Electronic Supplementary Material (ESI) for Soft Matter.

SUPPORTING INFORMATION

Introducing Tween-Curcumin Niosomes: Preparation, Characterization and Microenvironment study

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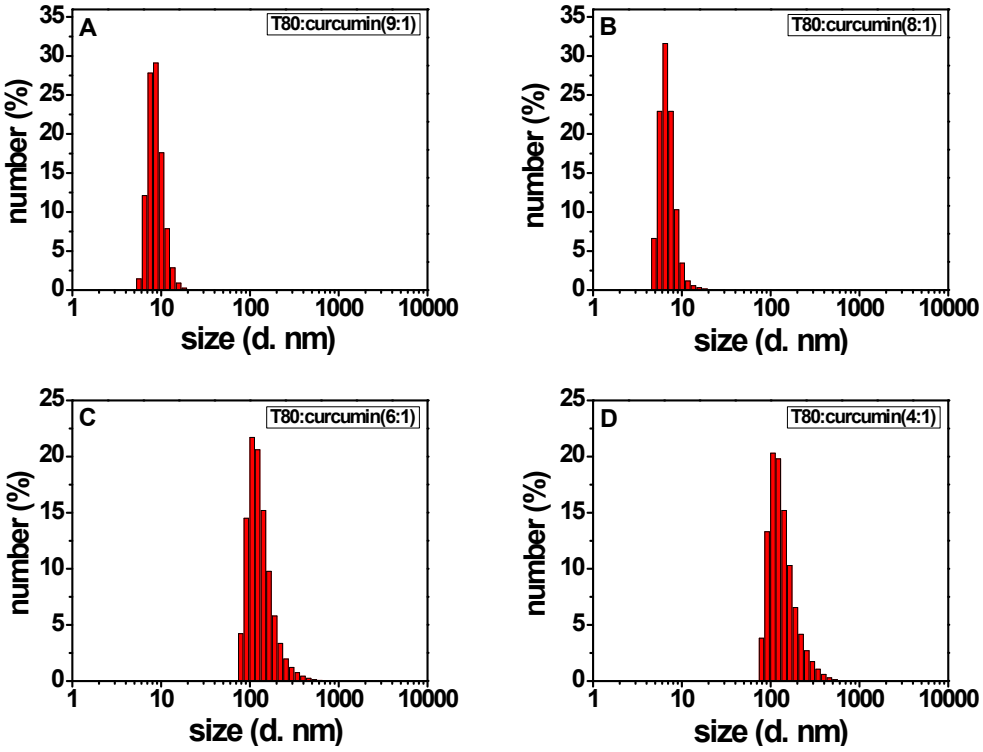
Table S1. Shows different formulations of T80:curcumin.

T80:curcumin formulation	**[T80] (mM)**	**[curcumin] (mM)**
20:1	1.25	0.0625
10:1	1.25	0.125
9:1	1.25	0.138
8:1	1.25	0.156
7:1	1.25	0.178
6:1	1.25	0.208
5:1	1.25	0.25
4:1	1.25	0.3125
2:1	1.25	0.625
1:1	1.25	1.25

Figure S1. Histograms showing size distributions of different formulations of T80:curcumin (A) 9:1 (B) 8:1 (C) 6:1 and (D) 4:1 obtained from DLS measurements at 25 ^{o}C. [T80] = 1.25 mM, [curcumin] were 0.138 mM, 0.156 mM, 0.208 mM, and 0.3125 mM for 9:1, 8:1, 6:1, and 4:1



formulations respectively.

Figure S2. Photograph showing different formulation of T80:curcumin, where T80 concentrations were fixed to 1.25 mM and curcumin concentrations, were varied to make desired formulations. The picture clearly shows that the turbidity increases when curcumin concentration increases from 20:1 to 1:1 formulation of T80:curcumin.

