

Supplementary Material to:

Modulating edible-oleogels physical and functional characteristics by controlling their microstructure

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Table S1. Composition of oleogels formulated with corn oil, glyceryl stearate (GS), β -carotene (β C), water (W), and varying concentrations of lecithin (L) or hydrogenated

Component	Corn oil (g)	GS (g)	W (ml)	L (g)	HL (g)	βC (g)
GS	32.0	8	0	0	0	0
GS-L (0.5%)	31.8	8	0	0.2	0	0
GS-L (1%)	31.6	8	0	0.4	0	0
GS-L (1.5%)	31.4	8	0	0.6	0	0
GS-L (2%)	31.2	8	0	0.8	0	0
GS-L (2.5%)	31.0	8	0	1.0	0	0
GS-HL (0.5%)	31.8	8	0	0	0.2	0
GS-HL (1%)	31.6	8	0	0	0.4	0
GS-HL (1.5%)	31.4	8	0	0	0.6	0
GS-HL (2%)	31.2	8	0	0	0.8	0
GS-HL (2.5%)	31.0	8	0	0	1.0	0
W-GS	31.6	8	0.4	0	0	0
W-GS-L (0.5%)	31.4	8	0.4	0.2	0	0
W-GS-L (1%)	31.2	8	0.4	0.4	0	0
W-GS-L (1.5%)	31.0	8	0.4	0.6	0	0
W-GS-L (2%)	30.8	8	0.4	0.8	0	0
W-GS-L (2.5%)	30.6	8	0.4	1.0	0	0
W-GS-HL (0.5%)	31.4	8	0.4	0	0.2	0
W-GS-HL (1%)	31.2	8	0.4	0	0.4	0
W-GS-HL (1.5%)	31.0	8	0.4	0	0.6	0
W-GS-HL (2%)	30.8	8	0.4	0	0.8	0
W-GS-HL (2.5%)	30.6	8	0.4	0	1.0	0
β C-GS	32.0	8	0	0	0	0.0320
β C-GS-L (0.5%)	31.8	8	0	0.2	0	0.0318
β C-GS-L (2.5%)	31.0	8	0	1.0	0	0.0310
β C-GS-HL (0.5%)	31.8	8	0	0	0.2	0.0318
β C-GS-HL (2.5%)	31.0	8	0	0	1.0	0.0310
β C-W-GS	31.6	8	0.4	0	0	0.0316
β C-W-GS-L (0.5%)	31.4	8	0.4	0.2	0	0.0314
β C-W-GS-L (2.5%)	30.6	8	0.4	1.0	0	0.0306
β C-W-GS-HL (0.5%)	31.4	8	0.4	0	0.2	0.0314
β C-W-GS-HL (2.5%)	30.6	8	0.4	0	1.0	0.0306

lecithin (HL).

Table S2. Thermal parameters of neat lecithin (L), hydrogenated lecithin (HL), and glyceryl stearate (GS) with the melting (T_m) or crystallization (T_c) temperatures (°C), as well as the corresponding difference in enthalpy ΔH (j/g) respecting the second heating and cooling cycles, are given. The ΔH is normalized by the sample weight.

Samples	T _{m1}	ΔH _{m1}	T _{m2}	ΔH _{m2}	T _{m3}	ΔH _{m3}	T _{c1}	ΔH _{c1}	T _{c2}	ΔH _{c2}
L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HL	81.23	-33.65	NA	NA	NA	NA	78.25	33.53	NA	NA
GS	41.11	-34.65	71.54	-66.52	76.13	-14.00	38.04	34.13	70.25	91.96

Table S3. Thermal properties of oleogels. Thermal parameters of oleogels with the melting (T_m) or crystallization (T_c) temperatures (°C), as well as the corresponding difference in enthalpy ΔH (j/g), respecting the second heating and cooling cycles, are given. The ΔH is normalized by the sample weight.

