

**Table S1 Results of ANOVA for the prepared experimental design**

Term	Coef	SE Coef	T	P
Constant	52.5707	8.6646	6.067	0.000
A	-0.1656	0.1373	-1.206	0.0245
B	-6.2556	13.8297	-0.452	0.657
C*	-8.5237	4.7340	-1.801	0.091
D	19.4847	47.3404	0.412	0.686
A <sup>2</sup>	0.0036	0.0012	3.065	0.007
B <sup>2</sup>	0.2133	5.2906	0.040	0.968
C <sup>2</sup> *	1.4050	0.7440	1.888	0.077
D <sup>2</sup>	-72.0000	74.03997	-0.968	0.348
AB	0.0367	0.0320	1.147	0.268
AC	0.0137	0.0120	1.147	0.268
AD	0.1125	0.1199	0.939	0.362
BC	-0.2500	0.7990	-0.313	0.758
BD	12.5000	7.9903	1.564	0.137
CD	1.5625	2.9964	0.521	0.609

S = 4.79417 PRESS = 1418.39; R<sup>2</sup>=0.9408 R-Sq(pred) = 77.18% R-Sq(adj) = 88.91%;\*R<sup>2</sup>=0.92

**Table S2 Independent variables and their levels used for CCD**

Independent Variables	Unit	Factors Symbol	Coded Levels	
Liquid/Solid Ratio(L/S)	-	X1	-1	1
Treatment Time in the Column	hour	X2	10	30
Ethanol Concentration	%	X3	6	24
			0	80

**Table S3. Response Surface Regression: Antioxidant Capacity versus L/S Ratio; Time (hr);**

Estimated Regression Coefficients for Antioxidant capacity

Term	Coef	SE Coef	T	P
Constant	9312.70	2649.11	3.515	0.006
X <sub>1</sub>	-93.02	274.31	-0.339	0.742
X <sub>2</sub>	490.16	218.79	2.240	0.049
X <sub>3</sub>	-119.77	48.16	-2.487	0.032
X <sub>1</sub> <sup>2</sup>	-0.17	6.54	-0.025	0.980
X <sub>2</sub> <sup>2</sup>	-21.51	6.54	-3.288	0.008
X <sub>3</sub> <sup>2</sup>	1.93	0.41	4.716	0.001
X <sub>1</sub> .X <sub>2</sub>	4.29	3.84	1.120	0.289
X <sub>1</sub> .X <sub>3</sub>	1.48	0.96	1.543	0.154
X <sub>2</sub> .X <sub>3</sub>	1.21	0.96	1.265	0.235

S = 1084,76 PRESS = 85852664

R-Sq = 95.85% R-Sq(pred) = 69.75% R-Sq(adj) = 92.12%

Analysis of Variance for Antioxidant

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	9	272,047,514	272,047,514	30,227,502	25.69	0.000
Linear	3	235,079,966	11,031,132	3,677,044	3.12	0.075
Square	3	30,809,714	30,809,714	10,269,905	8.73	0.004
Interaction	3	6,157,834	61,57,834	2,052,611	1.74	0.221
Residual Error	10	11,767,102	11,767,102	1,176,710		
Lack-of-Fit	5	11,085,380	11,085,380	2,217,076	16.26	0.004
Pure Error	5	681,722	681,722	136,344		
Total	19	283,814,616				

Unusual Observations for Antioxidant

Obs	StdOrder	Antioxidant	Fit	SE Fit	Residual	St Resid
16	14	22474.000	20324.618	760.038	2149.382	2.78 R

R denotes an observation with a large standardized residual.

Predicted Response for New Design Points Using Model for Antioxidant

Point	Fit	SE Fit	95% CI	95% PI
1	9697.3	966.098	( 7544.7; 11849.9)	( 6460.7; 12933.9)
2	10342.0	760.038	( 8648.5; 12035.5)	( 7390.8; 13293.2)
3	10171.6	760.038	( 8478.1; 11865.1)	( 7220.4; 13122.8)
4	10660.0	760.038	( 8966.5; 12353.5)	( 7708.8; 13611.2)
5	8428.9	966.098	( 6276.3; 10581.5)	( 5192.3; 11665.5)
6	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)
7	19965.1	966.098	(17812.5; 22117.7)	(16728.5; 23201.7)
8	17149.5	966.098	(14996.9; 19302.1)	(13912.9; 20386.1)
9	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)
10	17208.4	966.098	(15055.8; 19361.0)	(13971.8; 20445.0)
11	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)

