

Supplementary material

Low-energy encapsulation of α -Tocopherol using fully food grade oil-in-water (O/W) microemulsions

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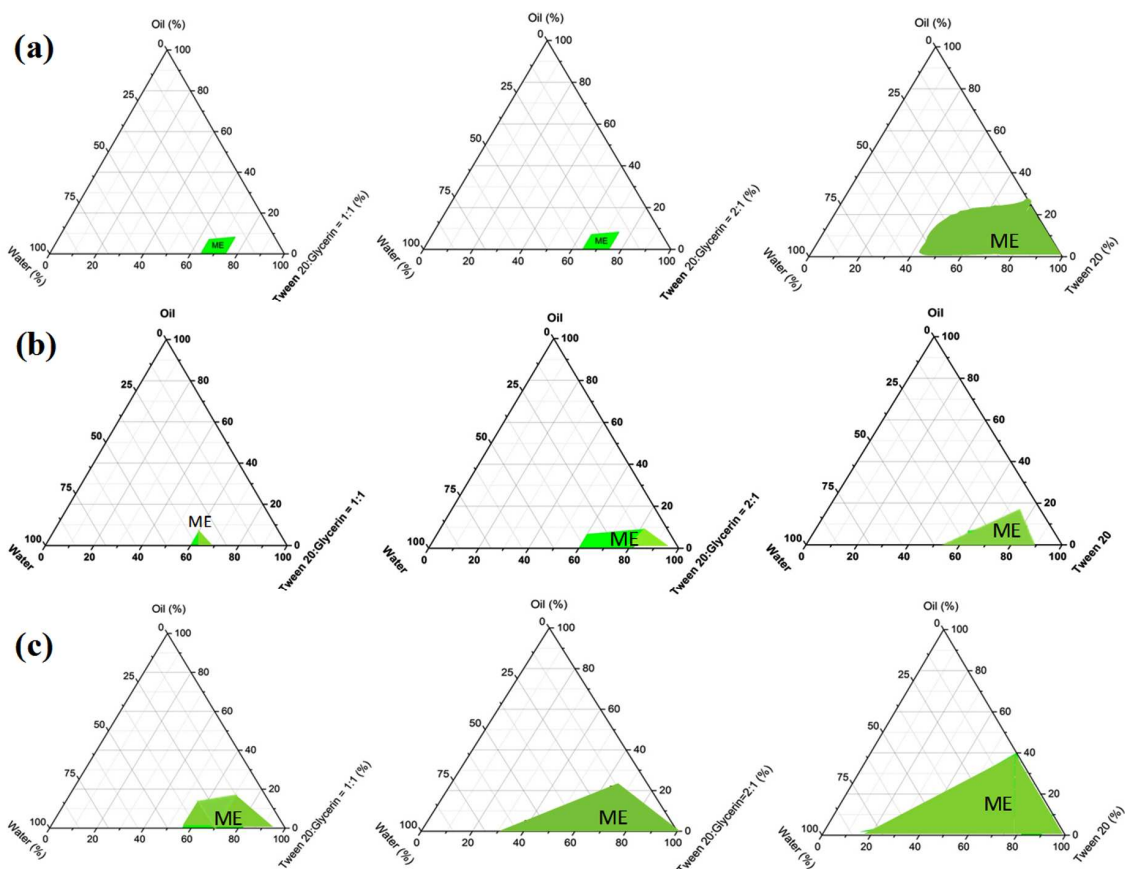
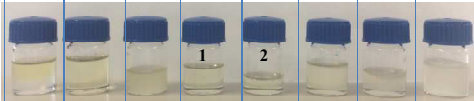


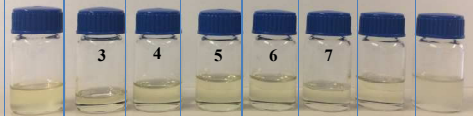
Figure S1. Pseudoternary phase behaviors of the systems consist of oil/(surfactants and cosurfactant) /water at 25 °C. Type of the oil is (a) IPM (b) lemon oil and (c) IAAC. The ratio of surfactant to cosurfactant changes from left to right as 1 : 1, 2 : 1 and 1 : 0, respectively. The microemulsion region is labeled in green as ME.

