Supplementary materials

Fig.S.1 Flowchart for the implementation of cation column for the separation of anthocyanins.

Rinsing with a 1N NaOH solution, removing mechanical impurities with water

↓

Rinsing with a 0.01N HCl , removing mechanical impurities with water

↓

Washing with methanol/glacial acetic acid (19:1,v/v)

↓

Loading with extration solution

↓

Washing with methanol/glacial acetic acid (19:1,v/v)

↓

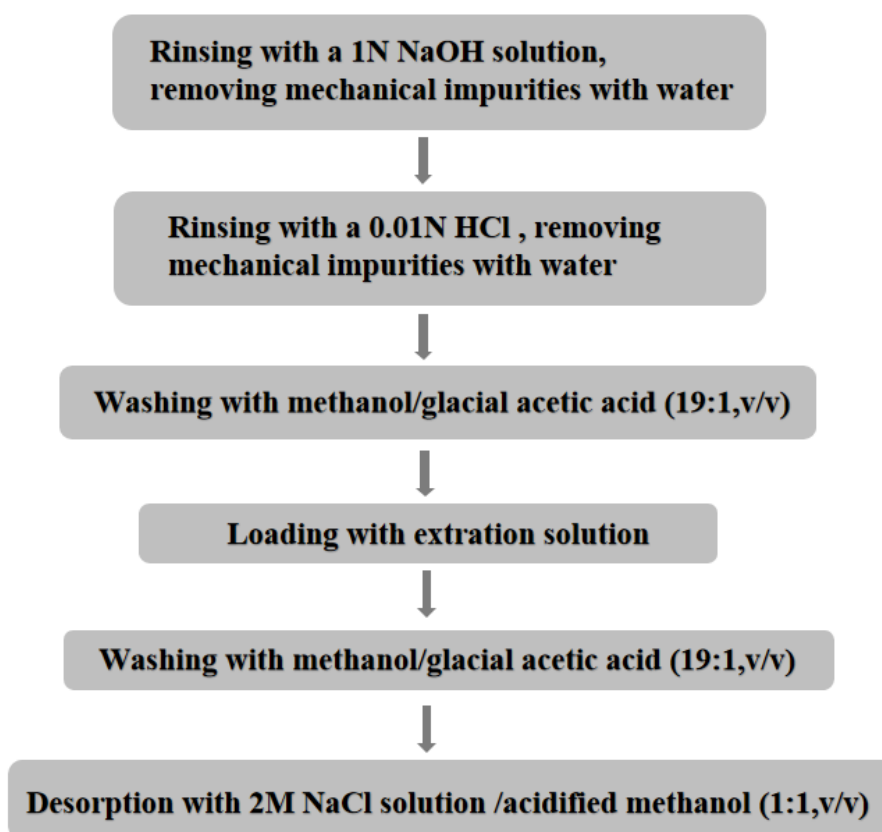Desorption with 2M NaCl solution /acidified methanol (1:1,v/v)