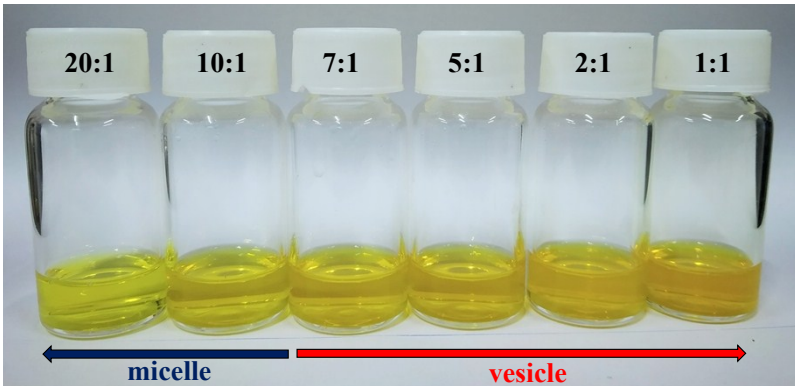
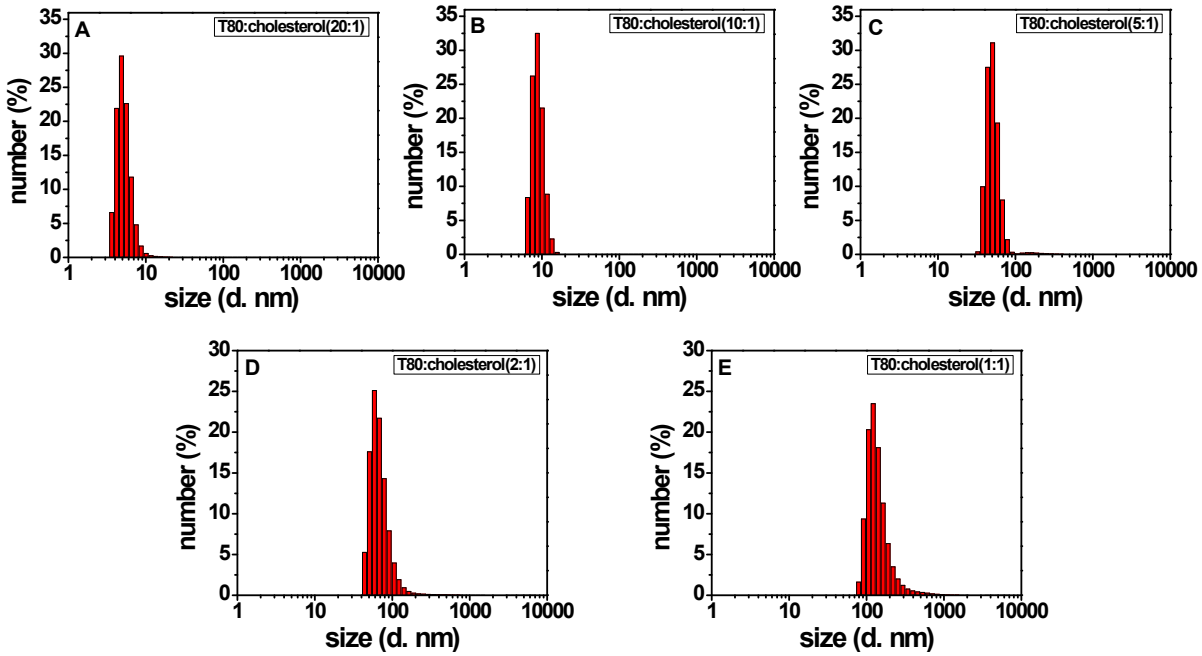


Figure S3. Histograms showing size distributions of different formulations of T80:cholesterol (A) 20:1 (B) 10:1 (C) 5:1 (D) 2:1 and (E) 1:1 obtained from DLS measurements at 25 °C. Niosomes

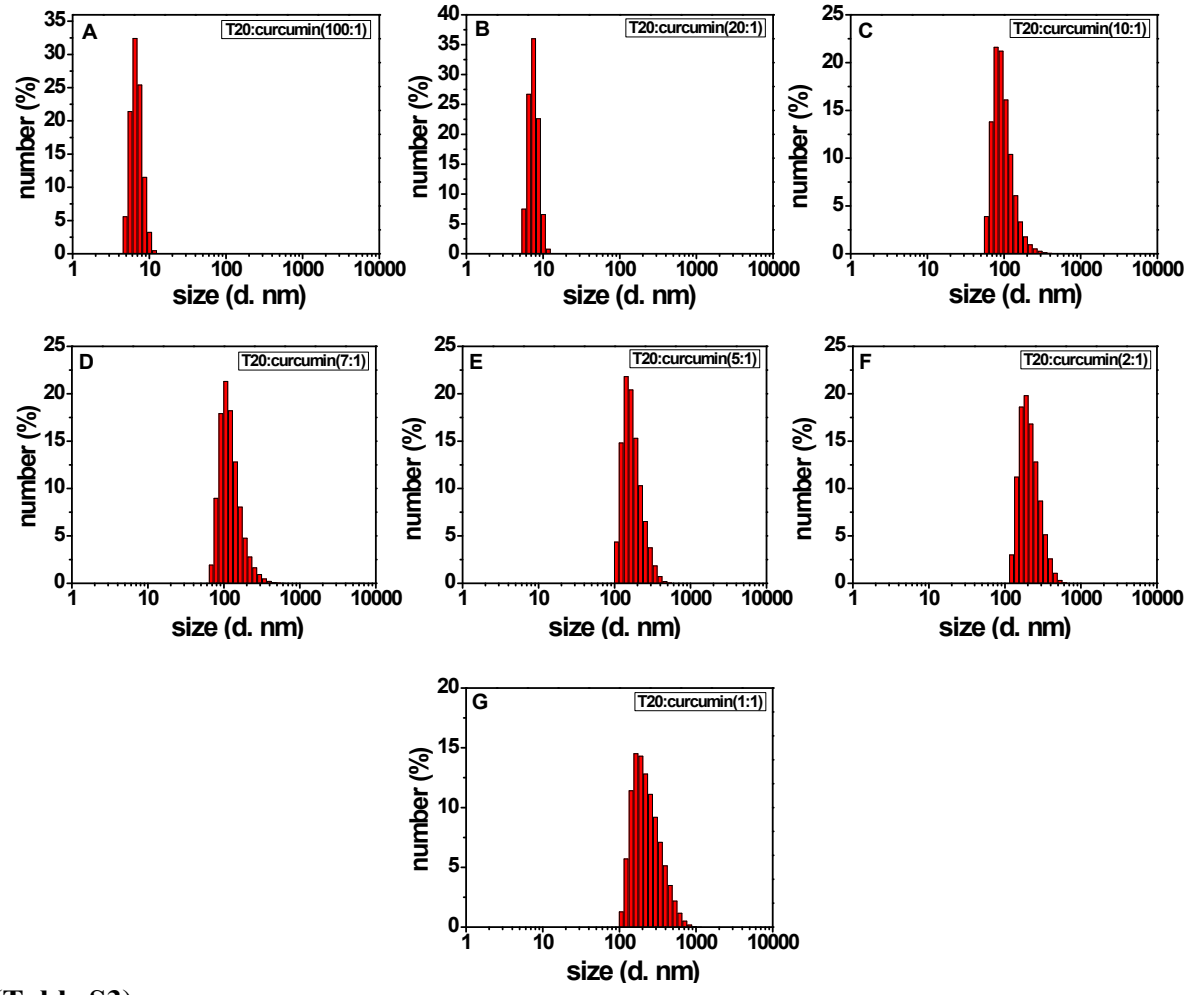


are forming below 10:1 molar ratio of T80:cholesterol.

