Supplementary Materials

Table S1. Retention time, resolution, peak symmetry, detection wavelengths, linear range, correlation coefficients (R^2), LOD and LOQ, intra-day precision and Inter-day precision for 24 colorants

Table S2. The recovery and precision of water-soluble colorants spiked in Premade cocktails (*n*=6)

Table S3. The intra-day precision and inter-day precision for 24 colorants

Table S4. Comparison of performance with other published methods (2014-2024)

Figure S1. Chromatogram for 24 pigments on four different chromatographic columns (520 nm)

Table S1. Retention time (RT), resolution, peak symmetry, detection wavelengths, linear range, correlation coefficients (R^2) [a], limits of detection (LOD) [b] limits of quantitation (LOQ) [c], Intra-day precision [d] and Inter-day precision [e] of colorants.

Peak	Compound	RT/ min	Peak symmetry	Detection wavelength/nm	Linear range µg/ mL	R^2	LOD µg/L	LOQ µg/L	Intra-day precision /%	Inter-day precision /%
1	Tartrazine	0.893±0.008	1.43	420	0.0036-50.0	0.9999	1.1	3.6	0.48	2.42
2	Amaranth	1.690±0.001	1.59	520	0.0058-50.0	0.9999	1.8	5.8	0.52	1.58
3	Ponceau s	4.003±0.003	1.71	520	0.0098-50.0	0.9999	2.9	9.8	0.12	3.57
4	Naphthol yellow S	2.0411±0.005	1.42	420	0.023-50.0	09999	6.9	23.0	0.11	2.82
5	Ponceau 4R	5.460±0.003	1.24	520	0.0045-50.0	0.9999	1.3	4.5	0.29	1.29
6	Sunset yellow	5.920±0.005	1.19	490	0.0035-50.0	0.9999	1.1	3.5	0.86	1.41
7	Orange G	6.263±0.006	1.22	490	0.009-50.0	0.9999	2.7	9.0	0.19	1.85
8	Allura red AC	6.957±0.003	1.17	520	0.0032-50.0	0.9999	1.0	3.2	0.31	1.45
9	Red 2G	7.430±0.001	1.17	520	0.0033-50.0	0.9999	1.0	3.3	0.41	1.45
10	Uranine	8.797±0.003	1.06	490	0.0052-20.0	0.9999	1.6	5.2	1.11	3.14
11	Azorubine	8.967±0.008	1.16	520	0.007-20.0	0.9998	2.1	7.0	0.2	1.65
12	Ponceau SX	9.373±0.003	1.19	520	0.0042-20.0	0.9997	1.3	4.2	0.23	1.34
13	Fast green FCF	9.753±0.007	1.37	620	0.0033-50.0	0.9999	1.0	3.3	1.09	1.48
14	Brilliant blue	10.057±0.003	1.17	620	0.0022-50.0	0.9999	0.7	2.2	1.1	0.89
15	Neutral Red	10.743±0.009	1.31	490	0.093-50.0	0.9995	27.8	93.0	0.35	3.95
16	Erythrosine	11.037±0.008	1.36	520	0.0053-50.0	0.9984	1.6	5.3	3.33	5.35
17	Orange II	11.677±0.008	1.18	490	0.0087-50.0	0.9999	2.6	8.7	0.57	3.45
18	Acid red 52	11.967±0.007	1.15	520	0.058-50.0	0.9999	1.7	5.8	0.25	1.01
19	Orange IV	12.923±0.003	1.19	420	0.0084-50.0	0.9981	2.5	8.4	3.04	5.44
20	Metanil yellow orange MNO	13.223±0.004	1.17	420	0.0068-50.0	0.9996	2.0	6.8	2.13	4.46
21	Chrysoidine Y	13.573±0.001	1.08	420	0.013-50.0	0.9991	3.8	13.0	1.51	3.87
22	Rhodamine B	14.907±0.001	1.11	520	0.0058-50.0	0.9998	1.7	5.8	0.63	3.97

23	Crystal violet	15.257±0.002	1.47	520	0.023-50.0	0.9997	6.9	23.0	1.42	5.36
24	Brilliant green	15.62±0.002	1.48	620	0.017-50.0	0.9998	4.9	17.0	2.97	4.73

[a] Calibration curves with compounds at concentrations of 0.01, 0.05, 0.1, 0.5, 1.0, 5.0, 8.0, 10.0, 20 and 50 μg/mL.