Fig.S.2 2D Contours and 3D surface plots for the effects of ultrasound power, extraction time and temperature on the yield of anthocyanins.
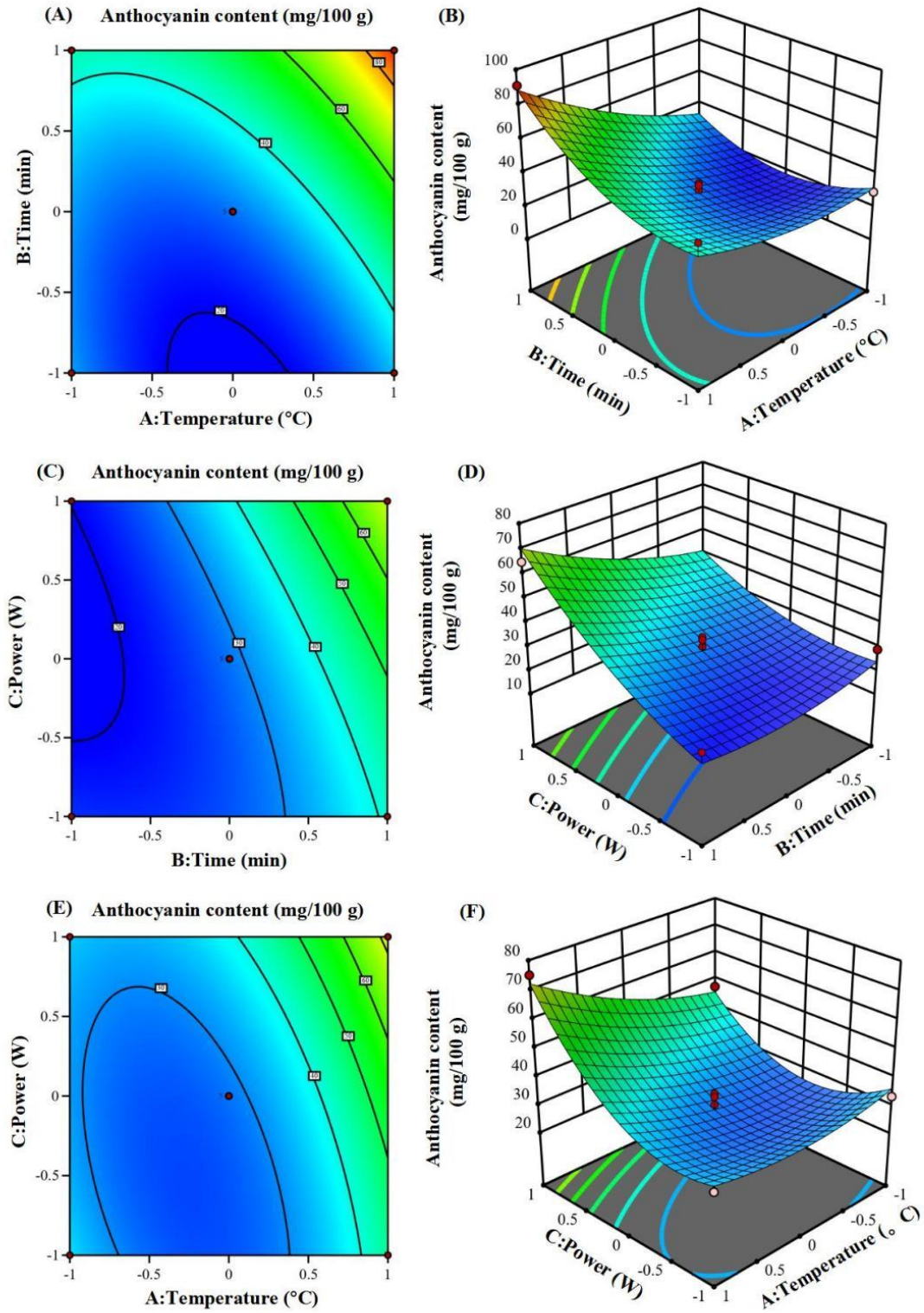
Fig.S.3 Changes in the content of 