Table S2. Number mean and PDI value for different formulations of T80:cholesterol obtained from DLS measurements at 25 °C. (error ±5 %)

Formulation (T80:cholesterol)	Number mean (nm)	PDI
20:1	5.2	0.65
10:1	8.9	0.522
5:1	52.9	0.431
2:1	70.5	0.429
1:1	146.9	0.449

Figure S4. Histograms showing size distributions of different formulations of T20:curcumin (A) 100:1 (B) 20:1 (C) 10:1 (D) 7:1 (E) 5:1 (F) 2:1 and (G) 1:1 obtained from DLS measurements at 25 ^{o}C. The mean hydrodynamic diameter increases with the decrease in T20:curcumin molar ratio



(**Table S3**).

Table S3. Number mean and PDI value for different formulations of T20:curcumin obtained from DLS measurement at 25 ^{o}C**.** (error ±5 %)

Formulation (T20:curcumin)	Number mean (nm)	PDI
100:1	6.8	0.459
20:1	7.6	0.461
10:1	99.9	0.445
7:1	125.7	0.325
5:1	176.9	0.331
2:1	218.0	0.250
1:1	243.7	0.222

Figure S5. represents the emission spectra of 5-carboxyfluorescein without and with 0.1% (w/v) TX-100 in different formulations of T80:curcumin (A)20:1 (B)10:1 (C)7:1 (D)5:1 (E)2:1 and (F)1:1. It shows no change with TX-100 for 20:1 and 10:1 whereas enhancement in fluorescence intensity for 7:1 to 1:1 formulations of T80:curcumin.

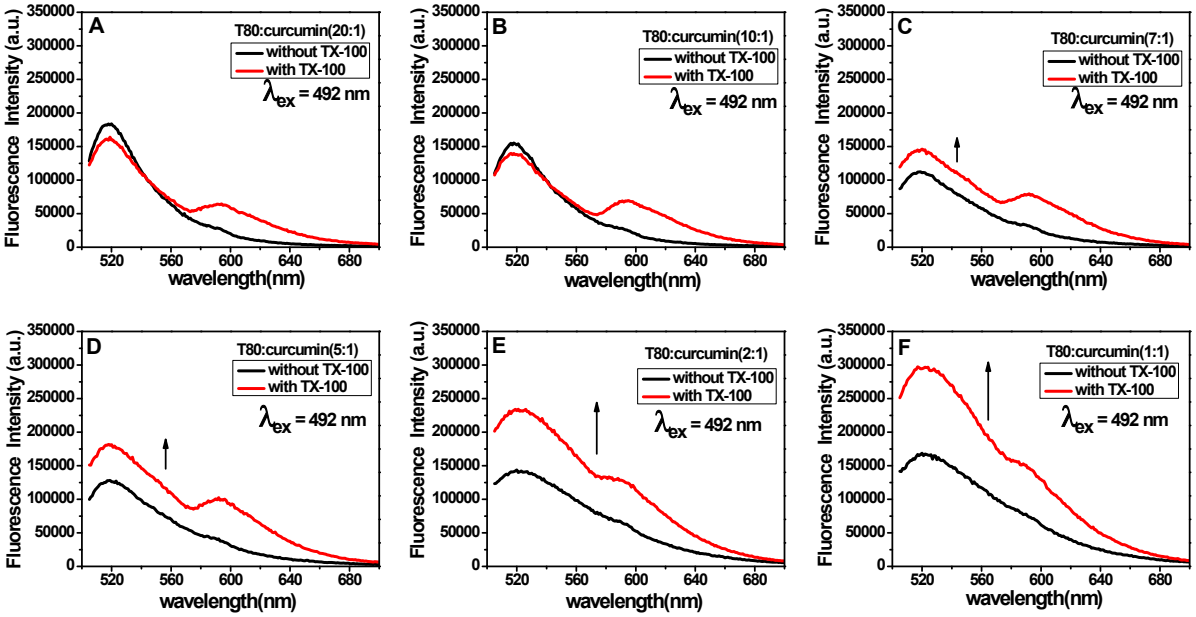
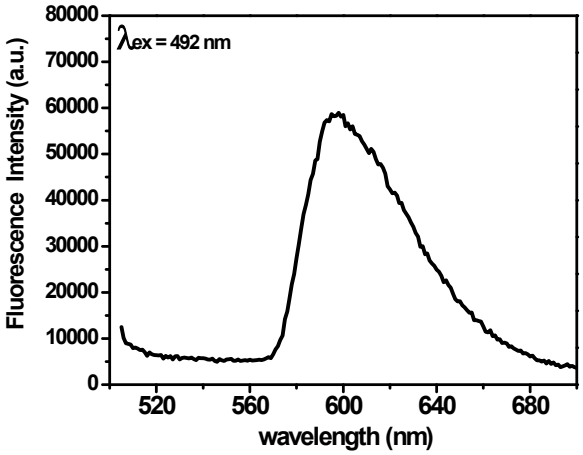


Figure S6. Emission spectra of TX-100 (0.1 % w/v) in water excited at 492 nm. The emission



maximum is around 600 nm.