[b] The limit of detection (LOD) was evaluated based on signal-to-noise ratio of 3 (S/N=3).

[c] The l limit of quantization (LOQ) was evaluated based on signal-to-noise ratio of 10 (S/N=10).

[d] Intra-day precision was the maximum value of the three concentration calculation data (0.5, 5, 10ug/mL).

[e] Inter-day precision was the maximum value of the three-concentration calculation.

Table S2. Recovery and precision of water-soluble colorants spiked in premade cocktails (n=6).

Peak	Compound	Added (μg/mL)	Recovery%	RSD%	Peak	Compound	Added (μg/mL)	Recovery%	RSD%
1	Tartrazine	0.1	89.45	0.58	13	Fast green FCF	0.1	91.25	1.00
		0.5	88.15	1.02			0.5	94.08	1.94
		1.0	85.02	3.53			1.0	93.73	5.92
2	Amaranth	0.1	86.79	0.19	14	Brilliant blue	0.1	91.54	1.25
		0.5	90.79	1.92			0.5	93.82	3.44
		1.0	84.78	1.50			1.0	93.03	5.34
3	Ponceau s	0.1	90.01	0.35	15	Neutral Red	0.1	77.25	0.36
		0.5	92.20	0.48			0.5	76.86	2.84
		1.0	92.29	1.57			1.0	75.61	2.11
4	Naphthol yellow S	0.1	91.51	0.47	16	Erythrosine	0.1	81.21	0.56
		0.5	94.51	0.54			0.5	79.01	3.13
		1.0	95.89	2.84			1.0	82.14	5.52
5	Ponceau 4R	0.1	96.08	0.40	17	Orange II	0.1	91.83	0.80
		0.5	94.20	0.86			0.5	91.10	2.69
		1.0	93.29	2.17			1.0	89.31	3.48
6	Sunset yellow	0.1	95.57	0.55	18	Acid red 52	0.1	88.63	0.31
		0.5	94.13	0.66			0.5	92.57	0.71
		1.0	93.12	2.97			1.0	91.39	1.76
7	Orange G	0.1	94.24	0.40	19	Orange IV	0.1	114.45	0.57
		0.5	94.96	0.82			0.5	96.32	2.55
		1.0	95.40	2.35			1.0	108.59	3.49
8	Allura red AC	0.1	94.85	0.37	20	Metanil yellow orange	0.1	75.09	0.86
		0.5	94.30	0.87			0.5	77.81	4.27
		1.0	93.67	2.47			1.0	76.05	4.03
9	Red 2G	0.1	95.56	0.34	21	Chrysoidine Y	0.1	---	---
		0.5	94.90	0.54			0.5	---	---
		1.0	94.39	2.77			1.0	---	---
10	Uranine	0.1	80.03	1.00	22	Rhodamine B	0.1	77.93	1.48
		0.5	80.25	2.72			0.5	75.01	4.83
		1.0	76.83	5.95			1.0	76.07	4.78
11	Azorubine	0.1	88.16	0.26	23	Gentian violet	0.1	---	---
		0.5	88.93	1.15			0.5	---	---
		1.0	86.43	2.21			1.0	---	---
12	Ponceau SX	0.1	89.64	0.42	24	Brilliant green	0.1	---	---
		0.5	89.46	0.40			0.5	---	---
		1.0	86.49	3.08			1.0	---	---