Component	wt%							
Tween 20	40.5	37.5	30	25	19.5	15.5	11.25	7.5
Glycerol	40.5	37.5	30	25	19.5	15.5	11.25	7.5
Oil + α T	9	8.5	6.5	5.5	4.35	3.65	2.65	1.9
Water	10	16.5	33.5	44.5	56.65	65.35	74.85	83.1



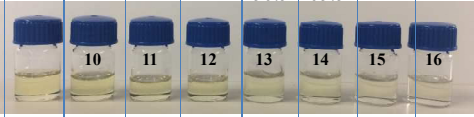
ME111

Component	wt%							
Tween 20	54	50	40	33.33	26	20.6	15	10
Glycerol	27	25	20	16.67	13	10.3	7.5	5
Oil + α T	10	8.5	6.7	5.55	4.35	3.45	2.5	1.75
Water	9	16.5	33.3	44.45	56.55	65.65	75	83.25




ME121

Component	wt%							
Tween 20	81	72.5	60	50	39	31	21	15
Glycerol	0	0	0	0	0	0	0	0
Oil + α T	10	8	6.6	5.55	4.5	3.5	2.35	1.7
Water	9	19.5	33.4	44.45	56.5	65.5	76.65	83.3



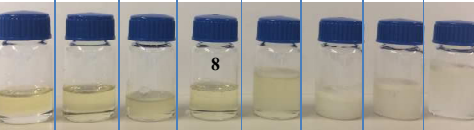
ME110

Component	wt%							
Tween 20	37.5	34	28	23.5	18.75	15	11	7.5
Glycerol	37.5	34	28	23.5	18.75	15	11	7.5
Oil + α T	16.5	15.5	13.5	10.5	8.35	6.65	4.9	3.3
Water	8.5	16.5	30.5	42.5	54.15	63.35	73.1	81.7



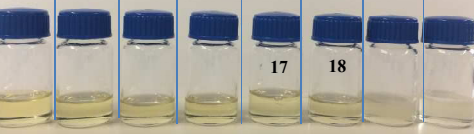
ME211

Component	wt%							
Tween 20	50	46	37.5	31.4	25	20	15	10
Glycerol	25	23	18.75	15.7	12.5	10	7.5	5
Oil + α T	16.5	15.5	12.5	11.15	8.35	6.65	5	3.3
Water	8.5	15.5	31.25	41.75	54.15	63.35	72.5	81.7



ME221

Component	wt%							
Tween 20	75	69.5	56	47	37.5	30	22	15
Glycerol	0	0	0	0	0	0	0	0
Oil + α T	16.5	15	13	11	8.5	6.5	5	3.4
Water	8.5	15.5	31	42	54	63.5	73	81.6



ME210

Figure S2. Visual appearance and composition of all α Toc holder samples prepared in this study, the obtained stable ME samples are marked with same numbers as indicated in

Table S1.

Table S1. Composition of stable α Toc -ME formulations and the droplet size & polydispersity index (PDI)

Class	No.	Oil phase (%)	Tween 20 (%)	Glycerol (%)	Water (%)	Blank particle size ^a (nm)	Blank PDI	Particle size ^a (nm)	PDI
ME111	1	5.55	25	25	44.45	9.05 ± 0.23	0.246 ± 0.018	18.83 ± 0.60	0.12 ± 0.030
	2	4.35	19.5	19.5	56.65	10.17 ± 0.01	0.251 ± 0.003	19.21 ± 0.29	0.197 ± 0.026
ME121	3	8.5	50	25	16.5	9.39 ± 0.98	0.214 ± 0.036	10.39 ± 0.12	0.209 ± 0.011
	4	6.70	40	20	33.30	8.27 ± 0.37	0.167 ± 0.047	9.91 ± 0.14	0.1 ± 0.007
	5	5.55	33.33	16.67	44.45	8.04 ± 0.17	0.114 ± 0.021	11.11 ± 0.42	0.214 ± 0.010
	6	4.35	26	13	56.55	8.70 ± 0.34	0.192 ± 0.005	10.08 ± 0.12	0.115 ± 0.008
	7	3.45	20.60	10.30	65.65	8.12 ± 0.20	0.175 ± 0.014	11.24 ± 0.49	0.243 ± 0.015
ME221	8	11.15	31.4	15.7	41.75	7.98 ± 0.10	0.105 ± 0.022	13.47 ± 0.70	0.175 ± 0.021
	10	8	72.5	0	19.5	8.12 ± 0.09	0.135 ± 0.017	8.84 ± 0.04	0.157 ± 0.016
	11	6.60	60	0	33.40	7.76 ± 0.10	0.122 ± 0.017	8.38 ± 0.20	0.105 ± 0.010
	12	5.55	50	0	44.45	7.99 ± 0.30	0.111 ± 0.060	9.25 ± 0.52	0.096 ± 0.058
	13	4.5	39	0	56.50	7.76 ± 0.06	0.075 ± 0.002	8.88 ± 0.52	0.135 ± 0.058
	14	3.50	31	0	65.50	7.53 ± 0.16	0.095 ± 0.025	9.02 ± 0.11	0.178 ± 0.028
	15	2.35	21	0	76.65	8.05 ± 0.24	0.167 ± 0.012	9.86 ± 0.04	0.217 ± 0.022
	16	1.70	15	0	83.30	8.61 ± 0.05	0.208 ± 0.006	10.26 ± 0.93	0.231 ± 0.054
ME210	17	8.35	37.5	0	54.15	8.29 ± 0.01	0.09 ± 0.004	11.15 ± 0.05	0.173 ± 0.005
	18	6.65	30	0	63.35	9.51 ± 0.20	0.257 ± 0.007	11.09 ± 0.16	0.201 ± 0.018

