

### Supplementary information

**Figure S1** Acid value, peroxide value, p-Anisidine value and color changes( $\Delta E$ ) of oils during storage

**Figure S2** PCA score map. The green point is the QC samples and the blue point is the official experimental sample. (a) positive mode; (c) negative mode

PCA-X one-dimensional distribution map of QC samples. (b) positive mode; (d) negative mode

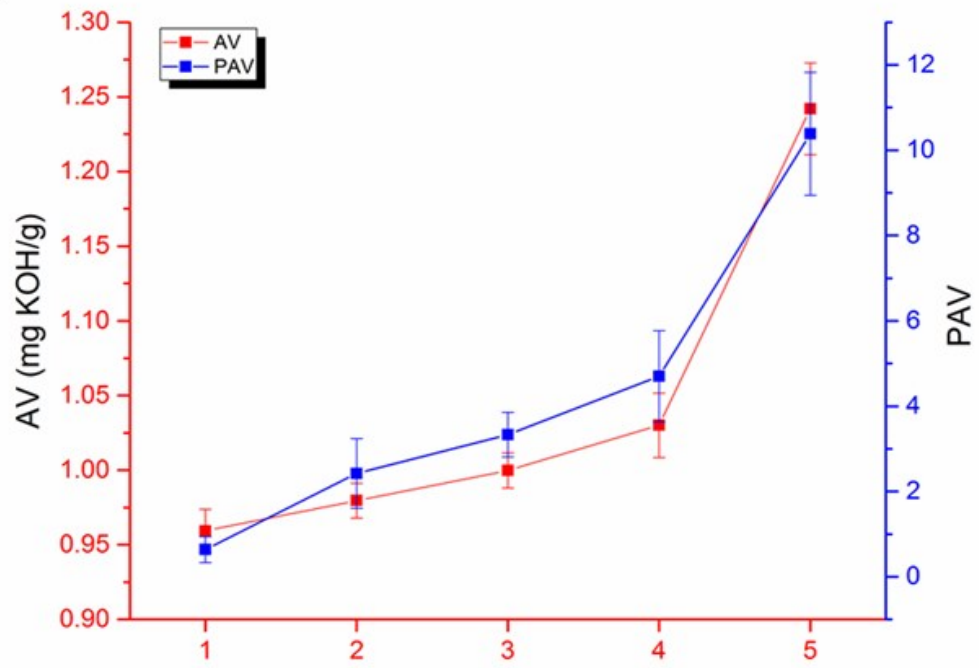
**Figure S3** Correlation analysis of QC samples. (a) positive mode; (b) negative mode

**Figure S4** Changes of main TG and DG species during light oxidation

**Figure S5** Changes of relative content of the phospholipids in rapeseed oil samples during light oxidation (% total PL)

Figure S1

(a)



(b)