13 anthocyanins in 17 groups under different treatment conditions for Box-Behnken design.
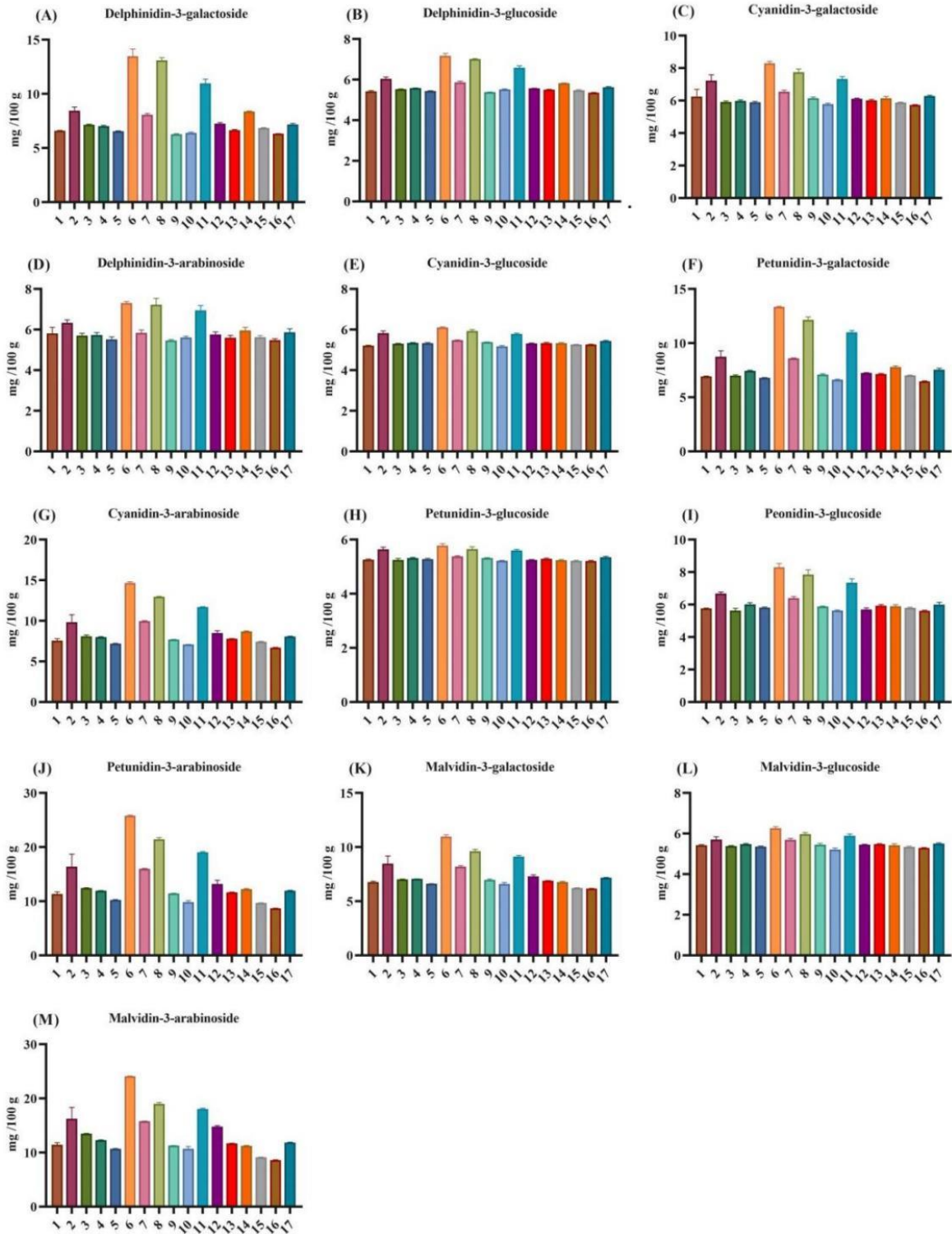
Table.S.1 Contents of detected 13 anthocyanins in the samples for Box-Behnken design.

