**Electronic supplementary information for Soft Matter manuscript**

# Tetraalkylammonium ion induced micelle-to-vesicle transition in aqueous sodium dioctylsulfosuccinate solution

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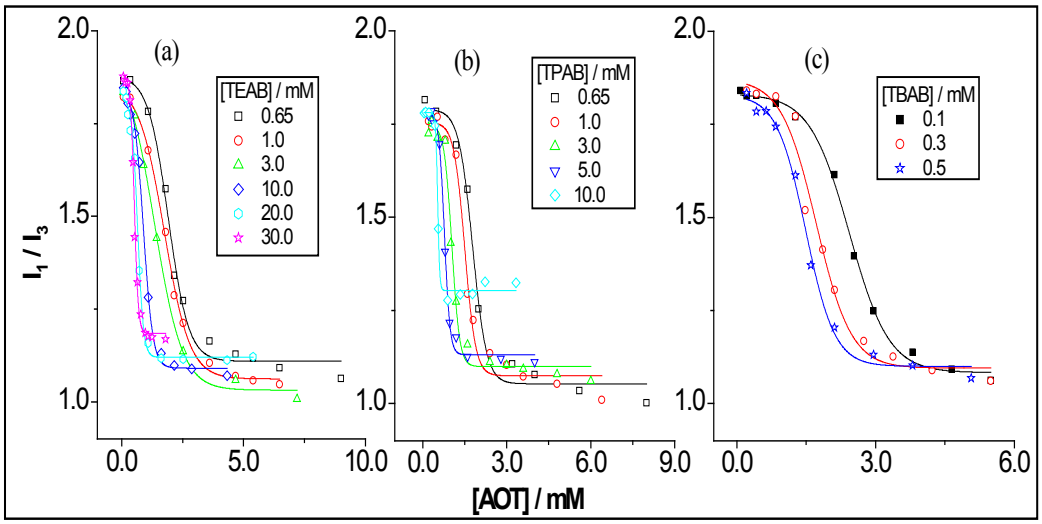


**Fig. S1.** Variation of $I_1/I_3$ of pyrene with AOT concentration in aqueous medium in the presence of TAAB. (a) TEAB, (b) TPAB, (c) TBAB.