Table S4. Different kinetic models and their parameters for the release of curcumin from different niosomal formulation.

Kinetic models	**Equation**	**Kinetic model parameters for different niosomal formulations**		
		5:1	**2:1**	**1:1**
Zero-order	$Q_t = Q_0 + K_0 t$	K_0=0.9 R^2=0.63	K_0= 0.84 R^2= 0.79	K_0= 0.60 R^2=0.67
First-order	$\log Q_t = \log Q_0 + (Kt /2{\cdot}303)$	K=0.029 R^2=0.44	K=0.036 R^2=0.54	K=0.030 R^2=0.49
Higuchi	$Q_t / Q_\infty = K_H \sqrt{t}$	K_H=8.87 R^2=0.83	K_H= 7.72 R^2=0.93	K_H=5.79 R^2=0.86
Hixson-Crowell	$(Q_t)^{1/3} = (Q_0)^{1/3} - Kt$	K=0.036 R^2=0.44	K=0.038 R^2=0.56	K=0.032 R^2=0.48
Korsmeyer-Peppas	$Q_t / Q_\infty = Kt^n$	K=5.94 n=0.67	K=3.15 n=0.76	K=3.58 n=0.67

		R^2=0.87	R^2=0.93	R^2=0.90

Figure S7. shows (A) Steady-state emission spectra and (B) normalized emission spectra of curcumin in different formulations of T20:curcumin. (λ_{ex} = 420 nm). Fluorescence intensity increases gradually with a red shift by decreasing the molar ratio of T20:curcumin. (C) shows steady-state fluorescence anisotropy of curcumin (recorded at emission maxima) in different formulations of T20:curcumin at 25 ^{o}C. Anisotropy decreases by decreasing the molar ratio of T20:curcumin.

