. Ultrasonic velocity decreases with increase in temperature and increases with increase in concentration of PEG. Similar increase in velocity with increase in concentration has also been reported by Syal V.K. et al[3]. This indicates interactions between PEG and solvent molecules. The increase or decrease in value of ultrasonic velocity and intermolecular free length with composition indicates interactions between contributing molecules. Intermolecular free length is a predominant factor as it determines the sound velocity in the condensed and fluid state. The increase in the solute concentration leads to the decrease in the gap between two species and this is ideally observed in present work. It is clear from Fig.7 and Table-4 that intermolecular free length increases with increase in temperature and decreases with increase in concentration (Fig.8). It is similar trend reported by earlier workers[18]. It is clear from Table-5, and Fig.9, that adiabatic compressibility increases with increase in temperature and Fig.10 shows the variation of adiabatic compressibility with concentration. It decreases with increase in concentration. These results are in agreement with earlier workers[9]. It may be due to that when solute molecules are added to the solvent, they attract certain solvent molecules towards themselves by wrenching the molecule from bulk of solvent due to the forces of electro striction because of this available solvent molecule for the next incoming solute gets decreased. Table -6, Fig. 11 & Fig. 12 show the variation of relaxation time with temperature and concentration. Relaxation time decreases with increase in temperature and increases with increase in concentration. This may be due to as per kinetic theory of fluid.

4. Conclusion

From above study it is concluded that there is association between polyethylene glycol and water because of interaction between solvent and solute may be responsible for increase in ultrasonic velocity, and in turns affects other parameters. It may be because of polymer molecules come close to the solvent molecules leaving sufficient space round them. It also shows the nature of polymer in solvent at different concentration and temperature and to study intermolecular interactions. Those in turns are useful for production and uses of polymers in pharmaceuticals and industry.

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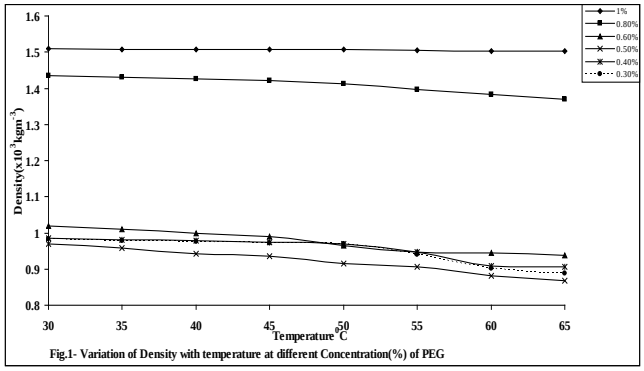

Fig.1- Variation of Density with temperature at different Concentration(%) of PEG

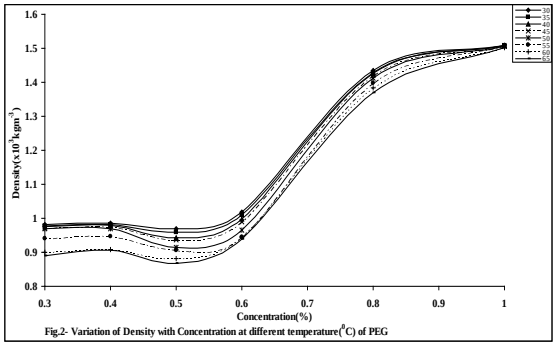

Fig.2- Variation of Density with Concentration at different temperature(^{0}C) of PEG

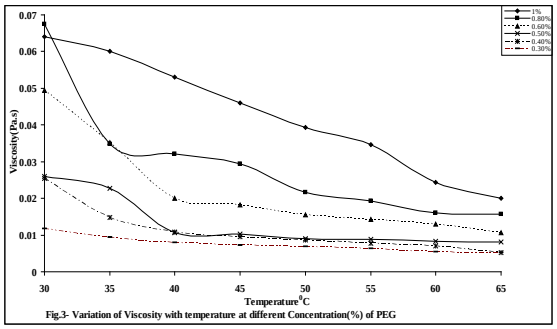

Fig.3- Variation of Viscosity with temperature at different Concentration(%) of PEG

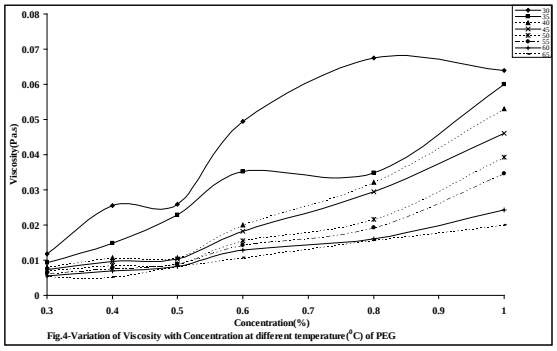

Fig.4-Variation of Viscosity with Concentration at different temperature(^{0}C) of PEG

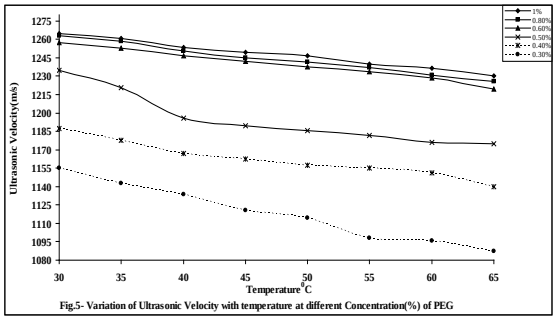

Fig.5- Variation of Ultrasonic Velocity with temperature at different Concentration(%) of PEG