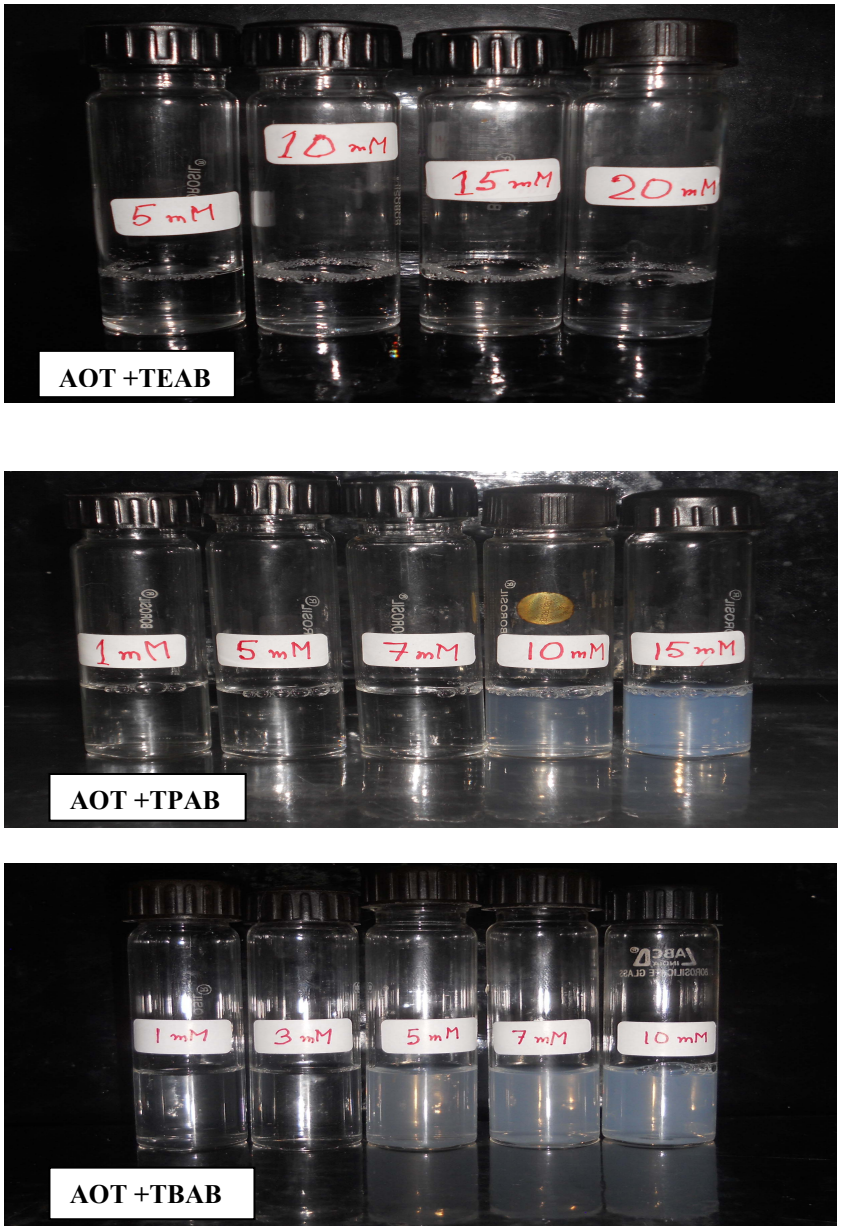


**Fig. S2.** Images of aqueous AOT (15 mM) + TAAB solutions as a function of TAAB amount at 25 ± 1 °C.

**Table S1**. Values of cmc of AOT in aqueous TAAB solutions at 25 °C obtained from surface tension data.

| Salt | Salt Conc. / mmol $kg^{-1}$ | Cmc / mmol $kg^{-1}$ | Salt Conc. / mmol $kg^{-1}$ | Cmc / mmol $kg^{-1}$ |
|---|---|---|---|---|
| TEAB | 0.65 | 2.50 | 10.0 | 1.10 |
| | 1.0 | 2.29 | 20.0 | 0.75 |
| | 3.0 | 1.88 | 30.0 | 0.56 |
| | 5.0 | 1.62 | 50.0 | 0.45 |
| TPAB | 0.65 | 2.01 | 10.0 | 0.50 |
| | 1.0 | 1.81 | 20.0 | 0.34 |
| | 3.0 | 1.39 | 30.0 | 0.25 |
| | 5.0 | 0.96 | 50.0 | 0.20 |
| TBAB | 0.1 | 2.30 | 1.0 | 0.70 |
| | 0.3 | 1.86 | 3.0 | 0.26 |
| | 0.5 | 1.60 | 5.2 | 0.17 |
| | 0.65 | 1.15 | | |

**Table S2.** Values of the fitted parameters of the sigmoid equation[a)] for $I_1/I_3$ data of pyrene in aqueous solutions of AOT + TAAB at 25 °C.

| Salt | Salt conc. / mmol $kg^{-1}$ | $A_1$ | $A_2$ | $10^3x_0$/ mol $kg^{-1}$ | $10^3b$/ mol $kg^{-1}$ |
|---|---|---|---|---|---|
| TEAB | 0.65 | 1.8807 | 1.1091 | 1.91 | 0.42 |
| | 1.0 | 1.8586 | 1.0617 | 1.74 | 0.53 |
| | 3.0 | 1.8387 | 1.0651 | 1.88 | 0.25 |
| | 10.0 | 1.8422 | 1.0906 | 0.89 | 0.19 |
| | 20.0 | 1.8203 | 1.1197 | 0.65 | 0.12 |
| | 30.0 | 1.8826 | 1.1841 | 0.52 | 0.08 |
| TPAB | 0.65 | 1.7898 | 1.0530 | 1.78 | 0.25 |
| | 1.00 | 1.7550 | 1.0743 | 1.50 | 0.19 |
| | 3.0 | 1.7473 | 1.0991 | 1.04 | 0.14 |
| | 5.0 | 1.7800 | 1.1310 | 0.77 | 0.10 |
| | 10.0 | 1.7807 | 1.3030 | 0.53 | 0.04 |
| TBAB | 0.1 | 1.8321 | 1.0831 | 2.43 | 0.43 |
| | 0.3 | 1.8714 | 1.0953 | 1.72 | 0.37 |
| | 0.5 | 1.8290 | 1.1006 | 1.49 | 0.31 |

[a)] $I_1/I_3 = A_2 + \{(A_1 - A_2)/[1 + \exp((c_s - x_0)/b)]\}$, where $c_s$ is AOT concentration, $x_0$ is the value of $c_s$ corresponding to the centre of the sigmoid, $A_1$ and $A_2$ are the upper and lower limits of the sigmoid, respectively, and b is a term that reflects the range of $c_s$ where sudden change in $I_1/I_3$ occurs. The value of $x_0$ is taken as equal to cmc.