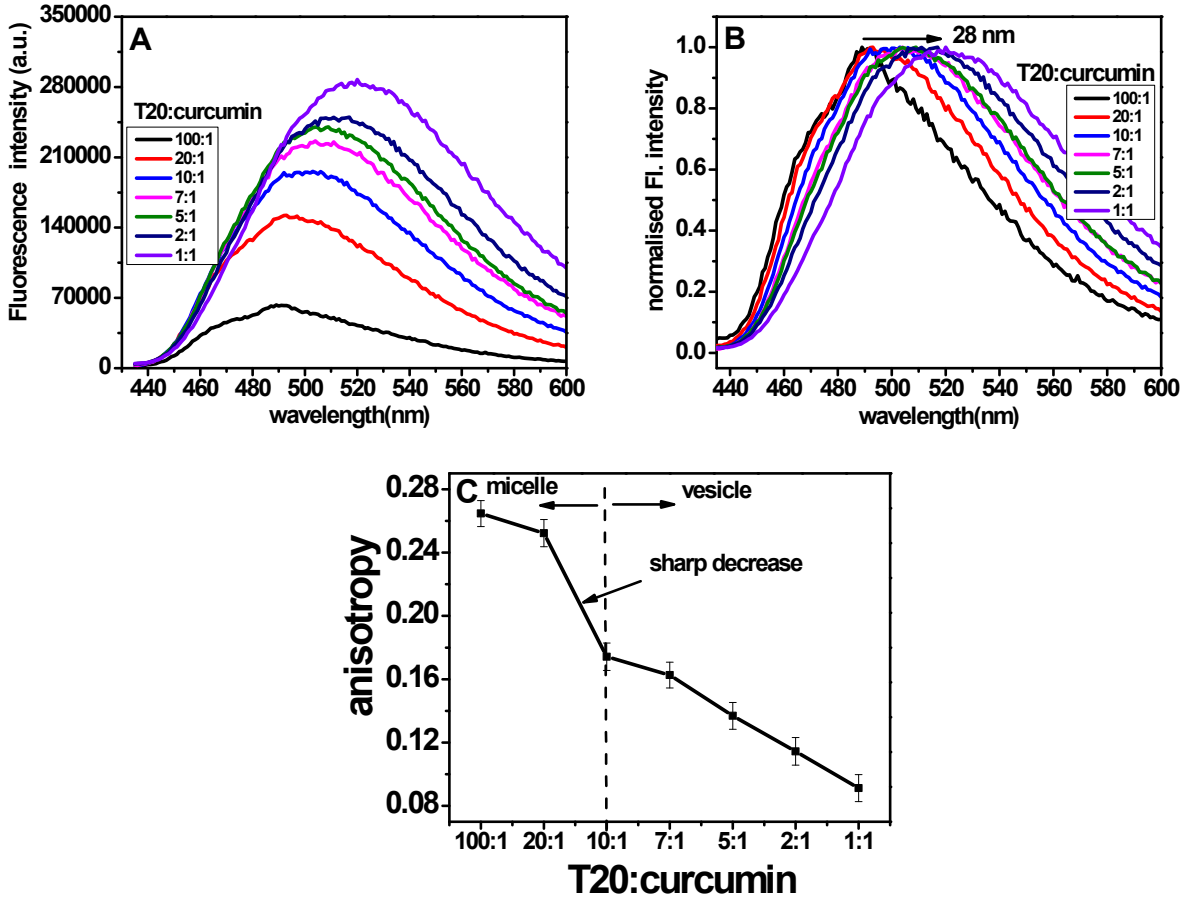
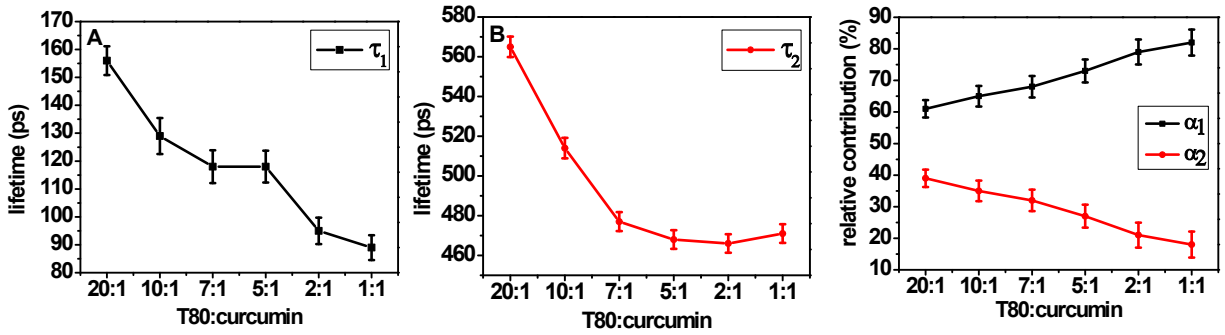
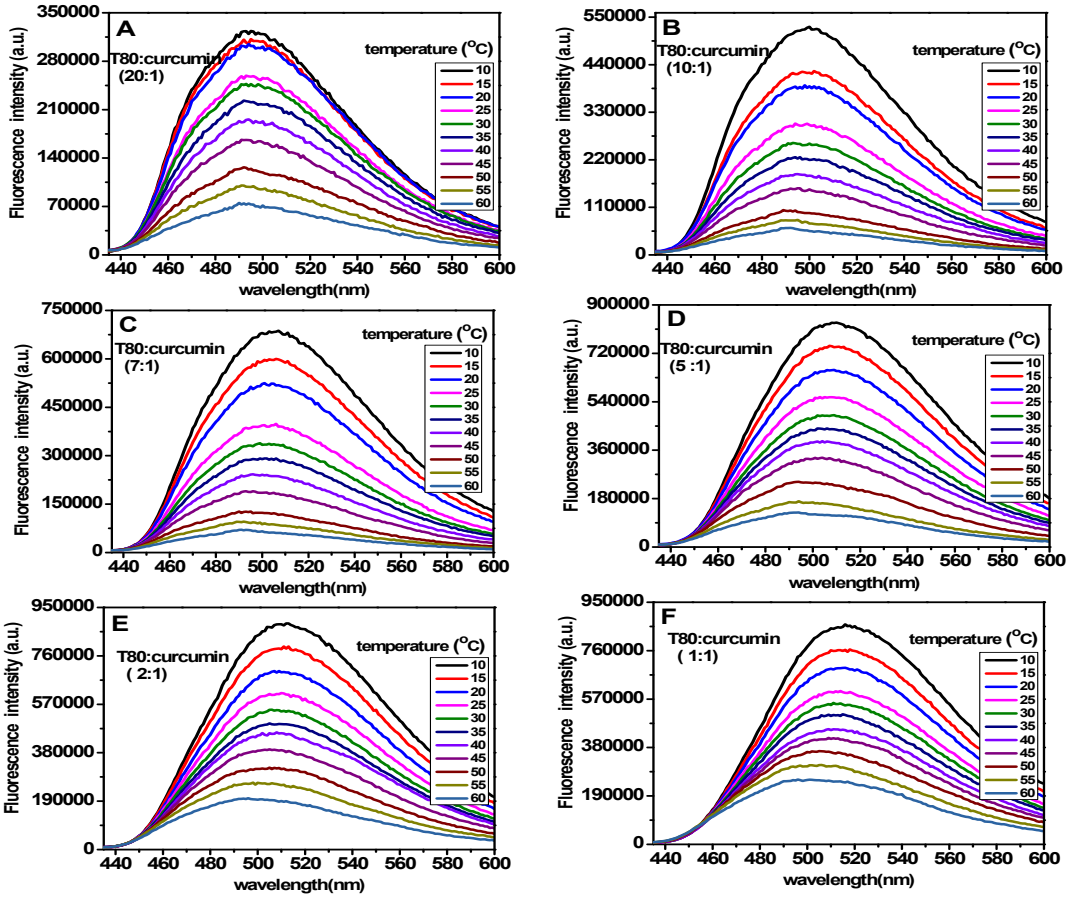


Figure S8. shows (A) Variation in the lifetime value of the shorter component, (B) Variation in the lifetime value of the longer component and (C) variation in the relative amplitude of both



shorter and longer component for different formulations of T80:curcumin at 25 °C. (λ_{ex} = 405 nm)

Figure S9. shows variation in emission spectra of curcumin with temperature for different formulation of T80:curcumin (A) 20:1 (B) 10:1 (C) 7:1 (D) 5:1 (E) 2:1 and (F) 1:1. Fluorescence



intensity decreases with the increase in temperature for all formulations.

Figure S10. represents normalized emission spectra of curcumin with variation in temperature for different formulation of T80:curcumin (A) 20:1 (B) 10:1 (C) 7:1 (D) 5:1 (E) 2:1 and (F) 1:1.(λ_{ex} = 420 nm) The extent of blue shift increases from 20:1 to 1:1 molar ratio of T80:curcumin.