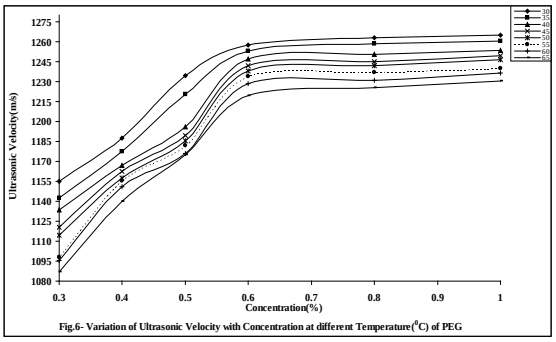

Fig.6- Variation of Ultrasonic Velocity with Concentration at different Temperature(^{0}C) of PEG

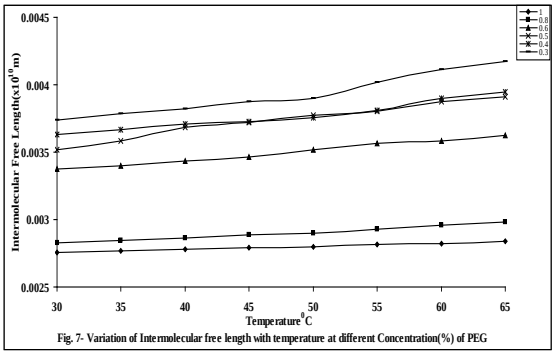

Fig. 7- Variation of Intermolecular free length with temperature at different Concentration(%) of PEG

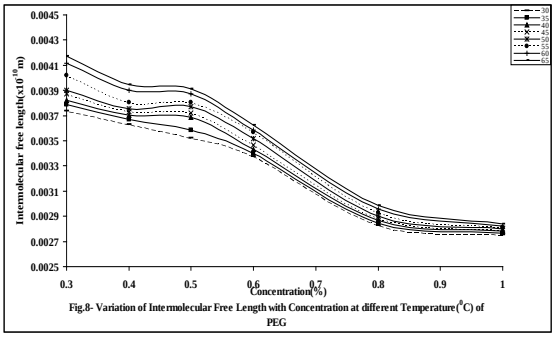

Fig.8- Variation of Intermolecular Free Length with Concentration at different Temperature(^{0}C) of PEG

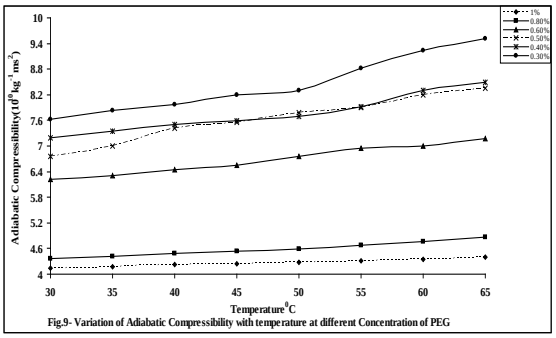

Fig.9- Variation of Adiabatic Compressibility with temperature at different Concentration of PEG

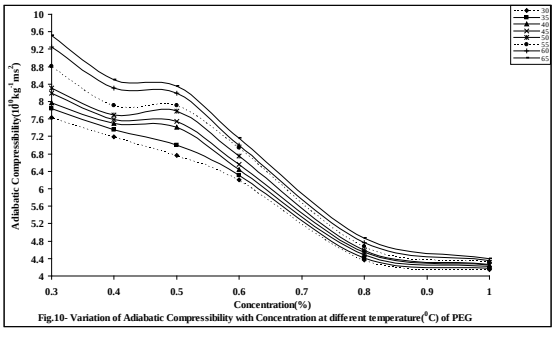

Fig.10- Variation of Adiabatic Compressibility with Concentration at different temperature(^{0}C) of PEG

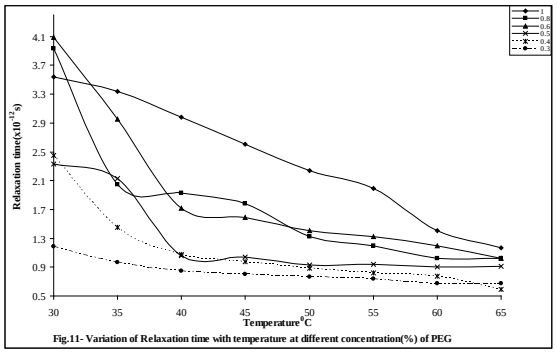

Fig.11- Variation of Relaxation time with temperature at different concentration(%) of PEG

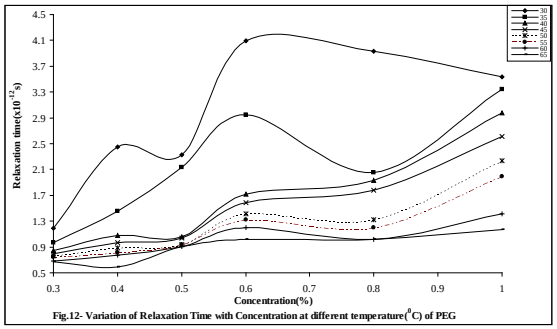

Fig.12- Variation of Relaxation Time with Concentration at different temperature(^{0}C) of PEG