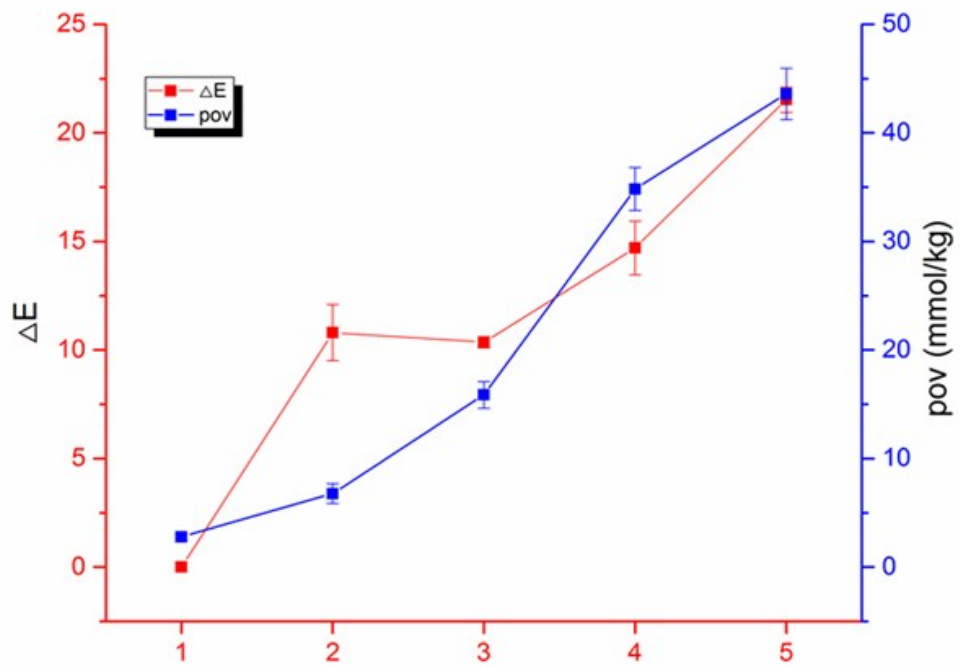


Figure S2

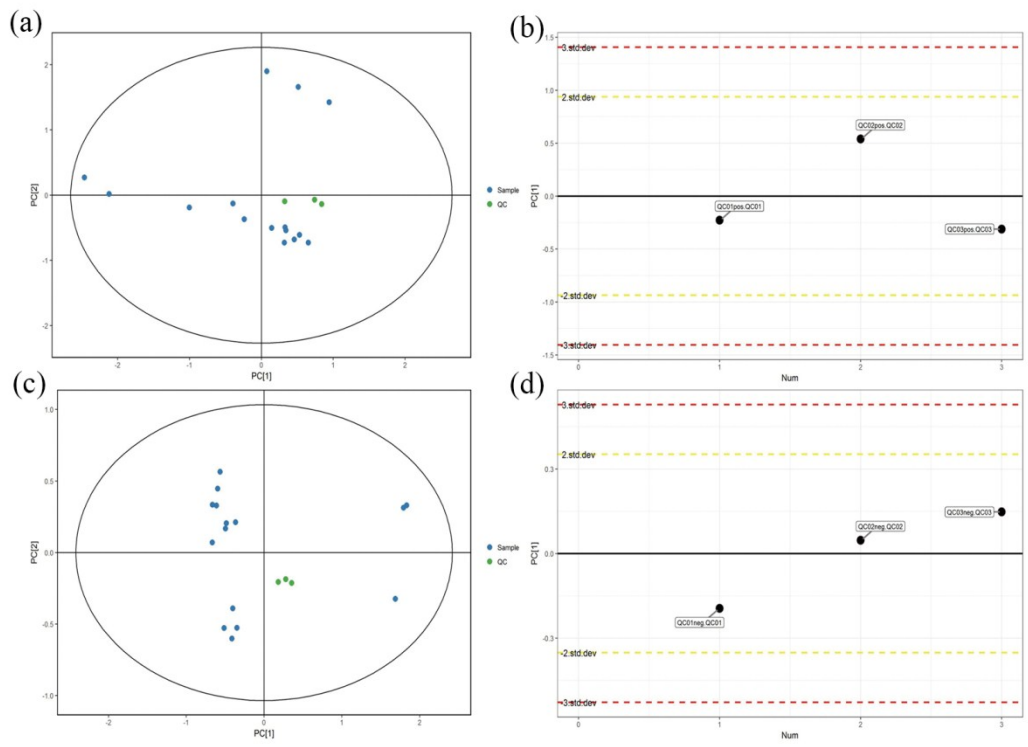
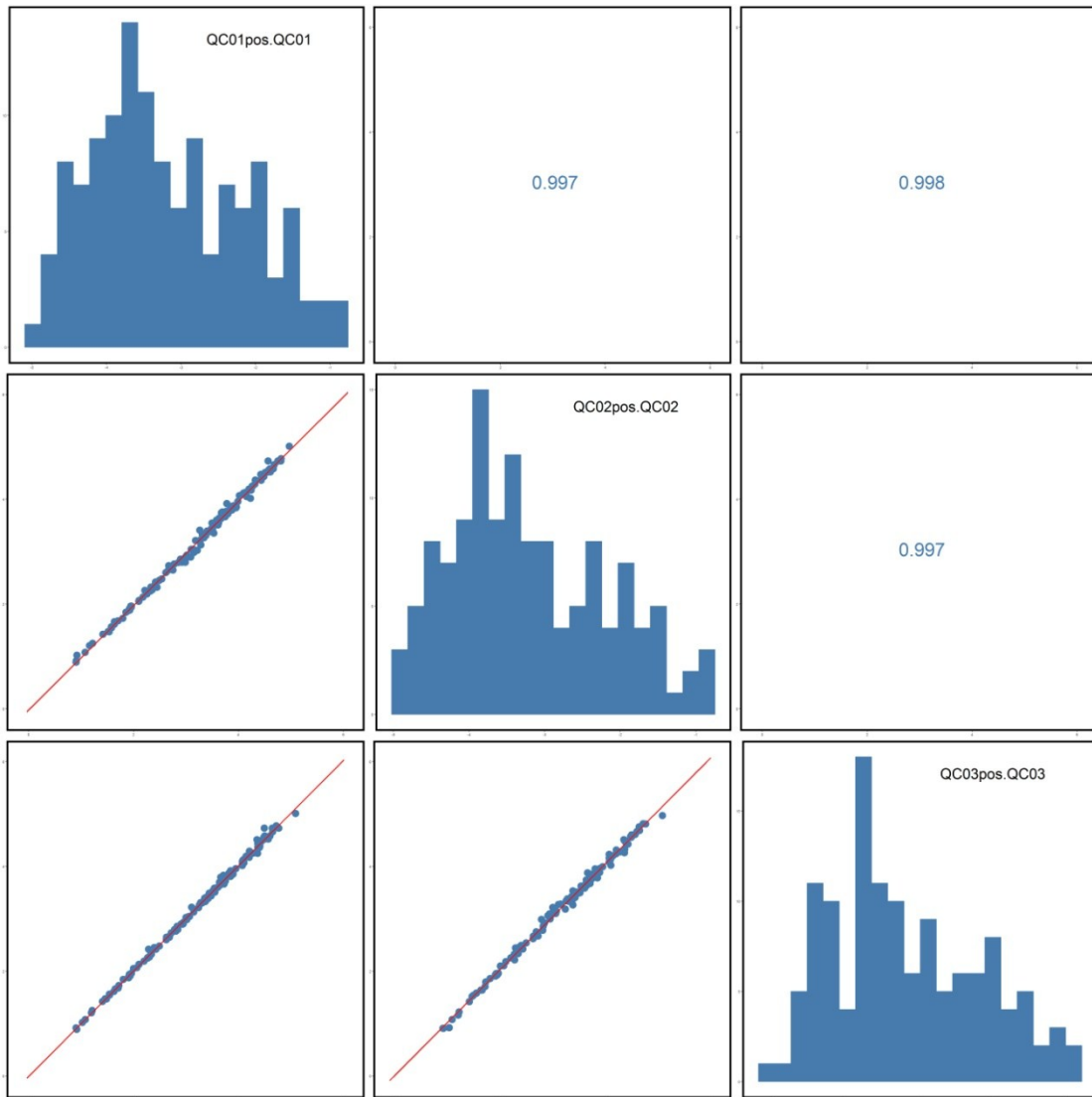


