Effect of mixed solvent and temperature on the the phase behavior of hydroxypropyl cellulose in the presence of SDS.

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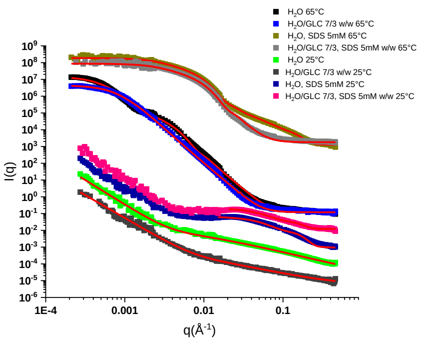
Hydroxypropylcellulose (HPC), one of the most well-known cellulose derivatives, is a surface-active non-ionic polymer. Nowadays HPC is used as emulsifier, stabilizer, thickener and film former in foods, cosmetics and paints. Because of this it is relevant its behaviour in commonly used co-solvent such as glycerol. Indeed one of the most interesting property of this polymer is its thermo-responsivity, HPC can change its solubility as a function of temperature. This feature allows the HPC to be considered for stimuli responsive foams, where macroscopic properties need to be reversibly changed on demand. Thermo-responsivity from HPC is substantially associated to the lower critical solution temperature (LCST) of the polymer in aqueous solutions. The presence of cosolvent can drastically modify this temperature and the size and morphology of the aggregate above the LCST. Furthermore, this kind of polymers typically form complexes with anionic surfactants. Here we have investigated the complexation process between HPC and SDS at different temperature and surfactant concentration in the mixed water/glycerol solvent. The collected experimental data show that the presence of glycerol drastically chances the aggregation process, ruling the morphology and the size of the aggregates and the value of the LCST with respect to that observed in pure water. We investigated the effect of sodium dodecyl sulfate (SDS), a widely used surfactant, on the transition temperature (LCST) of the hydroxypropyl cellulose (HPC) in aqueous solution and in mixed solvent water/glycerol 7/3 w/w by Fluorescence Spectroscopy, Dynamic Light Scattering and Small Angle Neutron Scattering using a temperature gradient. The fluorescence spectroscopy has been conducted using the ANS (8-Anilinonaphthalene-1-sulfonic acid) as a probe. The analysis of the spectra shows a blue signal shift upon formation of polymer-surfactant aggregates and reveals an opposing effect between increasing the SDS concentration and adding glycerol. In particular SDS causes an increase in the LCST value while the presence of glycerol causes a reduction in LCST. This suggests a significant role of glycerol, a nonaqueous hydrogen-bonding solvent, in determining the properties of the system. Furthermore with the Dynamic Light Scattering and SANS experiments, we have studied the change, in morphology and dimension, of the aggregates in solution in the presence of the glycerol and SDS before and after the transition temperature.



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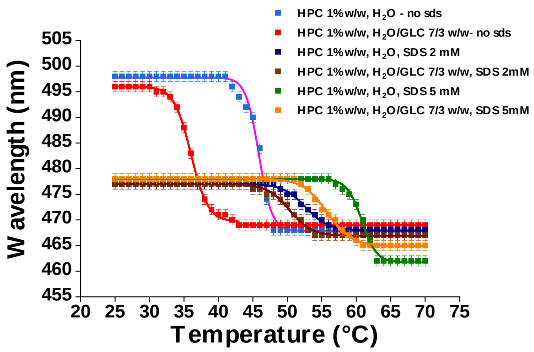

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Figure1. SANS scattering profiles at 25 and 65°C.
Figure 2. *The values of the wavelength corresponding to the maximum emission peak reported as a function of temperature*