Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supporting Information

Polymer assisted drug sequestration from plasma protein by surfactant with curtailed denaturing capacity

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Derivation of equations 3 & 6

Binding of a ligand (L) with protein (P) can be represented by following equation.

$$P + L \rightleftharpoons PL \quad \text{(S1)}$$

The dissociation constant (K_d) for complex PL is defined as

$$K_d = \frac{[L][P]}{[PL]} \quad \text{(S2)}$$

where [L], [P] and [PL] are concentrations of free ligand, free protein and protein-ligand complex. If the total concentration of the ligand is $[L]_0$, then the concentration of protein bound ligand, $[L]_b$, is given by

$$[L]_b = [L]_0 - [L] \quad \text{(S3)}$$

Further, if the number of equivalent binding sites in protein for ligand L is n, then $[L]_b$ and [PL] are related by following equation.

$$[L]_b = n\,[PL] \quad \text{(S4)}$$

Substituting the value of [PL] from eq. S2

$$[L]_b = n\frac{[L][P]_0}{K_d + [L]} \quad \text{(S5)}$$

where $[P]_0$ is total concentration of protein.

Substituting the value of [L] from eq. S3 into eq. S5

$$[L]_b^2 - [L]_b(n[P]_0 + K_d + [L]_0) + n[P]_0[L]_0 = 0 \quad \text{(S6)}$$

The solution of $[L]_b$ is given by

$$[L]_b = \frac{b - \sqrt{b^2 - 4c}}{2} \quad \text{(S7)}$$

where b and c are given by

$$b = n[P]_0 + K_d + [L]_0 \quad \text{(S8)}$$

$$c = n[P]_0[L]_0 \quad \text{(S9)}$$

Estimation of K_d by absorption measurements: The total absorbance (A_λ) at wavelength λ is given by

$$A_\lambda = \epsilon[L] + \epsilon_b[L]_b \quad \text{(S10)}$$

Where ϵ and ϵ_b are the molar extinction coefficient of free and protein bound ligands. It is assumed that there is no absorption at wavelength λ due to protein and the optical path is 1 cm. Substituting the value of $[L]$ and $[L]_b$ from eq. S3 and S7, respectively in eq. S10.

$$A_\lambda = \epsilon[L]_0 + (\epsilon_b - \epsilon)\frac{b-\sqrt{b^2-4c}}{2} \quad \text{(S11)}$$

Thus, for estimation of K_d, total absorbance, A_λ, are measured for ligand in presence of different concentrations of protein, $[P]_0$. The non-linear fitting of the experimental data by eq. S11 results the value of K_d, n and ϵ_b.

Estimation of K_d by emission measurements: Total emission intensity at wavelength λ (I_λ) is given by

$$I_\lambda = F[L] + F_b[L]_b \quad \text{(S12)}$$

where F and F_b are the molar fluorescence intensity at λ for free and protein bound ligand. The emission from protein at λ is neglected. The value of F can be calculated by measuring emission intensity at λ for known concentration of free ligand in aqueous solution. Substituting the value of $[L]$ and $[L]_b$ from eq. S3 and S7, respectively in eq. S12.

$$I_\lambda = F[L]_0 + (F_b - F)\frac{b-\sqrt{b^2-4c}}{2} \quad \text{(S13)}$$

Thus, variation of I_λ, with $[P]_0$ are fitted with eq. S13 to get values of K_d, n and F_b.

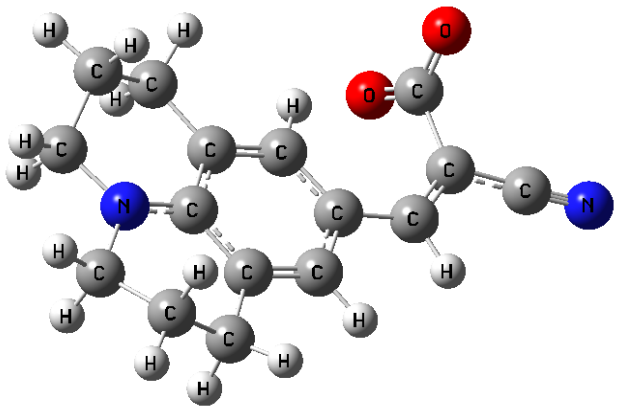

Figure S1-Optimized geometry of CCVJ in water obtained from quantum chemical calculations.