Figure S3



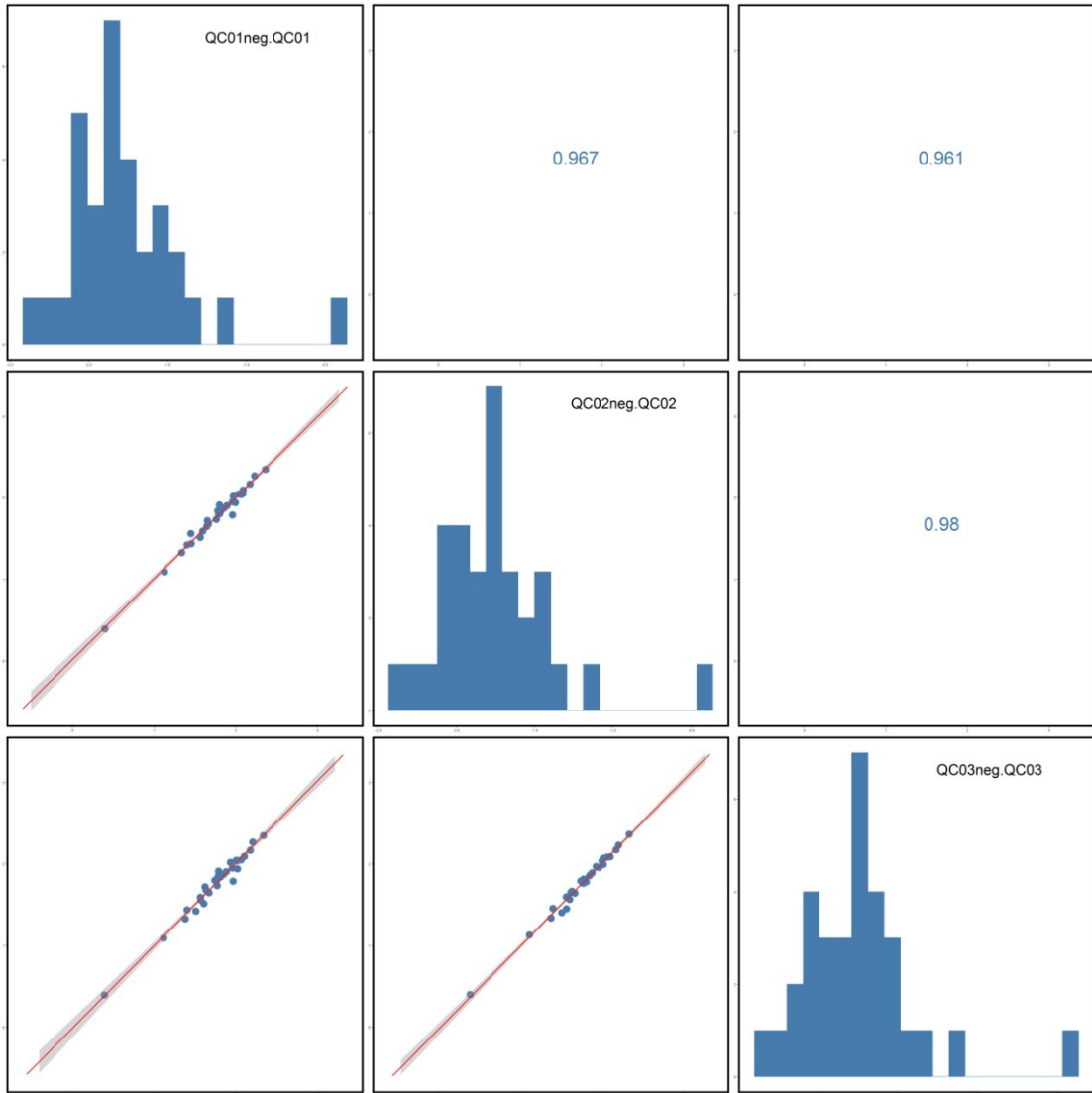