Table S3. The intra-day precision and inter-day precision for 24 colorants

Peak	Compound	Intra-day precision /%	Inter-day precision /%
1	Tartrazine	0.48	2.42
2	Amaranth	0.52	1.58
3	Ponceau s	0.12	3.57
4	Naphthol yellow S	0.11	2.82
5	Ponceau 4R	0.29	1.29
6	Sunset yellow	0.86	1.41
7	Orange G	0.19	1.85
8	Allura red AC	0.31	1.45
9	Red 2G	0.41	1.45
10	Uranine	1.11	3.14
11	Azorubine	0.2	1.65
12	Ponceau SX	0.23	1.34
13	Fast green FCF	1.09	1.48
14	Brilliant blue	1.1	0.89
15	Neutral Red	0.35	3.95
16	Erythrosine	3.33	5.35
17	Orange II	0.57	3.45
18	Acid red 52	0.25	1.01
19	Orange IV	3.04	5.44
20	Metanil yellow orange MNO	2.13	4.46
21	Chrysoidine Y	1.51	3.87
22	Rhodamine B	0.63	3.97
23	Gentian violet	1.42	5.36
24	Brilliant green	2.97	4.73

Table S4. Comparison of performance with other published methods (2014-2024)

Method/ number of colorants	Pretreatment	analysis time /min	Matrix	Same colorants	Linear Range (μg/mL)	LOD (μg/L)	Recovery (%)	Reference
HPLC-DAD/ **24**	Solid-phase extraction (SPE)	16min	Premade cocktail	Tartrazine	0.0036-50.0	1.09	88.15	presented method
				Amaranth	0.0058-50.0	1.75	90.79	
				Naphthol yellow S	0.023-50.0	6.91	96.08	
				Ponceau 4R	0.0045-50.0	1.34	96.48	
				Sunset yellow	0.0035-50.0	1.06	95.57	
				Orange G	0.009-50.0	2.69	95.12	
				Allura red AC	0.0032-50.0	0.97	94.85	
				Red 2G	0.0033-50.0	1.00	93.45	
				Uranine	0.0052-20.0	1.57	79.61	
				Azorubine	0.007-20.0	2.11	88.93	
				Ponceau SX	0.0042-20.0	1.25	89.64	
				Fast green FCF	0.0033-50.0	0.98	94.08	
				Brilliant blue	0.0022-50.0	0.66	93.82	
				Erythrosine	0.0053-50.0	1.58	77.11	
				Acid Orange II	0.0087-50.0	2.62	91.83	
				Acid red 52	0.058-50.0	1.74	92.57	
				Rhodamine B	0.0058-50.0	1.74	76.58	
UPLC-MS/MS **7**	magnetic dispersive solid-phase extraction (MD-SPE)	9min	wine and soft drinks	Tartrazine	0.005~1.0	1.25	84.0~116.2	[34] Journal of Chromatography A, **2014**
				Amaranth	0.005~1.0	1.51		
				Ponceau 4R	0.0025~0.5	1.00		
				Sunset yellow	0.005~1.0	0.45		
				Allura red AC	0.005~1.0	1.22		
				Brilliant blue	0.0025~0.5	0.71		
				Erythrosine	0.005~1.0	0.50		
UPLC-MS/MS **5**	simple pretreatment	6min	Red wine	Tartrazine	0.001~0.3	0.30	92.1	[33] Food Analytical Methods, **2015**
				Amaranth	0.0015~0.3	0.50	92.7	
				Sunset yellow	0.001~0.1	0.03	94.4	
				Allura red AC	0.001~0.1	0.10	93.6	
				Brilliant blue	0.001~0.1	0.01	96.4	
HPLC-DAD **10**	Liquid-liquid extraction	30min	yogurt and drink	Tartrazine	0.5~25	1.22	82~115	[23] Food Chemistry, **2014**
				Sunset yellow	0.5~25	1.06		
				Azorubine	0.5~25	1.32		
				Amaranth	0.5~25	1.41		
				Ponceau 4R	0.5~25	1.20		
				Erythrosine	0.5~25	0.37		
				Allura red AC	0.5~25	4.58		
				Brilliant blue	0.5~25	0.18		