Samples	T _{m1}	ΔH _{m1}	T _{m2}	ΔH _{m2}	T _{m3}	ΔH _{m3}	T _{m4}	ΔH _{m4}	T _{m5}	ΔH _{m5}	T _{c1}	ΔH _{c1}	T _{c2}	ΔH _{c2}	T _{c3}	ΔH _{c3}	T _{c4}	ΔH _{c4}
Corn oil	-16.29	-7.76									-13.97	4.08						
GS	-17.99	-8.17			42.22	-1.30			71.67	-39.87	-14.27	2.77			40.05	9.18	61.87	21.03
GS-L (0.5%)	-18.29	-7.84			41.29	-8.89	62.01	-14.50	71.32	-15.36	-15.97	2.64			38.88	8.37	60.86	21.94
GS-L (1.5%)	-16.76	-6.79			40.82	-7.11	61.43	-17.18	72.07	-0.84	-14.74	2.73			38.37	7.81	59.75	20.06
GS-L (2.5%)	-17.44	-5.75			41.50	-6.69	61.03	-15.42			-15.08	3.03			39.02	6.65	58.65	18.79
GS-HL (0.5%)	-16.97	-6.77			40.10	-8.19	62.70	-3.64	71.99	-17.36					37.50	6.37	61.39	20.18
GS-HL (1.5%)	-16.31	-6.07			39.07	-3.69	64.48	-17.79	71.56	-2.41	-13.82	2.58	18.04	1.36	35.23	3.42	62.14	22.72
GS-HL (2.5%)	-16.71	-5.99	13.34	-0.73	39.10	-2.62	65.48	-18.35	71.26	-1.52	-14.54	2.86	12.79	1.27	34.86	3.16	63.21	21.32
W-GS	-18.93	-7.93			42.73	-1.20			71.82	-39.89			30.76	1.21	40.04	5.41	61.03	21.84
W-GS-L (0.5%)	-17.19	-5.51			42.29	-8.59	62.58	-14.11	72.42	-14.23	-14.98	2.89	30.04	1.5	39.66	5.60	61.13	21.40
W-GS-L (1.5%)	-16.66	-5.28			40.96	-7.74	62.29	-18.06	72.70	-1.11	-14.72	2.96	25.38	0.99	38.69	5.57	60.39	20.56
W-GS-L (2.5%)	-17.96	-5.83			41.43	-6.67	61.09	-16.11			-14.31	3.28	25.94	0.90	39.06	4.98	58.33	18.89
W-GS-HL (0.5%)	-16.29	-5.44			39.70	-10.64			71.34	-30.37	-14.51	2.92	20.03	0.28	37.17	5.23	60.99	21.59
W-GS-HL (1.5%)	-15.36	-5.18	17.26	-0.58	39.17	-3.46	64.62	-14.78	71.56	-3.92	-14.34	2.99	18.62	1.68	35.56	3.51	61.99	22.53
W-GS-HL (2.5%)	-17.19	-5.11	13.56	-0.68	38.44	-2.97	65.28	-19.47			-14.16	2.49	13.23	1.36	33.98	2.87	62.60	23.13

Table S4. Maximum hardness of oleogels. The oleogels were formulated with corn oil, glyceryl stearate (GS), varying concentrations of lecithin (L) or hydrogenated lecithin (HL), beta-carotene (β C), and water (W).