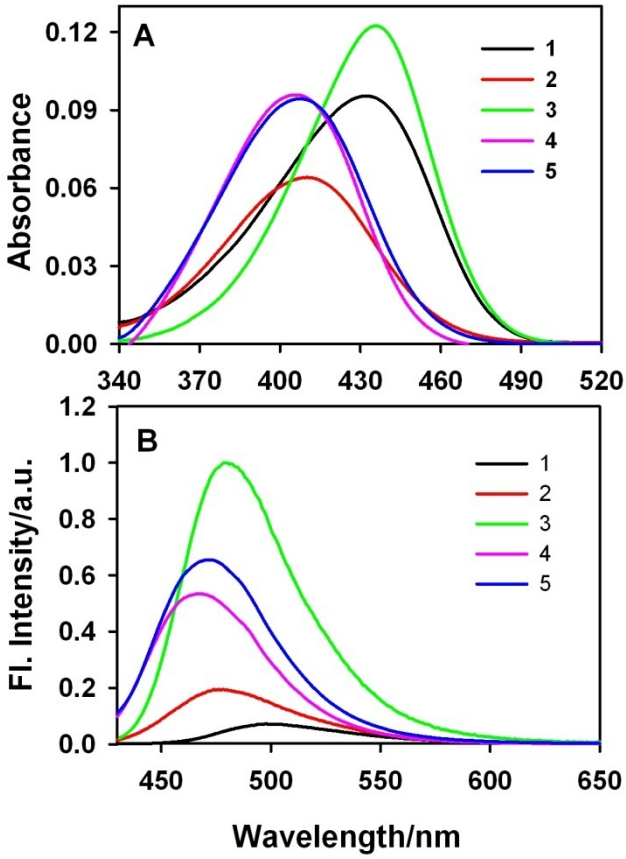

Figure S2- (A) Absorption and (B) emission spectra of 3.6 μM CCVJ in (1) water, (2) 0.6 mM CTAB, (3) 1% P123, (4) 1% P123+ 0.6 mM CTAB and (5) BSA + 1% P123 +0.6 mM CTAB.

Deconvolution of emission spectrum: Following equation is used to deconvolute the emission spectra (I(λ)) of CCVJ in BSA-P123-CCVJ systems.

$$I(\lambda) = A_{BSA} I^{BSA}(\lambda) + A_{P123\text{-}CTAB} I^{P123\text{-}CTAB}(\lambda) \quad \text{(S14)}$$

where $I^{BSA}(\lambda)$ and $I^{P123\text{-}CCVJ}(\lambda)$ represent the emission spectra of 3.6 μM CCVJ in BSA solution and in 1%P123-0.6 mM CTAB solution and parameters, A_{BSA} and $A_{P123\text{-}CCVJ}$ are their respective contribution towards the total emission spectrum, I(λ). $I^{BSA}(\lambda)$ and $I^{P123\text{-}CCVJ}(\lambda)$ have been determined independently. All emission spectra of CCVJ in BSA-P123-CTAB solutions were fitted by eq. S14 using non-linear least square fitting method to get the values of A_{BSA} and $A_{P123\text{-}CCVJ}$.

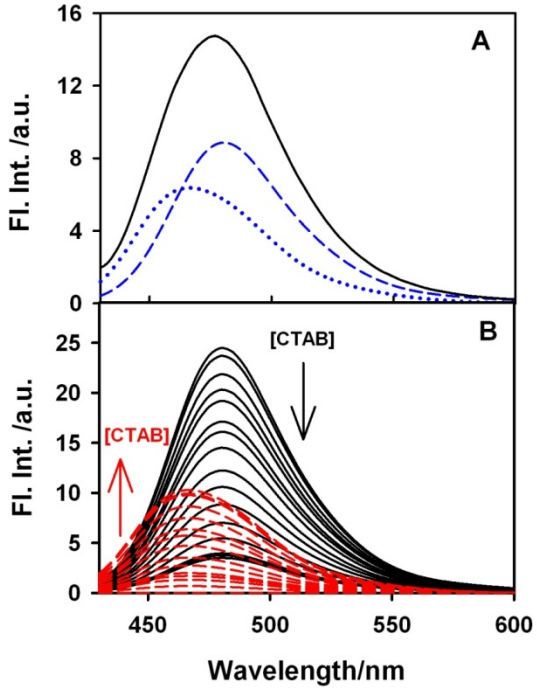

Figure S3- (A) Deconvolution of emission spectra of CCVJ in BSA-P123 solution with 0.25 mM CTAB. The solid line is experimentally measured emission spectrum of CCVJ (I(λ)). The dashed and dotted spectra represent the emission spectra of CCVJ in BSA ($I^{BSA}(\lambda)$) and in P123-CTAB supramolecular assemblies ($I^{P123\text{-}CCVJ}(\lambda)$), respectively obtained by spectral deconvolution process. (B) The deconvoluted emission spectra of CCVJ in BSA (solid line) and in P123-CTAB supramolecular assemblies (dashed curves) in the presence of different concentrations of CTAB.

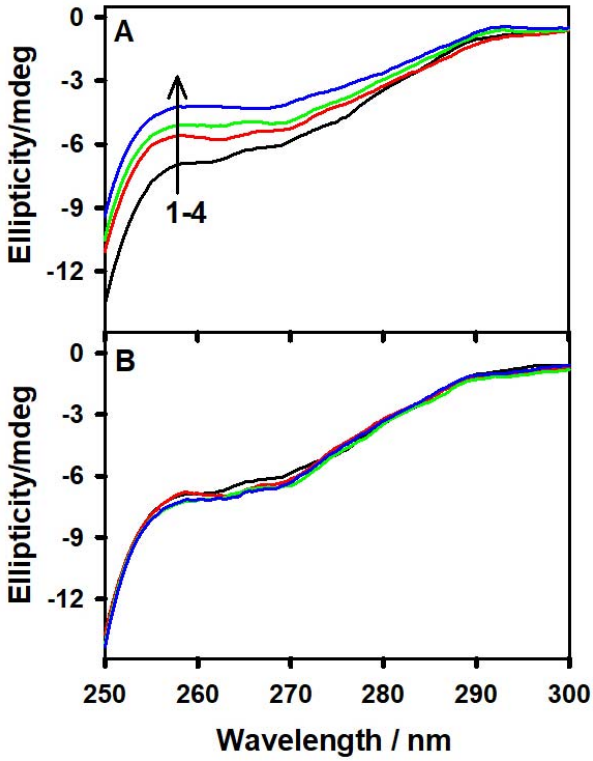

Figure S4: Near-UV CD spectra of BSA in (A) water and (B) 1% P123 solutions in presence of different concentrations of CTAB (1-4: 0, 0.2, 0.4 and 0.75 mM).