

Supplementary material

The Use of Soy and Egg Phosphatidylcholines Modified with Caffeic Acid Enhances the Oxidative Stability of High-Fat (70%) Fish Oil-in-Water Emulsions

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Table S1. Development of the creaming index during storage

Sample codes	Creaming Index (%)				
	Day 1	Day 2	Day 5	Day 8	Day 12
1-CAS	0.0	0.0	0.0	0.0	0.0
2-CPC	0.0	0.0	0.0	1.0	2.0
3-SPC_L	0.0	0.0	0.0	2.0	2.0
4-SPC_M	0.0	1.0	2.0	4.0	5.0
5-SPC_H	1.0	1.0	3.0	6.0	7.0
6-EPC_L	0.0	0.0	0.0	1.0	2.0
7-EPC_M	0.0	0.0	1.0	2.0	3.0
8-EPC_H	0.0	1.0	2.0	3.0	4.0
9-CPC_L	2.0	4.0	6.0	7.0	6.0
10-CPC_H	6.0	10.0	12.0	14.0	14.0

Table S2. Statistical analysis for a) peroxide value, b) α -tocopherol, c) 1-penten-3-ol, d) 2-pentenal, e) (*E,E*)-2,4-heptadienal, and f) hexanal

(a) PV	Day 0	Day 2	Day 5	Day 8	Day 12
1-CAS	0.14±0.00 ^a	0.26±0.02 ^a	1.50±0.00 ^b	4.22±0.26 ^c	5.41±0.08 ^{d,H}
2-CPC	0.16±0.03 ^a	0.46±0.00 ^b	1.64±0.00 ^c	3.24±0.09 ^d	4.89±0.10 ^{e,G}
3-SPC_L	0.16±0.03 ^a	0.92±0.00 ^b	2.69±0.02 ^c	3.96±0.14 ^d	5.36±0.01 ^{e,H}
4-SPC_M	0.13±0.01 ^a	0.54±0.01 ^b	1.27±0.01 ^c	2.27±0.00 ^d	2.90±0.02 ^{e,E}
5-SPC_H	0.12±0.01 ^a	0.27±0.00 ^b	0.67±0.00 ^c	1.23±0.06 ^d	1.69±0.03 ^{e,A}
6-EPC_L	0.15±0.00 ^a	0.73±0.00 ^b	2.32±0.02 ^c	3.59±0.03 ^d	4.52±0.06 ^{e,F}
7-EPC_M	0.18±0.02 ^a	0.48±0.01 ^b	1.20±0.00 ^c	1.99±0.04 ^d	2.62±0.08 ^{e,D}
8-EPC_H	0.13±0.00 ^a	0.34±0.01 ^b	0.93±0.03 ^c	1.42±0.00 ^d	1.92±0.07 ^{e,B}
9-CPC_L	0.17±0.01 ^a	0.50±0.02 ^b	1.22±0.02 ^c	1.74±0.06 ^d	2.26±0.03 ^{e,C}
10-CPC_H	0.19±0.02 ^a	0.38±0.01 ^b	0.85±0.00 ^c	1.21±0.00 ^d	1.68±0.03 ^{e,A}
(b) α -tocopherol	Day 0	Day 2	Day 5	Day 8	Day 12
1-CAS	164.1±1.29 ^b	164.5±5.86 ^b	163.5±1.16 ^{ab}	158.6±0.97 ^a	160.3±2.15 ^{ab,AB}

2-CPC	190.5±1.59 ^b	193.4±0.56 ^{bc}	194.8±3.82 ^c	184.0±1.99 ^a	191.8±0.50 ^{bc,F}
3-SPC_L	186.0±0.11 ^a	186.0±0.54 ^a	190.5±3.71 ^a	186.3±0.63 ^a	183.3±8.95 ^{a,DE}
4-SPC_M	181.2±0.98 ^b	181.6±6.57 ^b	180.3±1.61 ^b	175.7±2.87 ^b	164.7±0.58 ^{a,AB}
5-SPC_H	173.6±0.00 ^{bc}	171.9±1.60 ^b	172.3±1.70 ^{bc}	174.1±0.17 ^c	164.3±0.65 ^{a,B}