	Del-3-gal	Del-3-glc	Cy-3-gal	Del-3-ara	Cy-3-glc	Pet-3-gal	Cy-3-ara	Pet-3-glc	Peo-3-glc	Pet-3-ara	Mal-3-gal	Mal-3-glc	Mal-3-ara
1	6.59 ± 0.04^{def}	5.43 ± 0.07^{ghi}	6.26 ± 0.76^{de}	5.82 ± 0.51^{c}	5.22 ± 0.02^{gh}	6.92 ± 0.07^{ghij}	7.56 ± 0.4^{ghi}	5.26 ± 0.04^{cd}	5.76 ± 0.04^{f}	11.34 ± 0.66^{efg}	6.77 ± 0.11^{def}	5.43 ± 0.04^{de}	11.44 ± 0.62^{f}
2	8.46 ± 0.55^{c}	6.04 ± 0.16^{d}	7.23 ± 0.62^{c}	6.34 ± 0.25^{b}	5.83 ± 0.18^{bc}	8.74 ± 0.96^{d}	9.81 ± 1.62^{d}	5.64 ± 0.15^{b}	6.68 ± 0.18^{d}	16.40 ± 3.95^{d}	8.48 ± 1.22^{c}	5.70 ± 0.25^{c}	16.24 ± 3.63^{c}
3	7.15 ± 0.09^{d}	5.53 ± 0.02^{fgh}	5.92 ± 0.1^{e}	5.71 ± 0.18^{c}	5.31 ± 0.03^{fg}	7.00 ± 0.13^{fghij}	8.07 ± 0.32^{efg}	5.25 ± 0.09^{cd}	5.63 ± 0.25^{f}	12.44 ± 0.07^{e}	7.00 ± 0.07^{de}	5.39 ± 0.03^{def}	13.49 ± 0.10^{de}
4	7.00 ± 0.15^{de}	5.58 ± 0.01^{fg}	5.98 ± 0.13^{e}	5.74 ± 0.2^{c}	5.35 ± 0.05^{ef}	7.44 ± 0.08^{efg}	7.99 ± 0.11^{efgh}	5.32 ± 0.04^{cd}	6.02 ± 0.18^{ef}	11.93 ± 0.05^{ef}	7.06 ± 0.01^{de}	5.48 ± 0.06^{de}	12.30 ± 0.07^{ef}
5	6.54 ± 0.06^{def}	5.44 ± 0.03^{ghi}	5.89 ± 0.11^{e}	5.53 ± 0.2^{c}	5.33 ± 0.05^{efg}	6.78 ± 0.06^{hij}	7.19 ± 0.06^{hij}	5.28 ± 0.04^{cd}	5.82 ± 0.06^{f}	10.25 ± 0.12^{fgh}	6.60 ± 0.03^{ef}	5.36 ± 0.05^{def}	10.67 ± 0.11^{fg}
6	13.47 ± 1.17^{a}	7.17 ± 0.22^{a}	8.30 ± 0.21^{a}	7.3 ± 0.14^{a}	6.11 ± 0.04^{a}	13.35 ± 0.11^{a}	14.67 ± 0.24^{a}	5.78 ± 0.12^{a}	8.30 ± 0.41^{a}	25.78 ± 0.23^{a}	10.99 ± 0.28^{a}	6.26 ± 0.14^{a}	24.12 ± 0.03^{a}
7	8.07 ± 0.21^{c}	5.87 ± 0.11^{e}	6.55 ± 0.16^{d}	5.84 ± 0.25^{c}	5.48 ± 0.01^{d}	8.6 ± 0.05^{d}	9.95 ± 0.14^{d}	5.38 ± 0.05^{c}	6.39 ± 0.18^{de}	15.99 ± 0.10^{d}	8.21 ± 0.14^{c}	5.70 ± 0.12^{c}	15.77 ± 0.07^{c}
8	13.10 ± 0.42^{a}	7.01 ± 0.05^{b}	7.75 ± 0.33^{b}	7.22 ± 0.55^{a}	5.94 ± 0.12^{b}	12.14 ± 0.49^{b}	12.98 ± 0.04^{b}	5.65 ± 0.16^{b}	7.85 ± 0.49^{b}	21.47 ± 0.49^{b}	9.62 ± 0.31^{b}	5.98 ± 0.12^{b}	19.00 ± 0.04^{b}
9	6.27 ± 0.09^{f}	5.38 ± 0.01^{hi}	6.15 ± 0.12^{de}	5.46 ± 0.08^{c}	5.38 ± 0.02^{def}	7.08 ± 0.15^{fghi}	7.69 ± 0.04^{fghi}	5.32 ± 0.02^{cd}	5.88 ± 0.06^{f}	11.42 ± 0.08^{efg}	6.96 ± 0.14^{de}	5.46 ± 0.10^{de}	11.25 ± 0.08^{f}
10	6.38 ± 0.15^{ef}	5.52 ± 0.04^{fghi}	5.78 ± 0.11^{e}	5.61 ± 0.11^{c}	5.18 ± 0.07^{gh}	6.61 ± 0.1^{ij}	7.07 ± 0.04^{ij}	5.22 ± 0.03^{d}	5.64 ± 0.06^{f}	9.81 ± 0.53^{gh}	6.58 ± 0.25^{ef}	5.22 ± 0.13^{f}	10.67 ± 0.77^{fg}
