Reversibility of liquid-crystalline phase of the complex salts CTA/PA$_{138}$-b-PNIPAM$_{212}$ and DTA/PA$_{138}$-b-PNIPAM$_{212}$ in aqueous medium.

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Abstract

CTA/PA$_{138}$-b-PNIPAM$_{212}$ and DTA/PA$_{138}$-b-PNIPAM$_{212}$ are complex-salts that have a core-shell structure with liquid-crystalline phase in the core. Adding simple salt (KCl) to the dispersion causes the collapse of the structure leading to the disappearance of the meso-phase. After dialysis and removal of the KCl, the core-shell is reorganized. SAXS technique was used to found out that DTA/PA$_{138}$-b-PNIPAM$_{212}$ has cubic Pm3n phase before and after the dialysis and CTA/PA$_{138}$-b-PNIPAM$_{212}$ has hexagonal phase before the dialysis and hexagonal or cubic Pm3n after it.

Key words: complex-salt, liquid-crystal, reversibility.

Introduction

Surfactants and polymers oppositely charged can associate in a core-shell macro-structure. The core is composed by surfactants that self-assemble in a liquid-crystalline phase and the shell is composed by the polymer that neutralizes the charge of surfactants. This kind of material is specially used by the industry in the formulation of cosmetics.

Results and Discussion

The liquid-crystalline phase of CTA/PA$_{138}$-b-PNIPAM$_{212}$ 2% (m/m) is hexagonal. After the dialysis a new phase was found out, cubic Pm3n. It was proposed that the proton binds to the polymer anionic sites during the dialysis process. The same result is obtained with complex-salt of CTA-PA formed with smaller polymer chains. To eliminate this effect the dialysis was carried out in pH around 8.5, which is the equivalence point reached in synthesis. With this new approach it was possible to reach the reversibility of the hexagonal phase, as presented in Image 1.

The complex-salt of DTA/PA$_{138}$-b-PNIPAM$_{212}$ 2% (m/m) presented cubic Pm3n phase in the bulk before and after the dialysis as indicated in Image 2.

Conclusions

Exploring the complex-salts with dialysis it was possible to disorder the macrostructures and reorganize them with their original liquid-crystalline core phase. DTA/PA$_{138}$-b-PNIPAM$_{212}$ presented cubic phase before and after the dialysis and CTA/PA$_{138}$-b-PNIPAM$_{212}$, hexagonal phase. It was found out that the latter also present cubic phase after the dialysis process.

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References


Image 1. SAXS curves for CTA/PA$_{138}$-b-PNIPAM$_{212}$ samples showing hexagonal and cubic Pm3n phases.

Image 2. SAXS curves for DTA/PA$_{138}$-b-PNIPAM$_{212}$ samples showing the cubic Pm3n phase.