12	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)
13	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)
14	7697.9	966.098	( 5545.3; 9850.5)	( 4461.3; 10934.5)
15	12777.6	760.038	(11084.1; 14471.1)	( 9826.4; 15728.8)
16	20324.6	760.038	(18631.1; 22018.1)	(17373.4; 23275.8)
17	8147.0	966.098	( 5994.4; 10299.6)	( 4910.4; 11383.6)
18	12407.5	372.915	(11576.5; 13238.4)	( 9851.6; 14963.3)
19	18306.5	966.098	(16153.9; 20459.1)	(15069.9; 21543.1)
20	12004.0	760.038	(10310.5; 13697.5)	( 9052.8; 14955.2)

**Analysis of Variance for Antioxidant Capacity (R<sup>2</sup>=0.9585)**

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	9	272,047,514	27,2047,514	30,227,502	25.69	0.000
Linear	3	235,079,966	11,031,132	3,677,044	3.12	0.075
Square	3	30,809,714	30,809,714	10,269,905	8.73	0.004
Interaction	3	6,157,834	6157834	2,052,611	1.74	0.221
Residual Error	10	11,767,102	11,767,102	1,176,710		
Lack-of-Fit	5	11,085,380	11,085,380	2,217,076	16.26	0.004
Pure Error	5	681,722	681,722	136,344		
Total	19	28,3814,616				

**Table S4. Response Surface Regression: TPC versus L/S Ratio; Time (hr);**

Estimated Regression Coefficients for Total Phenol Content

Term	Coef	SE Coef	T	P
Constant	0.105738	0.047151	2.243	0.049
X <sub>1</sub>	-0.002571	0.004882	-0.527	0.610
X <sub>2</sub>	0.002010	0.003894	0.516	0.617
X <sub>3</sub>	0.002304	0.000857	2.688	0.023
X <sub>1</sub> <sup>2</sup>	0.000077	0.000116	0.660	0.524
X <sub>2</sub> <sup>2</sup>	-0.000123	0.000116	-1.058	0.315
X <sub>3</sub> <sup>2</sup>	-0.000019	0.000007	-2.604	0.026
X <sub>1</sub> .X <sub>2</sub>	0.000019	0.000068	0.275	0.789
X <sub>1</sub> .X <sub>3</sub>	-0.000004	0.000017	-0.238	0.817
X <sub>2</sub> .X <sub>3</sub>	-0.000002	0.000017	-0.128	0.901

S = 0.0193076 PRESS = 0.0139841

R-Sq = 72.29% R-Sq(pred) = 0.00% R-Sq(adj) = 47.35%

Analysis of Variance for Total Pheenol Content

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	9	0.009726	0.009726	0.001081	2.90	0.056
Linear	3	0.003745	0.003262	0.001087	2.92	0.087
Square	3	0.005925	0.005925	0.001975	5.30	0.019
Interaction	3	0.000055	0.000055	0.000018	0.05	0.985
Residual Error	10	0.003728	0.003728	0.000373		
Lack-of-Fit	5	0.000754	0.000754	0.000151	0.25	0.921
Pure Error	5	0.002974	0.002974	0.000595		
Total	19	0.013454				

Unusual Observations for Total Phenol Content

Total

Obs	StdOrder	phenol	Fit	SE Fit	Residual	St Resid
13	17	0.109	0.155	0.007	-0.046	-2.55 R

R denotes an observation with a large standardized residual.

Predicted Response for New Design Points Using Model for Total Phenol Content

Point	Fit	SE Fit	95% CI	95% PI
1	0.116248	0.0171955	(0.077934; 0.154562)	(0.058640; 0.173856)
2	0.157109	0.0135279	(0.126967; 0.187251)	(0.104580; 0.209638)
3	0.128709	0.0135279	(0.098567; 0.158851)	(0.076180; 0.181238)
4	0.113109	0.0135279	(0.082967; 0.143251)	(0.060580; 0.165638)
5	0.127348	0.0171955	(0.089034; 0.165662)	(0.069740; 0.184956)
6	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)
7	0.123048	0.0171955	(0.084734; 0.161362)	(0.065440; 0.180656)
8	0.110948	0.0171955	(0.072634; 0.149262)	(0.053340; 0.168556)
9	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)
10	0.144848	0.0171955	(0.106534; 0.183162)	(0.087240; 0.202456)
11	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)
12	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)