HPLC-MS/MS **18** synthetic colorants	Solid-phase extraction (SPE)	11min	Ice cream.etc	Tartrazine Sunset yellow Azorubine Amaranth Ponceau 4R Erythrosine Red 2G Allura red AC Brilliant blue Fast green FCF	0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07 0.01~0.07	5.00 2.00 2.00 5.00 2.00 10.00 2.00 5.00 5.00 5.00	86.8~130.8	[35] Food Chemistry, **2016**
HPLC-UV **8**	Solid-phase extraction(SPE)	17min	drink	Tartrazine Sunset yellow Azorubine Amaranth Ponceau 4R Allura red AC Brilliant blue	5~50 5~50 5~50 5~50 5~50 5~50 5~50	190 147 106 105 146 1154 105	94.2~106.7	[28] Tropical Journal of Pharmaceutical Research, **2016**
HPLC-DAD **11**	Matrix assisted dispersion solid-phase extraction	20min	drink and yogurt	Tartrazine Amaranth Ponceau 4R Sunset yellow Allura red AC Red 2G Azorubine Brilliant blue	0.01~2 0.01~2 0.01~2 0.01~2 0.01~2 0.01~2 0.01~2 0.01~2	11.00 11.00 9.00 10.00 11.00 12.00 13.00 8.00	79.3~101.0	[24] Food Analytical Methods, **2017**
HPLC-DAD, **8**	Liquid-liquid microextraction method	25min	beverage	Tartrazine Amaranth Ponceau 4R Sunset yellow Allura red AC Erythrosine Brilliant blue Azorubine	0.005~1.0 0.005~1.0 0.005~1.0 0.005~1.0 0.005~1.0 0.005~1.0 0.005~1.0 0.005~1.0	0.016 0.024 1.12 0.028 0.33 1.02 1.04 0.026	90.9 89.4 83.1 74.5 102.5 81.4 76.4 82.5	[22] Food Chemistry, **2018**
HPLC-UV-Vis **6**	Dispersion solid-phase extraction method	19min	drink	Tartrazine Amaranth Ponceau 4R Sunset yellow Brilliant blue	0.5~2 0.5~2 0.5~2 0.5~2 0.5~2	150 150 150 150 150	76~108	[25] J. Braz. Chem. Soc, **2018**
LC - MS/MS, **15**	Liquid-liquid extraction	5min	Tomato sauce, cotton candy, and cucumber pickle	Rahodamine B Acid Orange II Azorubine Ponceau SX	0.001~0.1 0.001~0.1 0.001~0.1 0.001~0.1	2.50 5.40 4.10 1.40	97.6 119.8 100.1 100.6	[36] Arabian Journal of Chemistry，**2020**

				Red 2G	0.001~0.1	3.50	102.6
				Orange G	0.001~0.1	2.90	93.0
UPLC-MS/MS, **52**	A variety of pretreatment methods	13min	chili sauce	Acid Orange II	0.001~0.02	49.75	101.9
				Rhodamine B	0.001~0.02	0.14	81.1
				Naphthol yellow S	0.001~0.02	1.03	73.8
				Gentian violet	0.001~0.02	0.03	81.9
				Orange IV	0.001~0.02	12.25	107.7
				Orange G	0.001~0.1	13.7	109.7
				Acid red 53	0.001~0.1	15.83	90.2
HPLC-DAD, **3**	Dispersive solid-phase microextraction	15min	beverages, pastilles, and candies	Tartrazine	0.008~4.2	0.07	105.58
				Sunset yellow	0.015~4.5	0.28	96.34
				Allura red AC	0.012~4.0	0.15	103.65
HPLC-DAD, **34**	Liquid-liquid extraction	13min	beverages and candies	Tartrazine	0.25~32.0	11.20	87.5~104
				Amaranth	0.125~16.0	17.20	
				Ponceau 4R	0.25~32.0	57.50	
				Sunset yellow	0.125~16.0	7.05	
				Orange G	0.25~32.0	7.47	
				Allura red AC	0.25~32.0	11.50	
				Red 2G	0.25~32.0	17.40	
				Gentian violet	0.25~32.0	6.54	
				Azorubine	0.25~32.0	19.90	
				Ponceau SX	0.25~32.0	8.73	
				Fast green FCF	0.125~16.0	4.78	
				Brilliant blue	0.25~32.0	7.75	
				Erythrosine	0.25~32.0	10.90	
				Acid Orange II	0.125~16.0	13.60	
				Acid red 52	0.125~16.0	4.99	
				Rhodamine B	0.25~32.0	11.40	
				Uranine	0.125~16.0	3.39	
				Chrysoidine Y	0.25~32.0	9.47	