6-EPC_L	188.5±2.54 ^a	186.1±1.72 ^a	188.3±7.28 ^a	190.3±0.22 ^a	187.8±0.39 ^{a,EF}
7-EPC_M	183.5±4.09 ^b	183.3±0.56 ^b	186.6±8.43 ^b	186.9±5.07 ^b	171.5±0.31 ^{a,C}
8-EPC_H	184.3±4.64 ^d	167.8±1.26 ^b	169.5±4.53 ^b	176.3±1.29 ^c	159.5±0.80 ^{a,A}
9-CPC_L	197.1±2.38 ^d	190.7±0.99 ^c	186.1±0.31 ^b	191.8±1.42 ^c	180.5±1.76 ^{a,D}
10-CPC_H	198.6±1.07 ^d	190.7±2.56 ^b	195.2±2.82 ^{cd}	192.6±1.39 ^{bc}	179.9±0.92 ^{a,D}
(c) 1-Penten-3-ol	Day 0	Day 2	Day 5	Day 8	Day 12
1-CAS	40.99±2.99 ^a	30.82±9.14 ^a	121.04±13.32 ^b	311.39±32.91 ^c	383.88±7.02 ^{d,E}
2-CPC	29.45±4.04 ^a	54.74±7.13 ^a	117.33±14.38 ^b	295.08±20.80 ^c	348.72±38.59 ^{d,E}
3-SPC_L	3.92±3.21 ^a	30.38±3.48 ^b	98.09±6.31 ^c	181.23±14.38 ^d	179.91±25.29 ^{d,C}
4-SPC_M	0.00±0.00 ^a	7.77±4.46 ^b	23.89±3.89 ^c	50.65±3.14 ^d	78.07±6.11 ^{e,B}
5-SPC_H	0.00±0.00 ^a	0.00±0.00 ^a	0.00±0.00 ^a	0.35±0.33 ^a	1.72±1.49 ^{b,A}
6-EPC_L	0.09±0.13 ^a	29.82±2.16 ^b	97.74±3.44 ^c	150.71±22.31 ^d	192.22±25.71 ^{e,C}
7-EPC_M	0.00±0.00 ^a	12.87±2.15 ^{ab}	27.86±11.23 ^b	82.79±27.90 ^c	95.53±9.89 ^{c,B}
8-EPC_H	0.00±0.00 ^a	0.00±0.00 ^a	5.30±0.40 ^b	10.54±1.01 ^c	14.96±2.72 ^{d,A}
9-CPC_L	6.94±1.71 ^a	35.10±1.65 ^a	118.86±8.12 ^b	172.82±18.54 ^c	255.42±42.63 ^{d,D}
10-CPC_H	7.97±0.99 ^a	25.88±2.28 ^b	54.55±11.09 ^c	85.77±9.88 ^d	62.75±8.59 ^{c,B}
(d) 2-Pentenal	Day 0	Day 2	Day 5	Day 8	Day 12
1-CAS	31.28±3.99 ^b	16.27±0.95 ^a	36.78±2.54 ^b	64.92±9.93 ^c	65.58±2.44 ^{c,CD}
2-CPC	20.86±3.95 ^a	24.30±3.42 ^a	33.92±1.75 ^b	61.46±3.62 ^c	63.76±6.40 ^{c,CD}
3-SPC_L	24.17±2.35 ^a	43.10±1.40 ^a	110.67±8.05 ^b	153.14±23.37 ^b	126.12±10.17 ^{c,F}
4-SPC_M	16.27±4.01 ^a	32.02±7.32 ^a	44.69±3.50 ^b	68.45±3.56 ^c	82.99±0.74 ^{d,DE}
5-SPC_H	9.92±3.96 ^a	10.88±2.58 ^a	10.17±3.46 ^a	18.29±3.21 ^b	21.57±0.61 ^{b,A}
6-EPC_L	11.93±1.80 ^a	39.38±1.97 ^b	94.97±1.69 ^c	118.23±20.23 ^d	137.78±11.42 ^{e,F}
7-EPC_M	8.91±1.45 ^a	34.37±2.01 ^b	45.71±9.07 ^b	73.19±6.75 ^c	86.91±10.59 ^{d,E}
8-EPC_H	8.53±5.16 ^a	14.97±2.37 ^{ab}	25.57±2.70 ^c	20.81±6.31 ^{bc}	29.45±7.89 ^{c,AB}
9-CPC_L	7.86±0.68 ^a	23.93±0.24 ^a	54.97±3.86 ^b	61.92±1.78 ^b	66.50±32.96 ^{b,CDE}