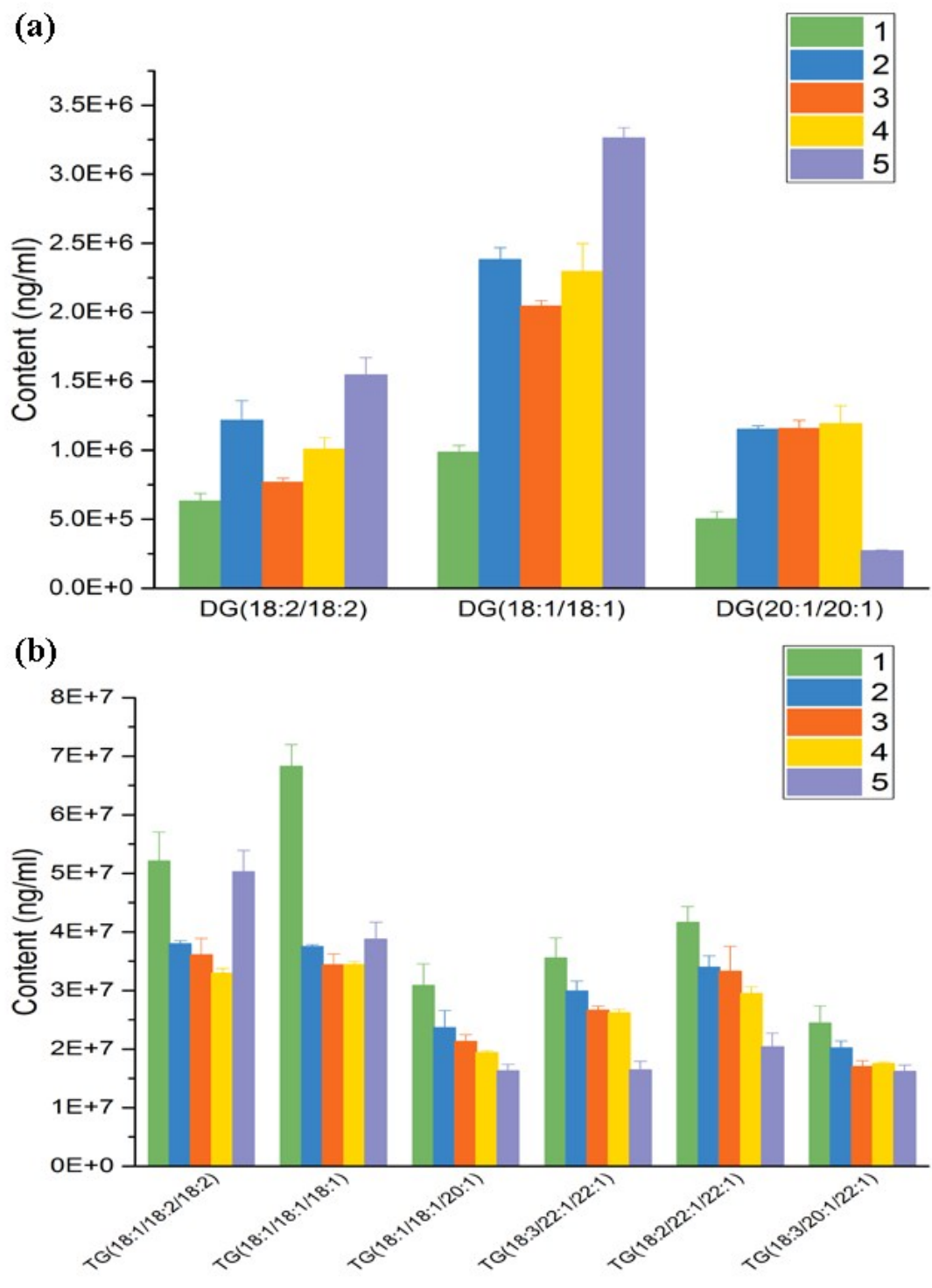
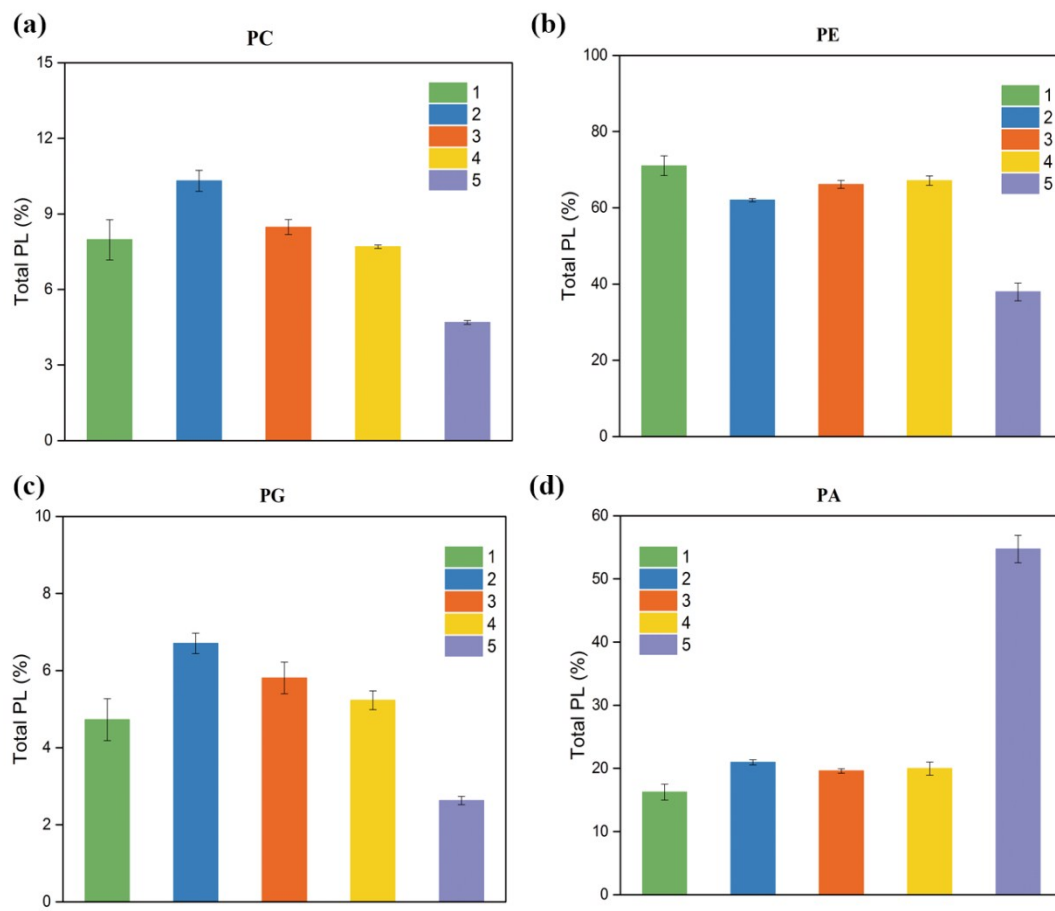