[37] Food Chemistry, **2020**				
[41] Microchemical Journal, **2023**				
[42] Journal of Food Composition and Analysis, **2024**				

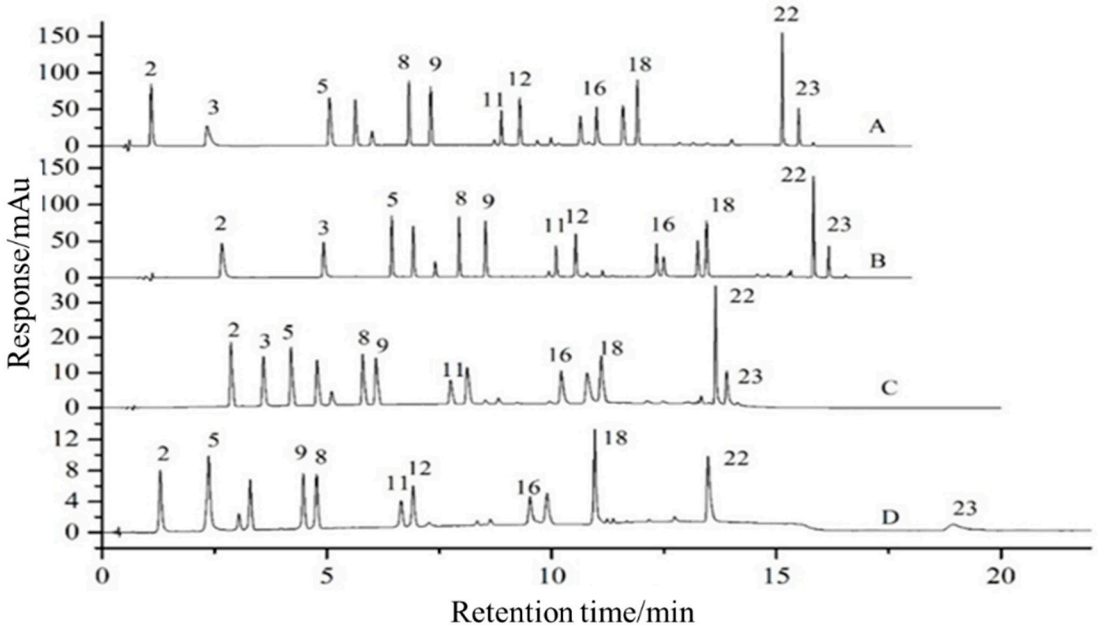


Figure S1. Chromatogram for 24 pigments on four different chromatographic columns 520 nm)
(A: Waters Acquity UPLC BEH C_{18}, 2.1×50 mm, 1.7 μm;
B: Waters Acquity UPLC BEH C_{18}, 2.1×100 mm, 1.7 μm;
C: Shimadzu Shim-pack XR-ODS, 3.0×75 mm, 2.2 μm;
D: Agilent Zorbax SB-C_{18}, 4.6×50 mm,1.8 μm)