10-CPC_H	12.35±0.46 ^a	29.92±1.73 ^b	53.35±6.88 ^c	65.09±5.05 ^d	50.61±1.31 ^{c,BC}
(e) 2,4-Heptadienal	Day 0	Day 2	Day 5	Day 8	Day 12
1-CAS	63.77±28.92 ^{ab}	40.39±7.66 ^a	86.70±7.96 ^b	182.20±16.44 ^c	237.02±23.88 ^{d,D}
2-CPC	31.43±10.49 ^a	48.06±13.40 ^{ab}	86.12±21.67 ^b	150.35±23.51 ^c	206.36±32.84 ^{d,D}
3-SPC_L	34.82±4.68 ^a	55.01±3.37 ^a	214.53±14.62 ^b	524.28±62.29 ^c	545.62±83.75 ^{c,E}
4-SPC_M	27.39±4.53 ^a	33.56±9.83 ^a	58.85±6.85 ^b	87.05±8.33 ^c	105.98±9.81 ^{d,BC}
5-SPC_H	15.17±1.73 ^a	27.16±6.42 ^{ab}	32.85±19.98 ^{abc}	38.94±6.88 ^{bc}	46.77±6.53 ^{c,AB}
6-EPC_L	22.06±3.22 ^a	41.88±7.07 ^a	155.68±5.40 ^b	367.89±67.79 ^c	529.64±39.72 ^{d,E}
7-EPC_M	20.15±1.97 ^a	33.13±4.24 ^a	54.09±6.51 ^b	83.41±17.75 ^c	124.25±14.61 ^{d,C}
8-EPC_H	15.28±11.01 ^a	17.16±2.38 ^a	29.54±2.73 ^{ab}	27.33±17.05 ^{ab}	43.69±11.33 ^{b,A}
9-CPC_L	15.16±1.92 ^a	30.51±4.83 ^{ab}	71.26±2.86 ^{bc}	98.21±29.88 ^c	141.88±40.67 ^{d,C}
10-CPC_H	19.05±2.39 ^a	29.86±5.68 ^b	47.74±1.78 ^c	61.76±3.67 ^{cd}	54.72±6.98 ^{d,AB}
(f) Hexanal	Day 0	Day 2	Day 5	Day 8	Day 12

1-CAS	24.67±1.80 ^b	13.09±3.46 ^a	29.00±6.25 ^b	40.93±2.17 ^b	28.12±1.83 ^{b,A}
2-CPC	30.15±4.92 ^a	39.42±10.98 ^a	33.42±1.41 ^a	38.41±7.42 ^a	33.25±6.58 ^{a,A}
3-SPC_L	40.83±2.39 ^a	44.60±1.67 ^a	51.39±7.71 ^{ab}	72.42±12.26 ^{bc}	64.56±7.52 ^{bc,BC}
4-SPC_M	39.93±11.46 ^a	46.22±11.77 ^a	35.39±4.39 ^a	39.72±2.96 ^a	49.18±3.25 ^{a,AB}
5-SPC_H	37.60±12.51 ^a	53.15±11.53 ^b	39.29±4.83 ^{ab}	36.28±3.65 ^{ab}	47.16±0.29 ^{ab,AB}
6-EPC_L	55.38±6.34 ^a	88.35±4.88 ^b	75.36±1.90 ^b	76.04±12.11 ^b	85.76±16.71 ^{b,C}
7-EPC_M	102.35±10.44 ^a	155.90±5.20 ^c	116.78±23.94 ^{ab}	136.87±8.50 ^{ab}	123.08±15.64 ^{ab,D}
8-EPC_H	225.93±81.44 ^a	154.24±28.25 ^a	181.91±8.88 ^a	183.80±9.06 ^a	160.81±41.19 ^{a,E}
9-CPC_L	11.69±0.65 ^a	29.58±1.34 ^b	51.15±2.85 ^c	49.21±1.89 ^c	50.64±9.26 ^{c,AB}
10-CPC_H	31.41±1.76 ^a	41.61±3.21 ^a	78.67±6.55 ^b	93.29±2.85 ^{bc}	88.57±11.35 ^{bc,C}

Small letters denote significant differences between sampling points for the same sample and capital letters denote significant differences between samples at the last sampling point ($p < 0.05$).