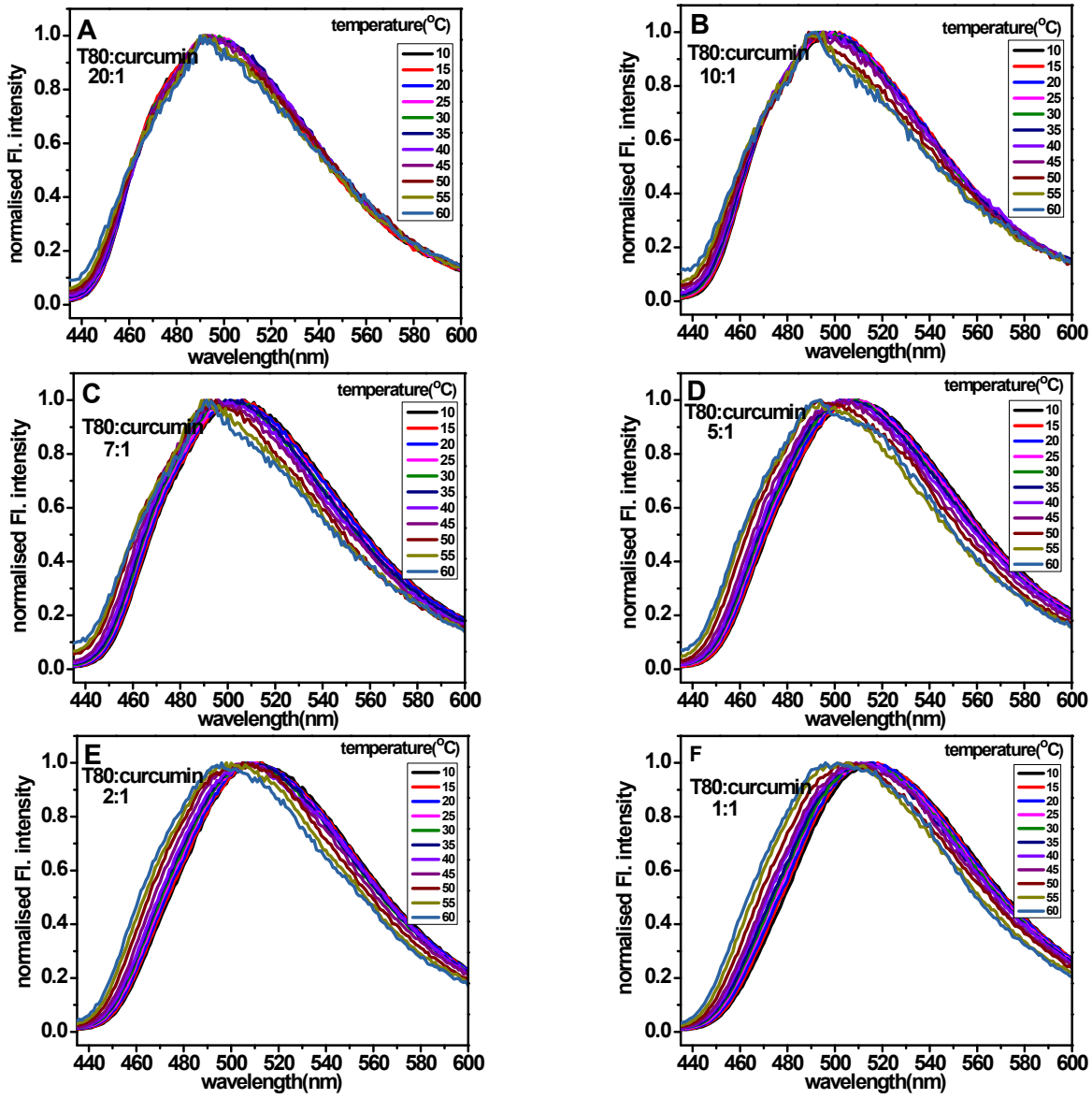


Figure S11. represents normalized emission spectra of curcumin with variation in temperature for different formulation of T20:curcumin (A) 100:1 (B) 20:1 (C) 10:1 (D) 7:1 (E) 5:1 (F) 2:1 and (G)

1:1. (λ_{ex} = 420 nm). The extent of blue shift increases from 100:1 to 1:1 molar ratio of T20:curcumin.

