



Figure S1. Basic anthocyanin structure.

Table S1. Box-Behnken experimental design of the sugar removal of the concentrated juices from purple carrot.

Level	Factor		
	A: Initial pH	B: Fermentation temperature (°C)	C: Initial sugar content (g/L)
1	2.5	28.0	160
2	3.0	30.0	200
3	3.5	32.0	240

Table S2. Box-Behnken experimental design of the fermentation of purple carrot vinegar.

Level	Factor		
	D: Fermentation temperature (°C)	E: Initial pH	C: Inoculation amount (%)
1	28.0	3.5	7.0
2	30.0	4.0	8.0
3	32.0	4.5	9.0

Table S3. Box-Behnken design matrix and estimated data for the sugar-removing rate.

Run	A: Initial pH	B: Temperature (°C)	C: Initial sugar content (g/L)	Sugar-removing rate (%)
1	3.0	30	200	69.81
2	2.5	28	200	45.69
3	2.5	30	160	76.03
4	3.0	28	240	14.66
5	3.0	30	200	74.16
6	3.0	28	160	90.16
7	3.5	30	240	23.99
8	3.5	28	200	62.99
9	3.5	30	160	89.85
10	3.0	32	160	84.86
11	3.0	30	200	66.75
12	3.5	32	200	58.52
13	3.0	30	200	70.53
14	3.0	30	200	68.83
15	2.5	32	200	50.19
16	3.0	32	240	10.5
17	2.5	30	240	11.32

**Table S4.** Box-Behnken design matrix and response values for the acetic acid yield.

Run	D: Temperature (°C)	E: pH	F: Inoculation amount (%)	Acetic acid content (g/L)
1	30	4.5	7	35.37
2	32	4.0	7	32.08
3	30	4.0	8	35.88
4	28	4.0	9	33.06
5	32	4.0	9	31.78
6	32	4.5	8	31.84
7	30	3.5	9	28.46
8	28	4.0	7	33.39
9	30	4.5	9	35.16
10	30	4.0	8	35.26
11	30	4.0	8	37.68
12	28	4.5	8	33.84
13	30	4.0	8	35.79
14	30	4.0	8	37.44
15	32	3.5	8	26.61
16	28	3.5	8	28.68
17	30	3.5	7	28.78