^a Z-average, all the values reported here are the mean of three measurements

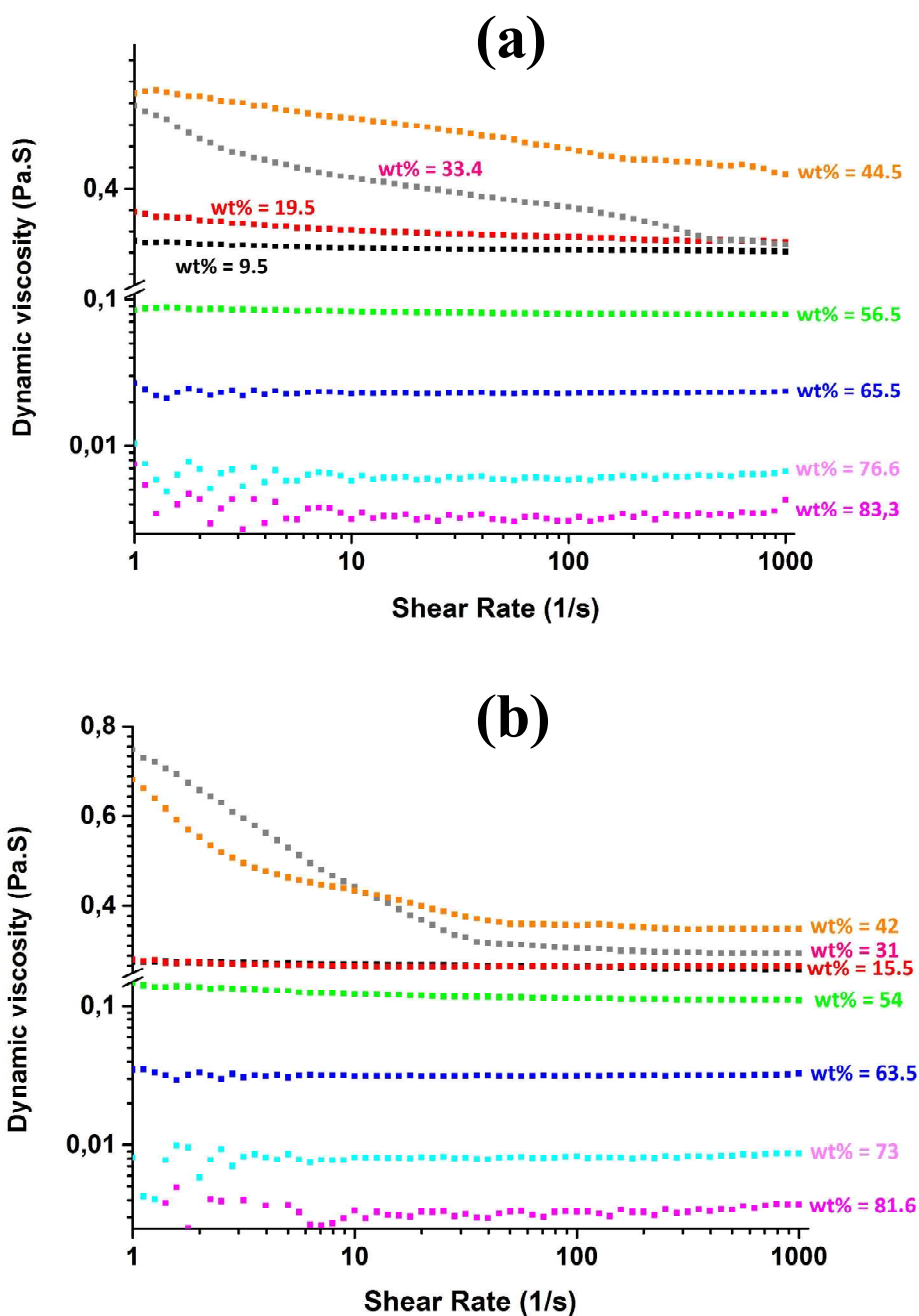


Figure S3. As an example, the rheological behavior of cosurfactant-free system: a) ME110 and b) ME210 were examined by plotting the shear stress (σ) versus the shear rate ($\dot{\gamma}$) values. Water content (wt%) of each sample was written close to its rheological curve.