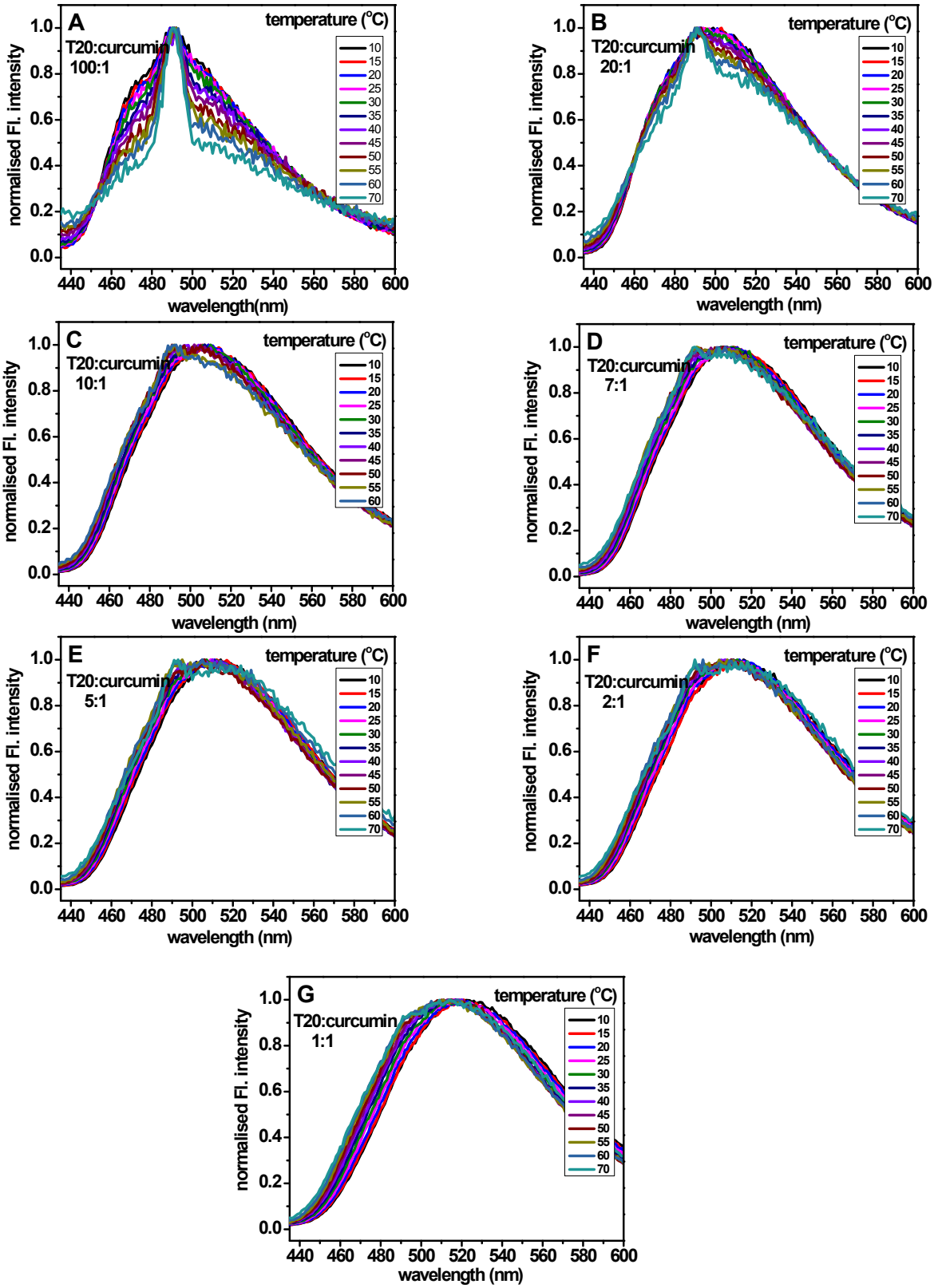
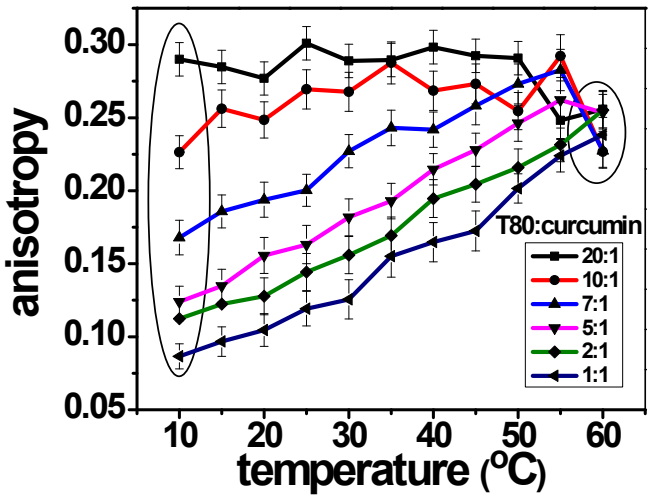
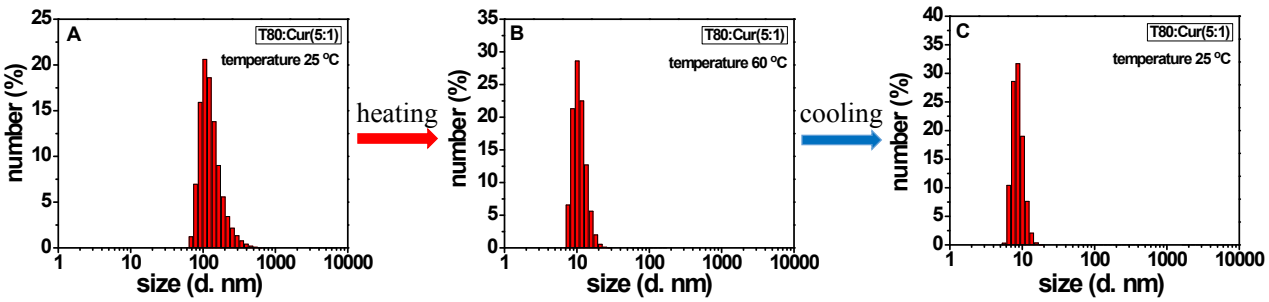

A
T20:curcumin
100:1
temperature (°C)
10
15
20
25
30
35
40
45
50
55
60
70
normalised FI. intensity
wavelength(nm)
B
T20:curcumin
20:1
wavelength (nm)
C
T20:curcumin
10:1
D
T20:curcumin
7:1
E
T20:curcumin
5:1
F
T20:curcumin
2:1
G
T20:curcumin
1:1

Figure S12. shows the variation in fluorescence anisotropy with temperature for different



formulations of T80:curcumin. (Recorded at emission maxima)(error within ±5 %)

Figure S13. Histograms showing size distribution of Tween 80:curcumin (5:1) formulation at various temperature (A) 25 °C (B) 60 °C (C) cooling to 25 °C after heating at 60 °C. Size decreases



with the increase in temperature, and this process is irreversible.

Figure S14. Histograms showing size distribution of Tween 80:curcumin (1:1) formulation at various temperature (A) 25 °C (B) 60 °C (C) cooling to 25 °C after heating at 60 °C. Size decreases slightly with the increase in temperature, and this process is irreversible.