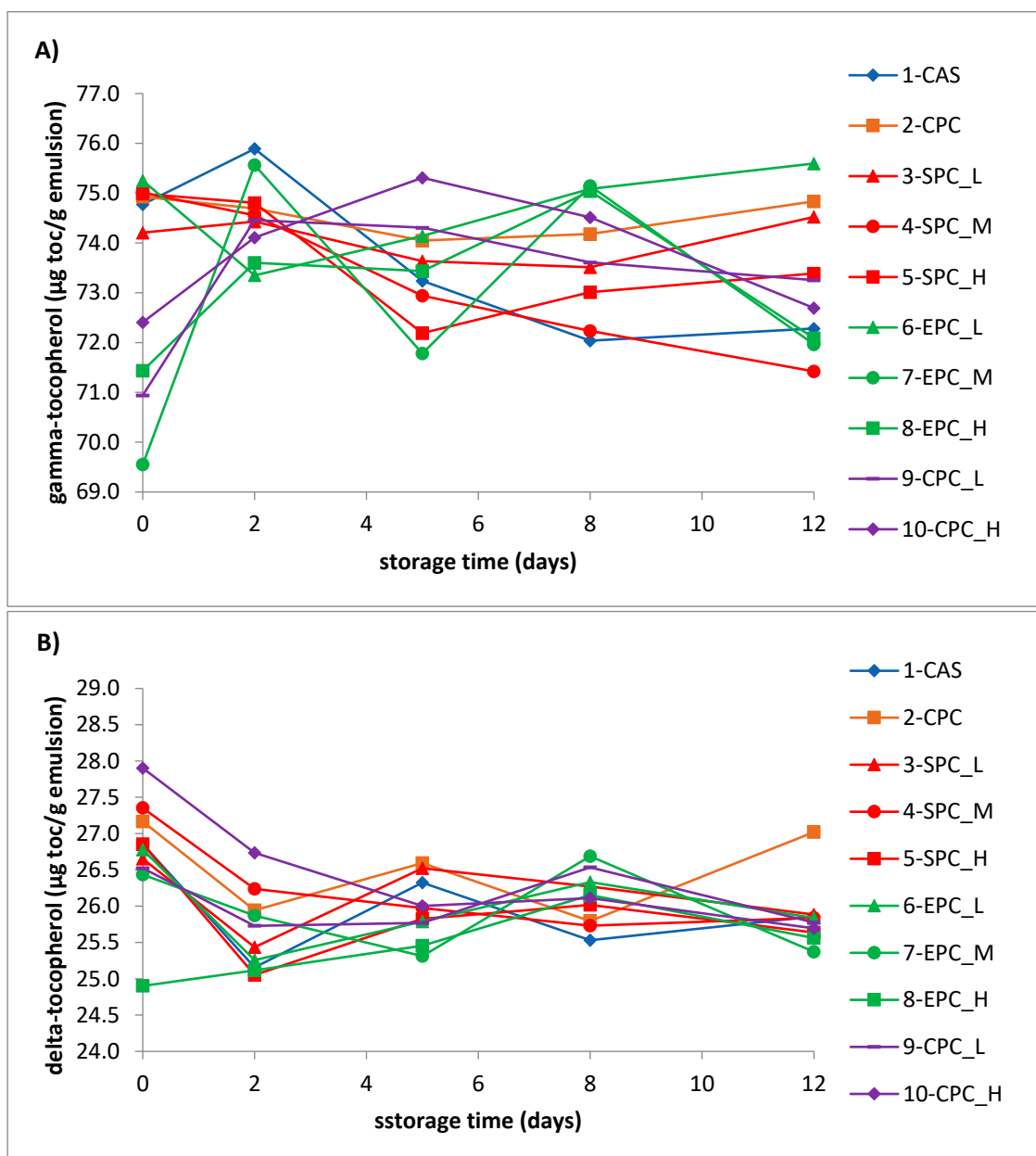
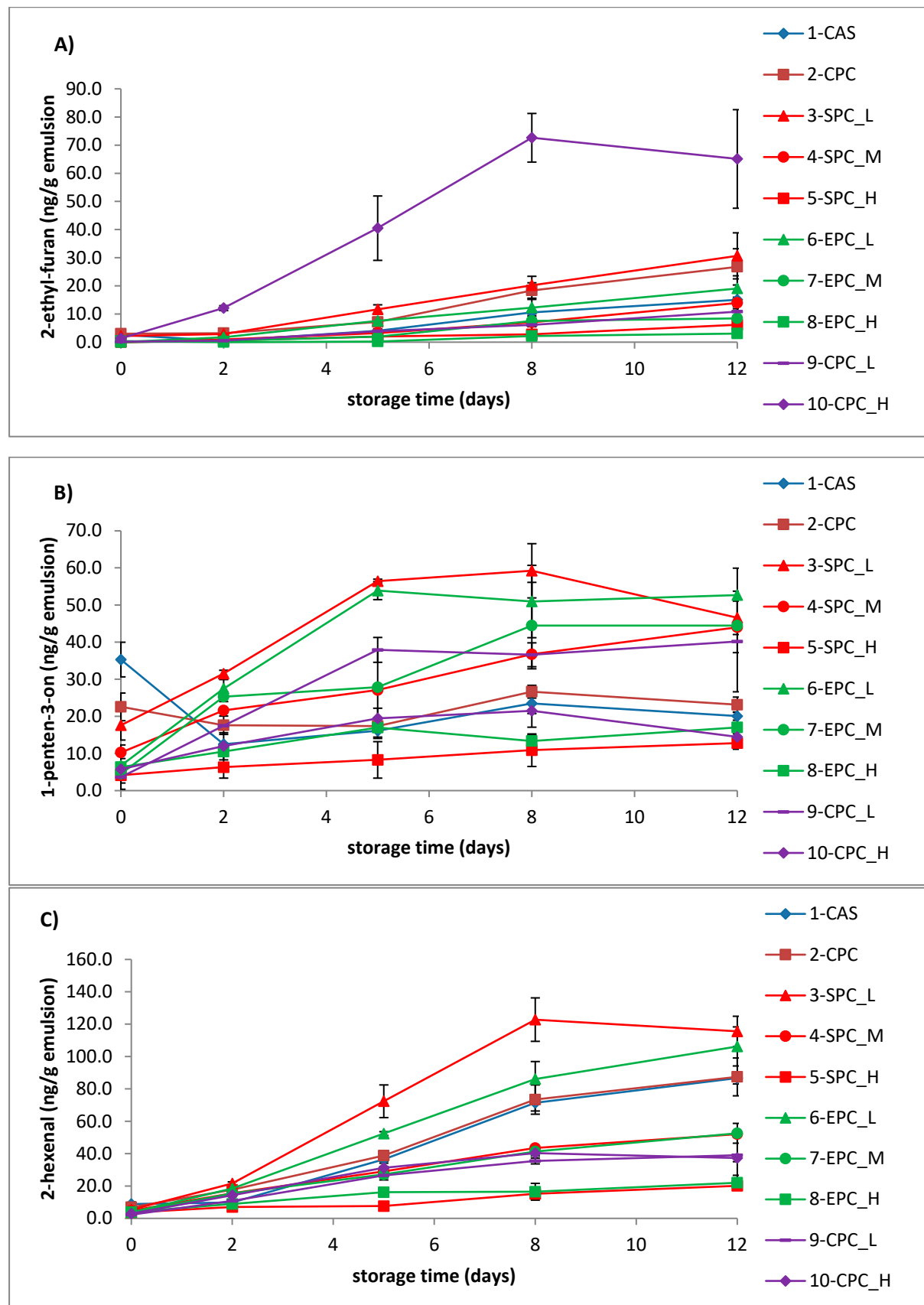
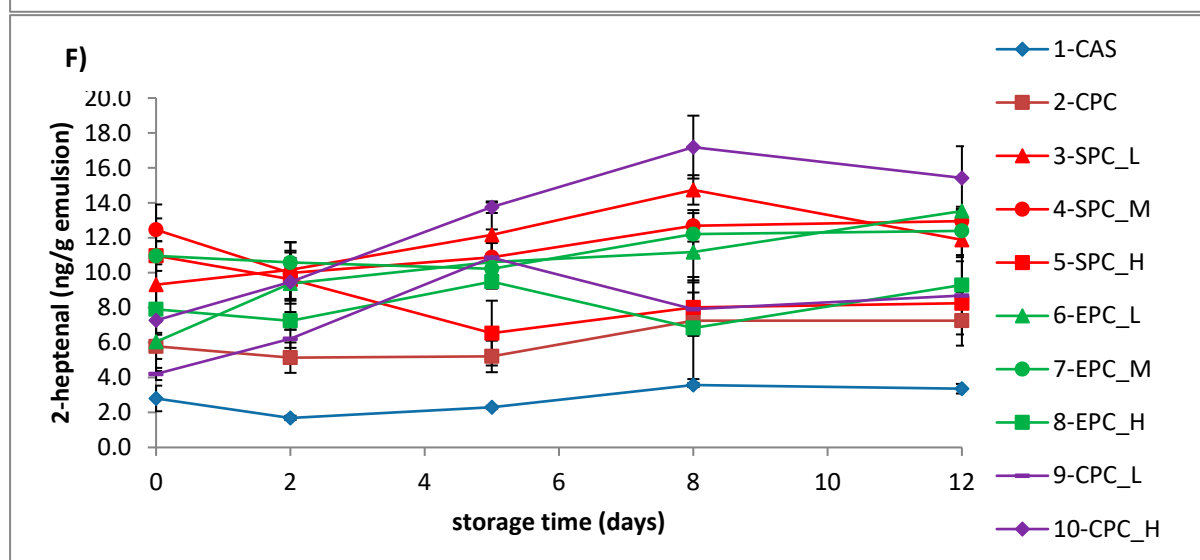