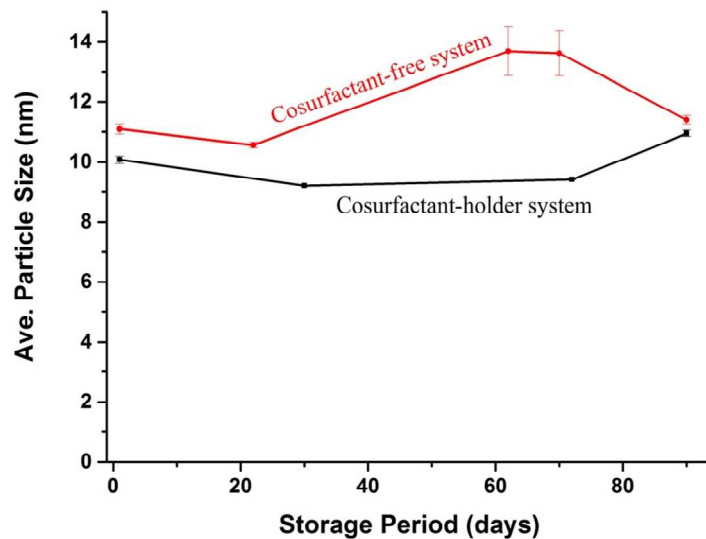


Figure S4. Stability data: variation of average particle size for cosurfactant-holder sample (black line) and a cosurfactant-free system (red line) at room temperature over a storage time of 3 months.

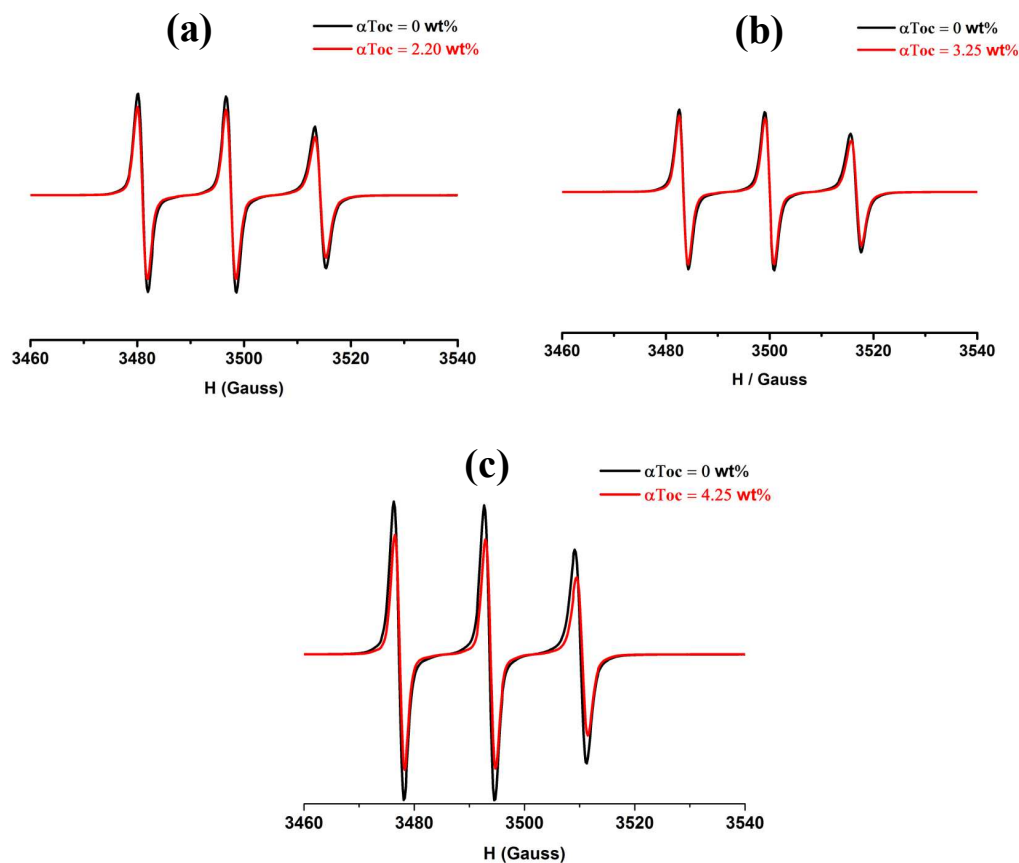


Figure S5. Corresponding EPR spectra in absence and presence of cosurfactant at different α -Toc concentration