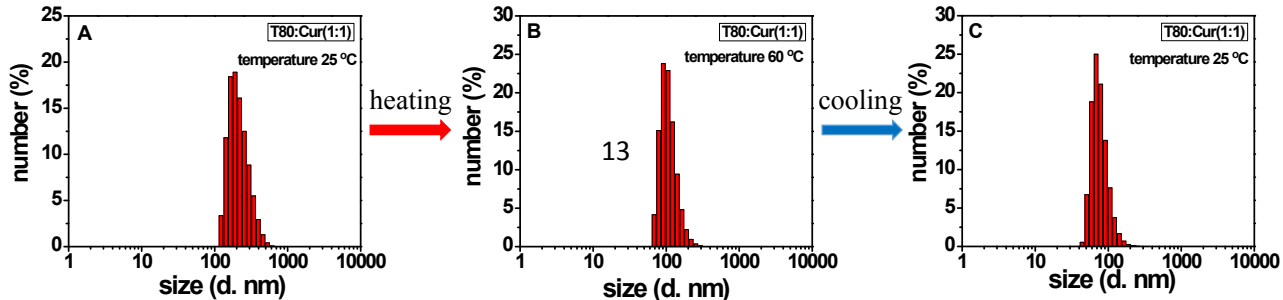
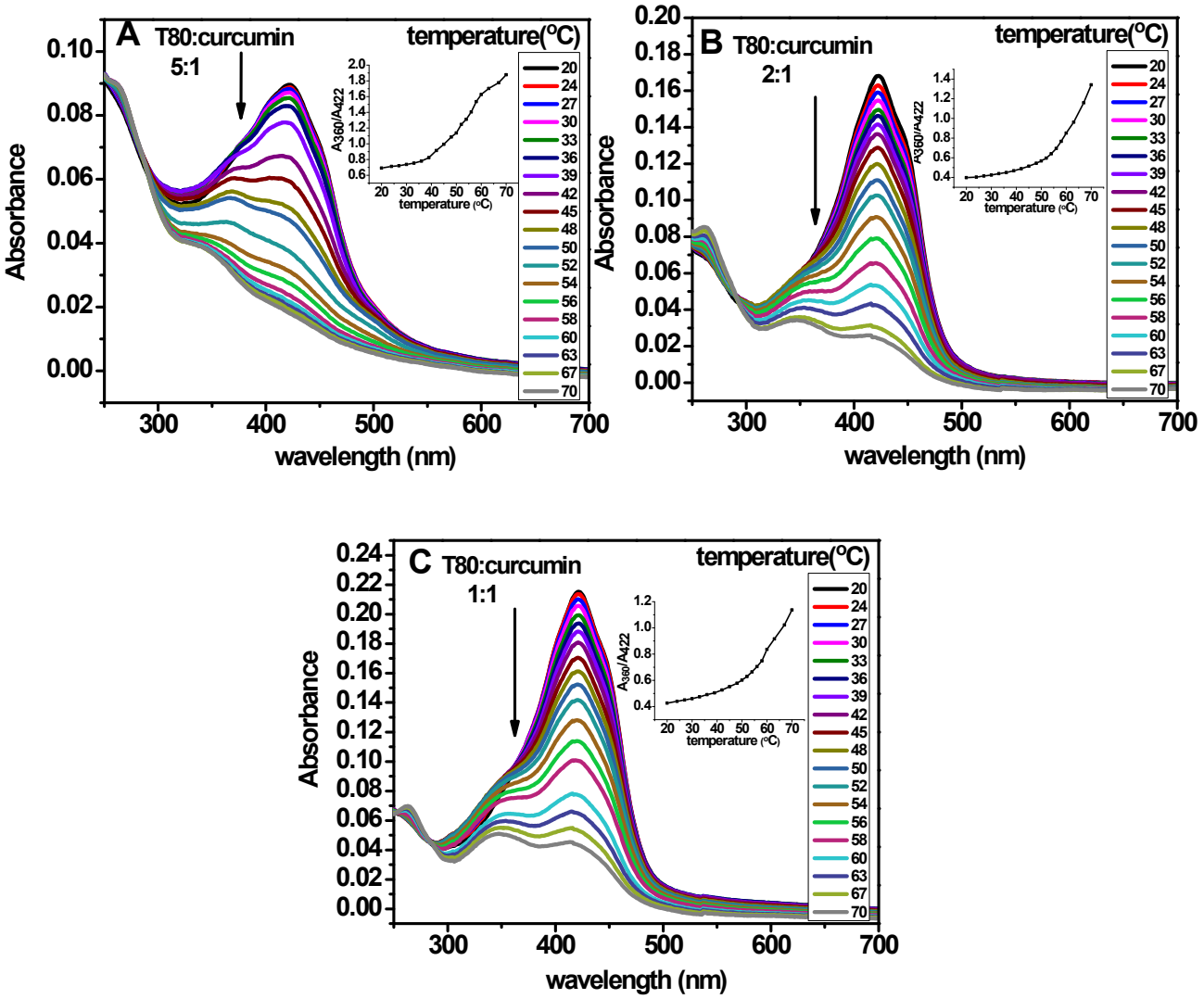


Figure S15. shows the decrease in absorption spectra of curcumin with the increase in temperature for different formulations of T80:curcumin (A) 5:1 (B) 2:1 and (C) 1:1. The inset shows a plot of A_{360}/A_{422} Vs. Temperature. The ratio increases with the increase in temperature for all



formulations.