Figure S4



**Figure S5**



**Table S1** Qualitative and quantitative results of lipid composition in rapeseed oil by UHPLC-QTOF-MS

MS2 name	type	mzmed	time	ng/ml	RSD
DG(16:0/16:0)	MS2 forward	586.5379826	7.607916667	11490.46535	7.59%
DG(15:0/18:2)	MS2 forward	596.530708	7.685708333	9016.860269	5.94%
DG(18:2/17:1)	MS2 forward	622.5467425	7.735025	42254.54476	4.51%
DG(18:2/18:2)	MS2 reverse	634.5404173	6.734491667	1306085.507	5.39%
DG(18:1/18:1)	MS2 reverse	638.5723726	7.733933333	2754286.466	5.60%
DG(18:0/18:0)	MS2 reverse	642.591148	8.2549	7483.339274	5.03%
DG(18:3/19:0)	MS2 reverse	650.5686163	7.239866667	6026.86637	7.87%
DG(20:1/18:3)	MS2 forward	662.5622154	6.734666667	8480.928471	6.94%
DG(16:0/22:1)	MS2 forward	668.6169485	8.755583333	62838.96811	6.14%
DG(20:1/20:1)	MS2 reverse	694.6346122	8.777475	1106595.278	5.60%
DG(20:1/22:1)	MS2 forward	722.6545325	8.798833333	10872.77888	14.86%
DG(20:0/22:1)	MS2 forward	724.6699744	9.2148	23191.19964	2.79%
DG(22:1/22:1)	MS2 forward	750.6941116	9.62385	147083.7842	5.29%
TG(12:0/12:0/16:0)	MS2 forward	712.642457	9.470275	5264.796519	5.19%
TG(12:0/14:0/16:0)	MS2 forward	740.6728779	9.84585	9028.038367	4.02%
TG(14:1/16:1/16:1)	MS2 reverse	790.6800749	9.229033333	5262.253102	5.57%
TG(12:0/18:1/16:1)	MS2 reverse	792.7058616	9.912366667	85723.86707	6.94%
TG(14:0/16:0/16:1)	MS2 reverse	794.7110445	9.904383333	12298.55891	5.09%
TG(14:0/16:0/16:0)	MS2 forward	796.7351956	10.53320833	11094.73191	7.79%
TG(16:1/16:1/16:1)	MS2 reverse	818.711665	9.641133333	8394.353759	6.54%
TG(14:0/16:0/18:1)	MS2 forward	822.7513771	10.57523333	56622.11384	1.11%
TG(16:0/16:0/16:0)	MS2 forward	824.7581816	10.57326667	9276.925368	1.57%
TG(14:0/16:0/18:0)	MS2 reverse	824.7653907	10.85793333	13724.88904	9.19%
TG(16:1/16:1/17:2)	MS2 reverse	830.7193015	9.888108333	16602.27463	4.75%
TG(16:1/16:1/17:1)	MS2 reverse	832.7352607	10.18634167	33387.96117	0.49%
TG(16:1/16:1/17:0)	MS2 reverse	834.750699	10.46978333	40524.54786	4.85%
TG(16:0/16:0/17:1)	MS2 forward	836.7655519	10.72765833	16566.74366	7.05%
TG(16:0/16:1/18:3)	MS2 forward	844.7378887	10.04344167	465975.9912	3.49%
TG(16:0/16:1/18:2)	MS2 forward	846.7536005	10.325375	967103.0606	2.84%
TG(16:0/16:0/18:1)	MS2 forward	850.7835079	10.86803333	621401.8596	2.89%
TG(16:0/16:0/18:0)	MS2 reverse	852.7890614	10.877675	105590.4177	5.22%
TG(16:0/17:2/18:3)	MS2 reverse	856.7364717	9.93895	71242.01325	5.42%
TG(16:0/17:1/18:3)	MS2 reverse	858.7523596	10.21741667	127509.0829	2.27%
TG(17:1/17:1/17:1)	MS2 reverse	860.757383	10.19838333	23960.46546	2.31%
TG(16:0/17:0/18:3)	MS2 reverse	860.7669946	10.49921667	190354.2623	9.25%
TG(16:0/17:1/18:1)	MS2 forward	862.7818265	10.74958333	117576.4447	4.41%
TG(16:0/17:0/18:1)	MS2 forward	864.796968	11.01529167	24948.29431	7.15%
TG(16:1/18:3/18:3)	MS2 reverse	866.7221708	9.466058333	334593.6174	4.85%
TG(16:0/18:3/18:3)	MS2 forward	868.7263692	9.454083333	54079.00712	4.93%