**SANS data anlysis**.

For monodispersed particles in a medium the differential scattering cross section per unit volume is presented by the following expression[R1-R3]

$$d\Sigma / d\Omega = nF(Q)S(Q) + B \qquad \text{(S1)}$$

where $n$ is the number density of the particles, $F(Q)$ is the single particle form factor and depends on the shape and size of the particles. $S(Q)$ is the structure factor and is decided by the spatial distribution of the particles thereby giving information about the inter-particle interaction. $B$ is a constant term accounting for the incoherent scattering background that occurs in the case of neutrons mainly due to the presence of hydrogen in the sample. The relevant equations of the form factors of different shapes are given below:

The form factor equations used for prolate-ellipsoidal micelles are

$$F(Q) = \frac{16\pi^2}{9}\left(\rho_p - \rho_s\right)^2\left(ab^2\right)^2\int_0^1\left[f(Q,\mu)\right]^2 d\mu \qquad \text{(S2)}$$

$$f(Q,\mu) = 3(\sin x - x\cos x)/x^3 \qquad \text{(S3)}$$

$$x = Q\left[a^2\mu^2 + b^2(1-\mu^2)\right]^{1/2} \qquad \text{(S4)}$$

where $\rho_p$ and $\rho_s$ are the scattering length densities of particle (micelle) and solvent, respectively. $a$ and $b$ are the semi-major and semi-minor axes of the ellipsoid, respectively. The term $\mu$ in the above equations refers to the cosine of the angle between the directions of $a$ and $Q$.

For vesicles having inner radius R and thickness dR, the form factor equation is

$$F(Q) = \frac{16\pi^2}{9}(\rho_p - \rho_s)^2 \left[ (R+dR)^3 \frac{\sin(Q(R+dR)) - Q(R+dR)\cos(Q(R+dR))}{Q^3(R+dR)^3} - R^3 \frac{\sin(QR) - QR\cos(QR)}{Q^3R^3} \right]^2 \quad \text{(S5)}$$

For a rod-like structure of radius $R$ and length $2l$, equation for $F(Q)$ is

$$F(Q) = (\pi R^2 l)^2 (\rho_p - \rho_s)^2 \int_0^{\pi/2} \frac{\sin^2(Ql\cos\beta)}{(Ql\cos\beta)^2} \frac{4J_1^2(QR\sin\beta)}{(QR\sin\beta)^2} \sin\beta \, d\beta \quad \text{(S6)}$$

where $J_1$ is the Bessel function of order unity and $\beta$ is the angle between the axis of the cylinder and bisectrix.

The expression for $S(Q)$ is given by the Fourier transform of the radial distribution function $g(r)$. $g(r)$ gives the probability of finding the centre of another micelle at a distance $r$ from the centre of a reference micelle. $S(Q)$ is calculated using the analysis as developed by Hayter and Penfold under mean spherical approximation.[R4] In this approximation, the micelle is treated as a rigid equivalent sphere of diameter $d = 2(ab^2)^{1/3}$ interacting with another micelle through a screened coulomb potential $u(r)$ given by the relation

$$u(r) = u_0 d \exp[-\kappa(r-d)]/r \qquad r > d \qquad \text{(S7)}$$

where $u_0$ is the potential at $r = d$ and the Debye-Hückel inverse screening length $\kappa$ is evaluated by using the expression

$$\kappa = \left( \frac{8\pi N_A e^2 I}{10^3 \varepsilon k_B T} \right)^{1/2} \quad \text{(S8)}$$

In eqn (S8), $N_A$, $e$, $\varepsilon$, $k_B$ and $T$ denote Avogadro number, electronic charge, dielectric constant of the solvent, Boltzmann constant and absolute temperature, respectively.

## References

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