13	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)
14	0.085848	0.0171955	(0.047534; 0.124162)	(0.028240; 0.143456)
15	0.168709	0.0135279	(0.138567; 0.198851)	(0.116180; 0.221238)
16	0.136709	0.0135279	(0.106567; 0.166851)	(0.084180; 0.189238)
17	0.104448	0.0171955	(0.066134; 0.142762)	(0.046840; 0.162056)
18	0.155227	0.0066375	(0.140438; 0.170017)	(0.109736; 0.200718)
19	0.149448	0.0171955	(0.111134; 0.187762)	(0.091840; 0.207056)
20	0.157109	0.0135279	(0.126967; 0.187251)	(0.104580; 0.209638)

**Analysis of Variance for Total Phenol Content (R<sup>2</sup>=0.7229)**

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Regression	9	0.009726	0.009726	0.001081	2.90	0.056
Linear	3	0.003745	0.003262	0.001087	2.92	0.087
Square	3	0.005925	0.005925	0.001975	5.30	0.019
Interaction	3	0.000055	0.000055	0.000018	0.05	0.985
Residual Error	10	0.003728	0.003728	0.000373		
Lack-of-Fit	5	0.000754	0.000754	0.000151	0.25	0.921
Pure Error	5	0.002974	0.002974	0.000595		
Total	19	0.013454				

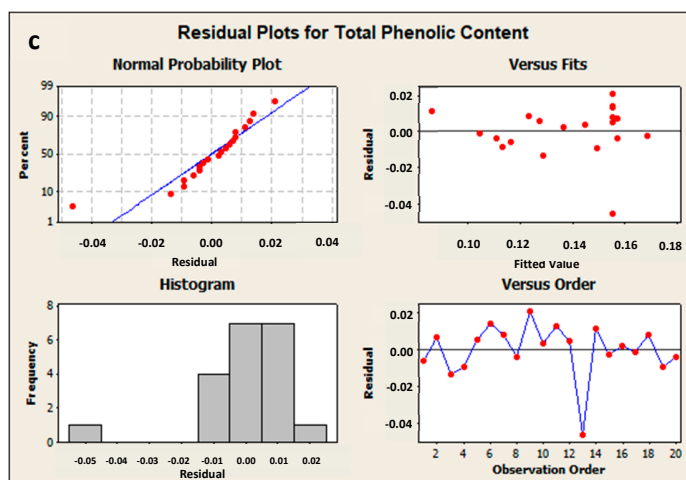
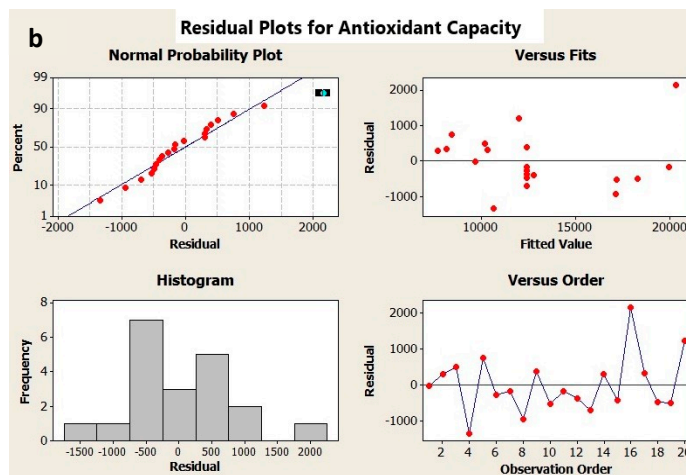
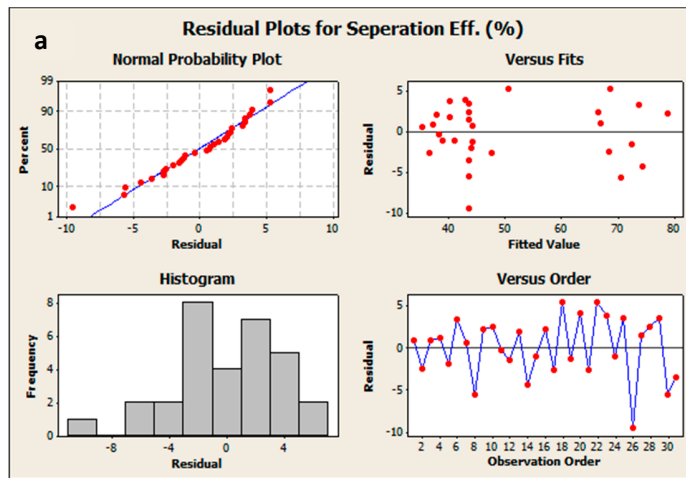


Figure S1 Residual Plots for the Separation Efficency(a).Total Phenol Content(b) and Total Antioxidant Capacity(c)