TG(16:0/18:2/18:3)	MS2 forward	870.7535518	10.08251667	4494057.924	2.52%
TG(16:1/18:1/18:2)	MS2 forward	872.7593388	10.06646667	693937.6398	1.28%
TG(16:0/18:2/18:2)	MS2 forward	872.7692381	10.3655	8559037.303	0.85%
TG(16:0/18:1/18:2)	MS2 forward	874.7848201	10.62174167	8495671.667	1.66%
TG(18:1/16:0/18:1)	MS2 forward	876.8005275	10.881175	7259631.923	3.19%
TG(16:0/18:0/18:1)	MS2 forward	878.8059464	10.88351667	1187921.284	2.13%
TG(17:2/18:2/18:3)	MS2 reverse	880.7413236	10.6087	59984.46871	7.02%
TG(17:1/18:1/18:3)	MS2 forward	884.7677111	10.23484167	124921.672	2.49%
TG(17:1/18:1/18:2)	MS2 forward	886.7727457	10.21459167	24518.88118	4.72%
TG(17:0/18:1/18:3)	MS2 forward	886.782975	10.51376667	265013.9499	2.52%
TG(17:0/18:1/18:2)	MS2 forward	888.788987	10.48425	53218.79422	0.64%
TG(17:1/18:1/18:1)	MS2 forward	888.7993168	10.77790833	433153.8727	9.58%
TG(18:3/18:3/18:3)	MS2 forward	890.7255904	9.180308333	347439.1932	6.26%
TG(17:0/18:1/18:1)	MS2 forward	890.8054006	10.76278333	82924.55734	4.60%
TG(18:2/18:3/18:3)	MS2 forward	892.7386689	9.498558333	1513233.289	5.44%
TG(17:0/18:0/18:1)	MS2 forward	892.8199381	11.02863333	45548.5344	5.40%
TG(18:2/18:2/18:3)	MS2 forward	894.7442286	9.493366667	254710.8566	6.34%
TG(18:1/18:3/18:3)	MS2 forward	894.7534587	9.815583333	9813496.064	3.82%
TG(18:1/18:2/18:3)	MS2 forward	896.7600772	9.80075	1625403.055	4.13%
TG(18:1/18:2/18:2)	MS2 forward	898.7854999	10.38483333	37943941.34	4.18%
TG(18:1/18:1/18:2)	MS2 forward	900.779817	10.06725	101844.0454	3.31%
TG(18:1/18:1/18:1)	MS2 forward	902.8160639	10.89695	38343654.31	5.15%
TG(16:0/18:1/20:1)	MS2 forward	904.8227823	10.890175	6203701.36	4.66%
TG(18:0/18:1/18:1)	MS2 forward	904.8312917	11.14600833	6904569.096	6.21%
TG(18:0/18:0/18:1)	MS2 forward	906.8371014	11.14654167	1403638.453	2.48%
TG(17:0/18:3/20:4)	MS2 reverse	908.7717719	10.88315	121381.5346	5.87%
TG(17:2/18:3/20:1)	MS2 reverse	910.7814151	10.29813333	46150.3454	1.88%
TG(18:3/18:3/19:0)	MS2 reverse	910.7875852	10.68093333	17585.36041	2.02%
TG(17:1/18:3/20:1)	MS2 reverse	912.7986096	10.558325	179230.7214	2.07%
TG(18:2/18:2/19:0)	MS2 reverse	914.814856	10.80351667	487586.418	0.06%
TG(17:0/18:1/20:1)	MS2 forward	918.8349304	11.03040833	108501.9972	5.05%
TG(17:2/19:0/19:0)	MS2 reverse	918.8453286	10.60456667	150737.8416	1.42%
TG(17:1/19:0/19:0)	MS2 reverse	920.8494741	11.27480833	45607.4559	1.93%
TG(18:3/18:3/20:1)	MS2 forward	922.784322	10.16993333	2242007.113	3.33%
TG(18:2/18:3/20:1)	MS2 forward	924.789163	10.1473	424714.7678	2.22%
TG(18:1/18:3/20:1)	MS2 forward	926.816476	10.6939	11830835.91	3.69%
TG(18:1/18:2/20:1)	MS2 forward	928.8210903	10.36868333	70323.30525	0.85%
TG(18:1/18:1/20:1)	MS2 forward	930.8470069	11.15171667	20026482.52	8.38%
TG(16:0/18:1/22:1)	MS2 forward	932.8532558	11.14323333	3379969.003	4.01%
TG(18:0/18:1/20:0)	MS2 forward	934.8681814	11.38160833	1165506.118	4.56%
TG(18:2/19:0/20:3)	MS2 reverse	940.8186338	9.772458333	38633.47531	7.76%
TG(17:1/18:2/22:1)	MS2 forward	942.8458034	11.06851667	378039.4795	2.44%
TG(18:3/18:3/22:3)	MS2 reverse	946.7636616	8.741208333	6665.047727	0.98%
TG(18:3/18:3/22:2)	MS2 reverse	948.7990733	10.1846	81567.01644	3.07%

