Supporting Information

Figure s1 shows the SANS data of SDS-D_{2}O system used in this paper. Figure s2 shows the Holtzer plot of the SANS data of P3TMAHT(SDS-d_{25})_{x}-D_{2}O with x=1/5, 1/2, and 5. Figure s3 shows comparison of $p(r)$ functions as calculated for P3TMAHT(SDS)_{x}-D_{2}O and P3TMAHT(SDS-d_{25})_{x}-D_{2}O for x≤1. Figure s4 shows the photoexcitation spectra of 0.1 mg/mL P3TMAHT-D_{2}O and P3TMAHT(SDS)_{x}-D_{2}O with x=1/5-5.

![Figure s1. SANS data of SDS-D_{2}O at concentrations 5.28 mg/mL (open cyan circles) and 10.55 mg/mL (open blue circles). Dashed line shows a -4 decay for comparison. T=20 °C.](image1)

![Figure s2. Holtzer representation of the SANS data of P3TMAHT(SDS-d_{25})_{x}-D_{2}O for x=1/5 (solid red squares), x=1/2 (solid black spheres), and x=5 (solid cyan upper triangles). The overall concentration was ~10 mg/mL. T=20 °C.](image2)
**Figure s3.** Comparison of distance distribution functions as estimated from the SANS data of P3TMAHT(SDS),-D₂O P3TMAHT(SDS-d₂5),-D₂O for x=1/5 (solid and dotted red lines) and for x=1/2 (solid and dotted black lines) using an elongated rod-like particle model; and for x=1 (solid and dotted green line) using a sheet-like particle model. The functions are calculated by Glatter software and correspond to the fits shown in Figs. 3a and 5.

**Figure s4.** Photoexcitation spectra of 0.1 mg/mL P3TMAHT-D₂O (solid blue curve) and P3TMAHT(SDS),x-D₂O for x=1/5 (dashed red curve), x=1 (dotted green curve), and x=5 (dashed and dotted cyan curve). The overall concentration was ~0.1 mg/ml. in all cases. The data were detected at λₜₐₜ = 680 nm. T=20 °C.