Oleogels	Maximum Hardness (N)
GS	1.42 \pm 0.08
GS-L (0.5%)	0.36 \pm 0.01
GS-L (1%)	0.17 \pm 0.01
GS-L (1.5%)	0.19 \pm 0.01
GS-L (2%)	0.29 \pm 0.01
GS-L (2.5%)	0.28 \pm 0.02
GS-HL (0.5%)	1.11 \pm 0.09
GS-HL (1%)	1.35 \pm 0.01
GS-HL (1.5%)	1.62 \pm 0.01
GS-HL (2%)	1.84 \pm 0.01
GS-HL (2.5%)	2.10 \pm 0.02
W-GS	1.98 \pm 0.28
W-GS-L (0.5%)	1.93 \pm 0.07
W-GS-L (1%)	1.06 \pm 0.12
W-GS-L (1.5%)	0.47 \pm 0.29
W-GS-L (2%)	0.51 \pm 0.22
W-GS-L (2.5%)	0.43 \pm 0.19
W-GS-HL (0.5%)	2.33 \pm 0.06
W-GS-HL (1%)	2.16 \pm 0.10
W-GS-HL (1.5%)	2.07 \pm 0.23
W-GS-HL (2%)	2.18 \pm 0.51
W-GS-HL (2.5%)	1.88 \pm 0.03
β C-GS	2.28 \pm 0.02
β C-GS-L (0.5%)	1.90 \pm 0.01
β C-GS-L (2.5%)	0.36 \pm 0.01
β C-GS-HL (0.5%)	2.07 \pm 0.01
β C-GS-HL (2.5%)	1.02 \pm 0.00
β C-W-GS	2.09 \pm 0.16
β C-W-GS-L (0.5%)	0.65 \pm 0.03
β C-W-GS-L (2.5%)	0.26 \pm 0.02
β C-W-GS-HL (0.5%)	1.45 \pm 0.00
β C-W-GS-HL (2.5%)	2.43 \pm 0.14

Table S5. Oil binding capacity of oleogels is expressed as a percentage of the total oil used in formulation after centrifugation (9000 rpm, 30 min, 25 °C). The oleogels were formulated with corn oil, glyceryl stearate (GS), beta-carotene (βC), water (W), and varying concentrations of lecithin (L) or hydrogenated

Oleogel	Without W and βC	With W	With βC	With W and βC
GS	99.125 ± 0.759 ^{abc}	99.937 ± 0.019 ^a	99.962 ± 0.022 ^a	99.659 ± 0.227 ^{ab}
GS-L (0.5%)	94.320 ± 1.121 ^e	99.936 ± 0.037 ^a	99.995 ± 0.007 ^a	97.789 ± 0.257 ^d
GS-L (1.0%)	74.917 ± 0.406 ^k	98.755 ± 0.188 ^{bcd}	NA	NA
GS-L (1.5%)	76.697 ± 1.110 ^j	98.648 ± 1.136 ^{cd}	NA	NA
GS-L (2%)	91.776 ± 1.389 ^f	91.228 ± 1.560 ^f	NA	NA
GS-L (2.5%)	89.435 ± 0.280 ^g	81.065 ± 0.884 ⁱ	94.293 ± 1.232 ^e	83.222 ± 0.647 ^h
GS-HL (0.5%)	100.034 ± 0.019 ^a	99.728 ± 0.184 ^{ab}	99.946 ± 0.030 ^a	99.968 ± 0.017 ^a
GS-HL (1%)	99.974 ± 0.025 ^a	99.742 ± 0.372 ^{ab}	NA	NA
GS-HL (1.5%)	100.066 ± 0.041 ^a	99.898 ± 0.154 ^a	NA	NA
GS-HL (2%)	100.003 ± 0.031 ^a	99.984 ± 0.016 ^a	NA	NA
GS-HL (2.5%)	99.971 ± 0.020 ^a	100.050 ± 0.078 ^a	99.773 ± 0.115 ^a	100.032 ± 0.021 ^a

lecithin (HL).

* Different lower case letters indicate significant differences ($p < 0.05$) between the oleogels based on the Least Squares Means (LSM) differences Student's t-test.