TG(18:2/18:3/22:3)	MS2 forward	948.8117737	10.47931667	25527.86077	4.37%
TG(18:3/18:3/22:1)	MS2 forward	950.8164148	10.48460833	5512225.413	3.70%
TG(18:2/18:3/22:1)	MS2 forward	952.831386	10.72923333	10103852.92	1.37%
TG(18:1/18:3/22:1)	MS2 forward	954.8372946	10.69336667	1875767.675	3.21%
TG(18:3/20:1/20:1)	MS2 reverse	954.8416743	10.39726667	149077.02	0.90%
TG(18:1/18:2/22:1)	MS2 forward	956.8526368	10.94063333	3830877.125	3.19%
TG(18:1/18:1/22:1)	MS2 forward	958.8679173	11.1442	3426164.538	5.09%
TG(18:0/18:1/22:1)	MS2 forward	960.884845	11.38441667	3915597.826	4.72%
TG(18:0/18:1/22:0)	MS2 forward	962.8970483	11.618225	510105.838	7.11%
TG(17:2/20:1/22:2)	MS2 reverse	968.8609345	11.08464167	215353.1273	3.19%
TG(17:1/20:1/22:1)	MS2 reverse	972.8913482	11.51084167	363511.9781	4.69%
TG(18:1/19:0/22:1)	MS2 reverse	974.9075307	11.14803333	564633.3192	0.38%
TG(18:3/20:3/22:2)	MS2 reverse	976.8275448	10.4693	26812.22744	6.88%
TG(18:0/19:0/22:1)	MS2 reverse	976.9139459	11.14955	119907.0877	1.83%
TG(16:0/21:0/22:1)	MS2 reverse	976.9208484	11.95729167	12003.80307	3.26%
TG(18:3/20:3/22:1)	MS2 forward	978.8455185	10.76196667	626090.925	7.19%
TG(18:3/20:2/22:1)	MS2 forward	980.8510792	10.72125	159612.2175	5.09%
TG(18:3/20:1/22:1)	MS2 forward	982.8783353	11.21989167	18248724.36	5.68%
TG(18:2/20:1/22:1)	MS2 forward	984.8839504	11.18759167	3555859.915	1.45%
TG(18:1/20:1/22:1)	MS2 forward	986.9001768	11.36273333	2581727.908	0.90%
TG(18:1/20:0/22:1)	MS2 forward	988.9132773	10.89770833	153235.5239	5.14%
TG(18:1/20:0/22:0)	MS2 forward	990.9279466	11.14915	57469.77117	2.85%
TG(20:2/20:5/21:0)	MS2 reverse	992.8667073	9.824533333	43234.23691	4.74%
TG(18:0/22:6/22:6)	MS2 reverse	996.7827139	9.4928	3129.848536	8.72%
TG(17:2/22:1/22:2)	MS2 reverse	996.8924375	11.318975	294231.108	1.83%
TG(18:3/22:1/22:6)	MS2 reverse	1000.849262	8.776316667	19200.42243	4.69%
TG(20:0/20:3/22:6)	MS2 reverse	1002.829891	10.39736667	20379.25482	3.49%
TG(18:3/22:1/22:3)	MS2 forward	1006.868346	10.47815833	24035.25836	5.16%
TG(18:3/22:1/22:2)	MS2 forward	1008.889596	10.72253333	41183.73495	3.91%
TG(18:3/22:1/22:1)	MS2 forward	1010.90971	11.45134167	25752964.64	4.55%
TG(18:0/22:2/22:2)	MS2 reverse	1012.911689	10.67775	78229.3609	6.49%
TG(18:2/22:1/22:1)	MS2 forward	1012.924695	11.62505	28600224.84	1.85%
TG(18:1/22:0/22:1)	MS2 forward	1016.942958	11.14600833	93621.87955	8.20%
TG(18:0/22:1/22:1)	MS2 reverse	1016.955676	12.0478	3680101.07	5.19%
TG(18:1/22:0/22:0)	MS2 forward	1018.963142	12.03451667	750978.566	4.54%
TG(19:0/22:1/22:4)	MS2 reverse	1024.922343	11.53728333	127731.3579	4.17%
TG(19:0/22:1/22:2)	MS2 reverse	1028.954371	11.92829167	276633.8655	12.61%
TG(20:3/22:1/22:3)	MS2 reverse	1034.899011	11.23408333	40949.52263	7.70%
TG(20:4/22:1/22:1)	MS2 reverse	1036.918737	11.45251667	53289.4515	3.32%
TG(20:3/22:1/22:1)	MS2 reverse	1038.93633	11.23494167	59548.43729	8.85%
TG(20:2/22:1/22:1)	MS2 reverse	1040.953376	11.85595833	1747591.639	9.97%
TG(20:0/22:1/22:1)	MS2 reverse	1044.980322	12.0201	1436994.98	4.70%
TG(21:0/22:1/22:2)	MS2 reverse	1056.984028	12.12528333	49242.24847	1.61%
TG(22:1/22:1/22:3)	MS2 reverse	1066.965676	11.86625833	44891.21949	5.14%

