

CHAPTER IV

CONCLUSIONS

The HPC-HTAB complex formation in dilute solution regime was studied by light scattering and viscometry. The critical aggregation concentration (cac) of complexes is lower than critical micelle concentration (cmc) of pure surfactant. This is consistent with the situation encountered with all neutral polymer-ionic surfactant complexes. Addition of HTAB has an effect on the size of this polymer with molecular weight equal to 370,000. Above cac, contraction of chains is evident by slight decreases in both R_h and specific viscosity. After reaching cmc, chains expand due to the electrostatic interaction between ionic head groups. When the maximum binding point is exceeded and free counterions (Br^-) from excess HTAB are present to screen the electrostatic force, the size of chains decreases again. The maximum binding point occurs at C_{HTAB}/C_{HPC} around 1.35 from light scattering and viscosity measurements. Increasing C_{HPC} shifts the maximum binding to higher C_{HTAB} . This value is the same for all polymer concentrations studied in dilute regime.

In concentrated solutions, the temperature induced sol-gel transition was identified by a frequency independent loss tangent. The physical gelation of pure HPC polymer system occurs at 48°C for C_{HPC} between 3.0 and 5.0%wt. At the gel point, the value of the scaling exponent is very small and increases with polymer concentration (from 0.06 to 0.19). The critical gel strength increases with polymer concentration because as the number of chains increase, the network is progressively strengthened.

For the ternary systems, the ratio of surfactant and polymer concentration were fixed at 1.35. For C_{HPC} between 4 and 5%wt, the gel point temperature is larger than for the binary systems, and it increases with C_{HTAB} and C_{HPC} . For C_{HPC} lower than 4%wt, the gel point temperature could not be found because of insufficient amount of HPC chains to induce entanglement. For C_{HPC} higher than 5%wt, the gel point temperature could not be found because the strong electrostatic effect obstructs chain entanglement. The value of the scaling exponent for the ternary systems is larger than that for the binary systems and decreases from 0.50 to 0.39 with increases in both C_{HPC} and C_{HTAB} . The critical gel strength parameter S , was also found to increase with C_{HPC} and C_{HTAB} . Our results suggest a difference in gelation mechanism between binary and ternary systems. The binary system has a lower power-law exponent corresponding to a larger fractal exponent of the gel clusters. This may reflect the influence of electrostatic interactions in disrupting the liquid crystal packing of the concentrated HPC solutions.