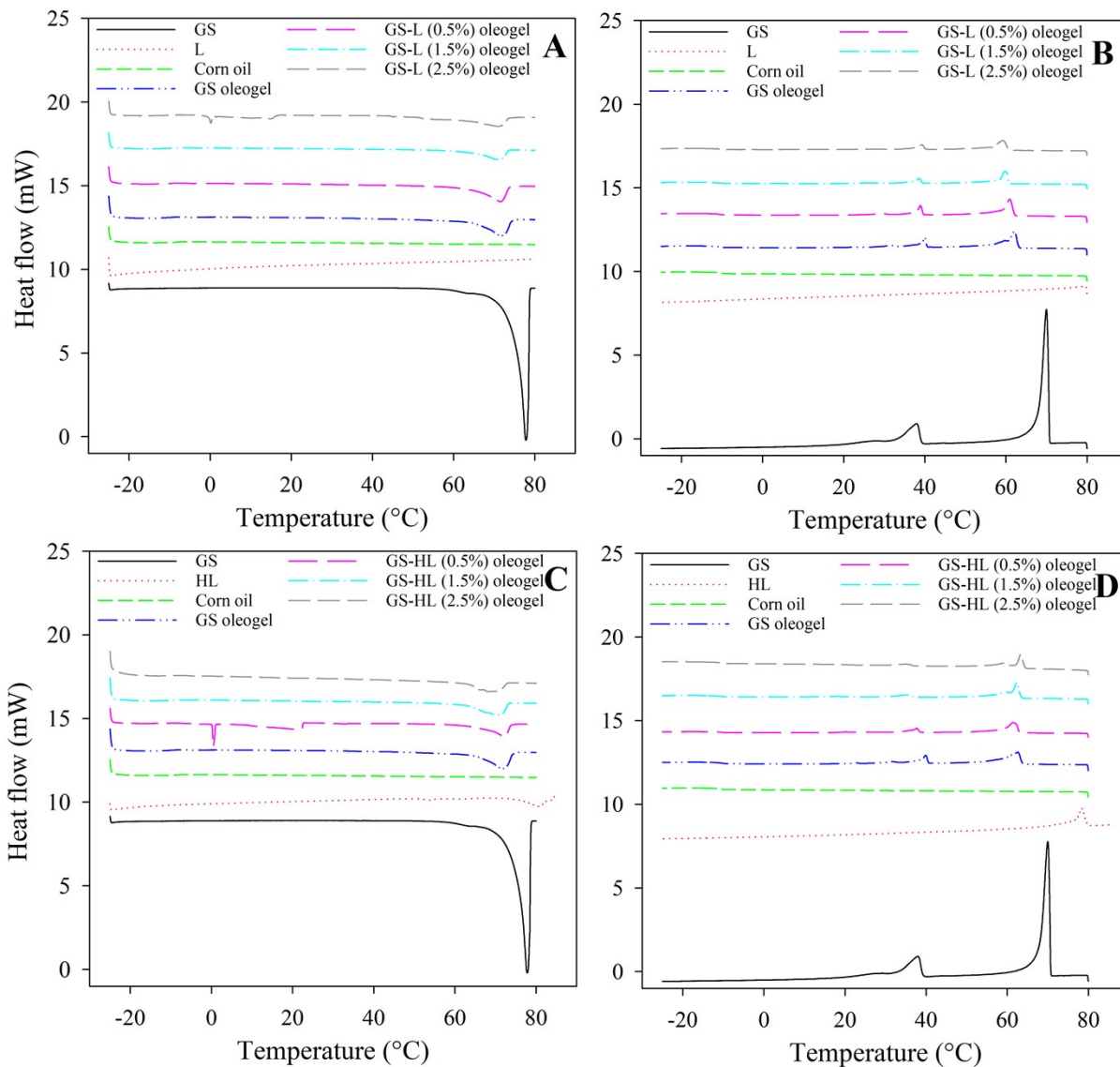


Figure S1. DSC profiles of the neat lecithin (L), neat hydrogenated lecithin (HL), neat glyceryl stearate (GS), liquid corn oil and corn oil-based oleogels containing GS, lecithin or hydrogenated lecithin at concentrations of 0.5, 1.5 and 2.5% (w/w) with first heating cycles for lecithin-containing oleogels (A) and hydrogenated lecithin-containing oleogels (C), and first cooling cycles for lecithin-containing oleogels (B) and hydrogenated lecithin-containing oleogels (D).