MS2 name	type	mzmed	time	ng/ml	RSD
PC(16:0/18:1)	MS2 forward	804.5743443	6.31265	1060.526004	1.78%
PC(18:2/18:2)	MS2 forward	826.5581574	5.167275	1255.54518	5.10%
PC(18:2/18:1)	MS2 forward	828.5731233	5.791516667	1564.199937	2.28%
PC(18:1/18:1)	MS2 forward	830.5896363	6.374858333	2945.749913	3.01%
PE(16:0/14:0)	MS2 forward	662.4750311	5.93505	2519.306368	6.91%
PE(16:0/16:0)	MS2 forward	690.5063846	6.330608333	3075.86022	5.44%
PE(16:0/17:1)	MS2 forward	702.5071503	5.947308333	45868.43312	4.19%
PE(17:1/17:1)	MS2 forward	714.5131409	5.414375	2480.97404	1.12%
PE(16:0/18:1)	MS2 forward	716.5222366	5.967116667	1893.039303	2.56%
PE(18:0/16:0)	MS2 forward	718.5301253	5.19735	975.9365755	6.71%
PE(17:1/18:0)	MS2 reverse	730.5367786	13.26111667	1204.24594	3.90%
PE(18:0/17:1)	MS2 reverse	730.5377207	6.588833333	8789.49236	7.42%
PE(18:2/18:2)	MS2 forward	738.5074106	5.243908333	1451.960427	2.24%
PE(18:2/18:1)	MS2 forward	740.522175	5.83385	1757.210073	4.75%
PE(18:1/18:1)	MS2 forward	742.5377065	6.405616667	4200.483049	4.08%
PE(20:1/18:3)	MS2 reverse	766.5455011	6.018708333	658.85293	1.31%
PE(21:0/17:1)	MS2 reverse	772.591064	5.719283333	506.7949301	4.14%
PE(17:2/22:1)	MS2 reverse	782.5856997	4.322	761.4066836	5.09%
PG(20:4/18:3)	MS2 forward	791.4929445	3.818308333	2450.980896	4.95%
PG(20:4/18:2)	MS2 reverse	793.5091577	4.365466667	1031.499423	5.05%
PG(20:3/18:2)	MS2 forward	795.5246575	4.932258333	909.6564819	5.27%
PA(18:2/14:0)	MS2 forward	643.4240976	2.068525	1752.23775	1.57%
PA(16:0/17:1)	MS2 forward	659.4762842	5.629016667	1831.219089	2.27%
PA(16:0/18:3)	MS2 forward	669.4497055	4.6866	1080.142348	4.39%
PA(16:0/18:2)	MS2 forward	671.4643165	5.22885	1989.995882	8.00%
PA(16:0/18:1)	MS2 forward	673.4806193	5.929966667	1203.801531	2.61%
PA(18:2/18:2)	MS2 forward	695.4653133	4.745158333	5105.310441	9.24%
PA(18:1/18:2)	MS2 forward	697.4808425	5.275333333	3466.655949	7.92%
PA(18:1/18:1)	MS2 forward	699.4969443	5.945808333	4440.351808	2.09%
PA(16:0/21:0)	MS2 reverse	717.5288819	5.180183333	1669.611698	8.68%
PA(18:0/22:1)	MS2 reverse	757.5883365	8.099258333	1709.817712	2.81%
PA(18:1/25:0)	MS2 forward	799.6066291	6.105025	1764.821086	0.41%

**Table S2** Content of PL species of rapeseed oil during light oxidation. (ng/ml )

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>PC</b>	8722.44±565.37	7299.61±119.09	6207.04±511.40	6050.43±117.04	7059.83±164.74
<b>PE</b>	78123.20±5439.76	44001.09±2554.56	48301.45±1524.47	52803.26±2036.61	57120.98±3054.931
<b>PG</b>	5172.08±408.32	4748.55±101.92	4259.72±495.05	4112.61±211.98	3961.35±207.11
<b>PA</b>	17798.09±735.81	14882.40±1073.43	14332.85±944.27	15687.89±577.13	82457.60±4078.33
<b>Total</b>	109815.82±3740.74	70931.65±3801.81	73101.07±3434.96	78654.19±1827.50	150599.77±2236.51