11	10.98 ± 0.65^{b}	6.58 ± 0.17^{c}	7.34 ± 0.25^{bc}	6.95 ± 0.41^{a}	5.78 ± 0.07^{c}	11.00 ± 0.28^{c}	11.7 ± 0.08^{c}	5.60 ± 0.07^{b}	7.36 ± 0.41^{c}	19.07 ± 0.23^{c}	9.12 ± 0.18^{b}	5.89 ± 0.14^{b}	18.06 ± 0.22^{b}
12	7.2454 ± 0.18^{d}	5.57 ± 0.01^{fg}	6.11 ± 0.08^{de}	5.75 ± 0.22^{c}	5.32 ± 0.03^{efg}	7.24 ± 0.06^{fgh}	8.47 ± 0.56^{ef}	5.25 ± 0.03^{cd}	5.70 ± 0.17^{f}	13.17 ± 1.18^{e}	7.29 ± 0.25^{d}	5.45 ± 0.03^{de}	14.77 ± 0.31^{cd}
13	$6.64\pm0.11d^{ef}$	5.51 ± 0.03^{fghi}	6.02 ± 0.09^{e}	5.60 ± 0.2^{c}	5.34 ± 0.05^{efg}	7.14 ± 0.1^{fghi}	7.79 ± 0.02^{fghi}	5.29 ± 0.05^{cd}	5.93 ± 0.13^{f}	11.61 ± 0.14^{efg}	6.89 ± 0.02^{de}	5.48 ± 0.05^{de}	11.66 ± 0.08^{f}
14	8.37 ± 0.09^{c}	5.82 ± 0.02^{e}	6.15 ± 0.18^{de}	5.96 ± 0.27^{bc}	5.33 ± 0.05^{efg}	7.80 ± 0.19^{e}	8.68 ± 0.13^{e}	5.24 ± 0.04^{cd}	5.90 ± 0.17^{f}	12.24 ± 0.18^{e}	6.76 ± 0.14^{def}	5.43 ± 0.11^{de}	11.21 ± 0.19^{f}
15	6.85 ± 0.06^{def}	5.48 ± 0.04^{fghi}	5.88 ± 0.05^{e}	5.62 ± 0.15^{c}	5.26 ± 0.02^{fgh}	7.01 ± 0.07^{fghij}	7.43 ± 0.06^{ghij}	5.22 ± 0.02^{d}	5.80 ± 0.08^{f}	9.69 ± 0.04^{gh}	6.20 ± 0.08^{f}	5.35 ± 0.06^{def}	9.11 ± 0.09^{gh}
16	6.30 ± 0.04^{ef}	5.36 ± 0.01^{i}	5.73 ± 0.05^{e}	5.48 ± 0.12^{c}	5.27 ± 0.02^{fgh}	6.46 ± 0.07^{j}	6.69 ± 0.04^{j}	5.21 ± 0.03^{d}	5.62 ± 0.07^{f}	8.70 ± 0.03^{h}	6.17 ± 0.04^{f}	5.29 ± 0.03^{ef}	8.59 ± 0.10^{h}
17	7.16 ± 0.2^{d}	5.63 ± 0.05^{f}	6.28 ± 0.10^{de}	5.87 ± 0.3^{bc}	5.44 ± 0.06^{de}	7.54 ± 0.26^{ef}	8.04 ± 0.10^{efg}	5.35 ± 0.06^{c}	6.01 ± 0.23^{e}	11.93 ± 0.13^{ef}	7.15 ± 0.08^{de}	5.51 ± 0.06^{d}	11.81 ± 0.19^{f}

Data are expressed as mean $\pm$ SD, n = 3. Different letters within column denote statistical difference at $p < 0.05$. Del-3-gal, Delphinidin-3-galactoside; Del-3-glc, Delphinidin-3-glucoside; Cy-3-gal, Cyanidin-3-galactoside; Del-3-ara, Delphinidin-3-arabinoside; Cy-3-glc, Cyanidin-3-glucosid; Pet-3-gal, Petunidin-3-galactoside; Cy-3-ara, Cyanidin-3-arabinoside; Pet-3-glc, Petunidin-3-glucoside; Peo-3-glc, Peonidin-3-glucoside; Pet-3-ara, Petunidin-3-arabinoside; Mal-3-gal, Malvidin-3-galactoside; Mal-3-glc, Malvidin-3-glucoside; Mal-3-ara, Malvidin-3-arabinoside.