Electronic Supplementary Information for *Soft Matter* Manuscript:
Wormlike Core-Shell Nanoparticles Formed by Co-Assembly of Double Hydrophilic Block Polyelectrolyte with Oppositely Charged Fluorosurfactant

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(i) Zoomed views of objects on Cryo-TEM micrographs of the PSCI-PEO/HFDPCl system at the stoichiometric ratio, $\beta = 0.71$:

![Zoomed views of objects on Cryo-TEM micrographs of the PSCI-PEO/HFDPCl system at the stoichiometric ratio, $\beta = 0.71$.](image)

**Fig. S1.** Zoomed views of objects on Cryo-TEM micrographs of the PSCI-PEO/HFDPCl system at the stoichiometric ratio, $\beta = 0.71$: (a) PSCI-PEO/HFDPCl wormlike micelle, (b) PSCI-PEO/HFDPCl spherical micelle and (c) HFDPCl threadlike micelle.

(ii) The model for the SAXS of PSCI-PEO/HFDPCl system at the stoichiometric ratio, $\beta = 0.71$: The scattering function, $I_{\text{PE-S}}(q)$, consists of contributions from (i) wormlike particles, described by the form factor $P_{\text{worm}}(q, L, b, R_c)$ for homogeneous semiflexible chain of the contour length $L$, the Kuhn length $b$ and the cylindrical cross-section with the radius $R_c$, (ii) from spherical particles, treated by the simple form factor $P_{\text{sphere}}(q, R_s)$ for homogeneous spheres of the radius $R_s$, and (iii) from densely packed surfactant micelles in the PE-S complex, described by the structure factor $S_{\text{cor}}(q, l, \xi)$ for disordered cell-cell correlations with the characteristic distance between cells $l$, and the correlation length $\xi$. The overall scattering function is given by the expression,

$$I_{\text{PE-S}}(q) = I_1 P_{\text{worm}}(q, L, b, R_c) + I_2 P_{\text{sphere}}(q, R_s) + I_3 S_{\text{cor}}(q, l, \xi) ,$$  \hspace{1cm} (S1)

where $I_1, I_2$, respectively, are the forward scattering intensities for wormlike and spherical particles and $I_3$ is the amplitude of the correlation peak.

1. **Wormlike particles.** The scattering from wormlike particles is given by the relationship

$$P_{\text{worm}}(q, L, b, R_c) = \frac{1}{L} \int_0^L P(q, x) dx,$$

where $P(q, x)$ is the form factor of the worm-like chain with contour length $L$, Kuhn length $b$, and cylindrical cross-section with radius $R_c$.
\[ P_{\text{wam}}(L, b, R_c, q) = P_{\text{cy1}}(R_c, q) P_{\text{chain}}(L, b, q), \quad (S2) \]

where

\[ P_{\text{cy1}}(R_c, q) = \left[ \frac{2 J_1(q R_c)}{q R_c} \right]^2, \quad (S3) \]

in which \( J_1(x) \) is the 1st order Bessel function, and

\[
P_{\text{chain}}(q, L, b) = \left\{ \frac{2(e^{-u} + u - 1)}{u^2} + \left[ \frac{4}{15} + \frac{7}{15u} - \left( \frac{11}{15} + \frac{7}{15u} \right) e^{-u} \right] \frac{b}{L} \right\} \times \\
\times \exp \left[ -\left( \frac{q b}{q_1} \right)^{p_1} \right] + \left( \frac{1}{L b q^2} + \frac{\pi}{L q} \right) \left[ 1 - \exp \left[ -\left( \frac{q b}{q_1} \right)^{p_1} \right] \right]. \quad (S4) \]

Here \( p_1 = 4.12, q_1 = 5.53 \) and

\[
u = \frac{L b q^2}{6} \left[ 1 - \frac{3b}{2L} + \frac{3b^2}{2L^2} - \frac{3b^3}{4L^3} \left( 1 - e^{-2L/b} \right) \right] \left[ 1 + \left( \frac{L}{3.12b} \right)^2 + \left( \frac{L}{8.67b} \right)^3 \right]^{0.059}. \quad (S5)\]

2. Spherical particles. Scattering from spherical particles is given by the relationship,

\[
P_{\text{sphere}}(q, R_s) = \frac{9}{q^6 R_s^6} \left[ \sin(q R_s) - q R_s \cos(q R_s) \right]^2. \quad (S6) \]

3. Correlation peak. The structure factor for correlations between surfactant micelles in the PE-S complex is given by the formula, \(^2\)

\[
S_{\text{cor}}(q, l, \xi) = \frac{\xi^{-2}}{\xi^{-2} + (q - 2\pi/l)^2}. \quad (S7)\]