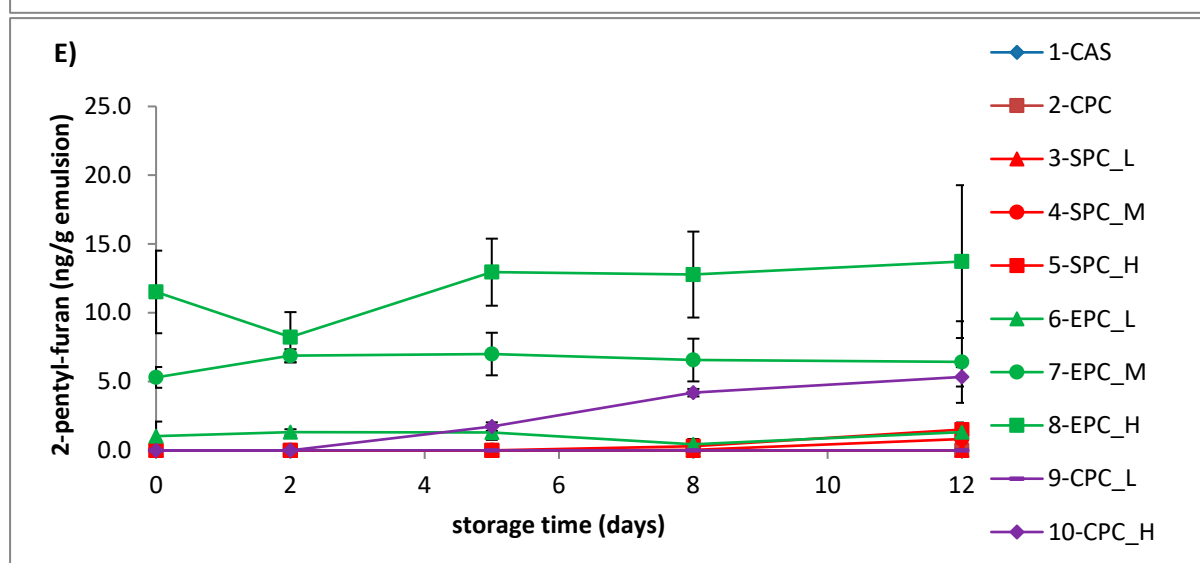
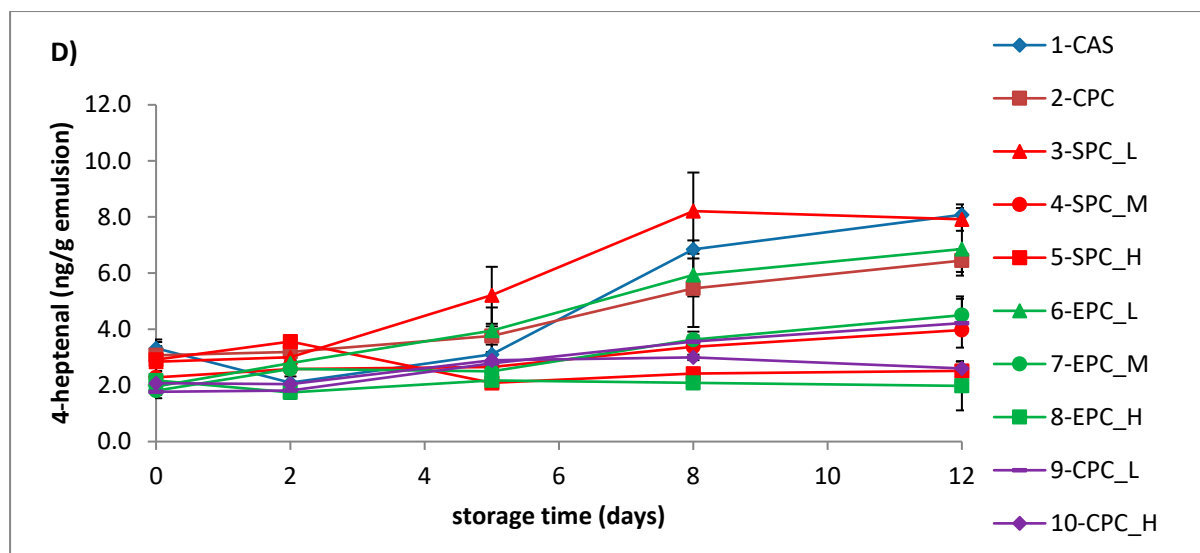


Figure S1. (A) Gamma- and (B) delta-tocopherol consumption during 12-day storage





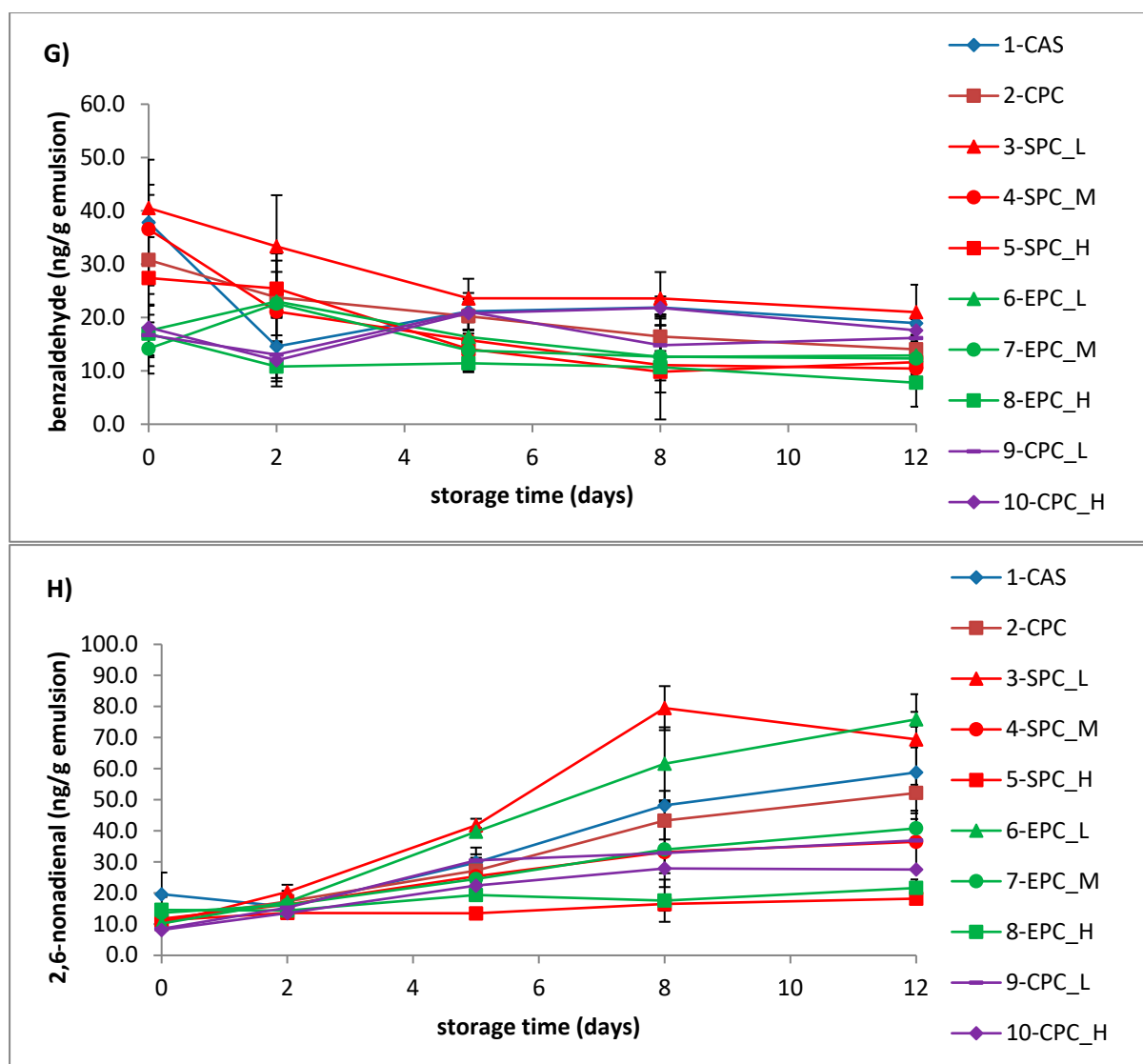


Figure S2. Development of the rest of the volatile compounds **A)** 2-ethyl-furan, **(B)** 1-penten-3-on, **(C)** 2-hexenal, **(D)** 4-heptenal, **(E)** 2-pentyl-furan, **(F)** 2-heptenal, **(G)** benzaldehyde, and **(H)** 2,6-nonadienal during 12-day storage