Solving the Challenge of Multi-Component Detection of Organic Acids in Food — Chromai Parallel Liquid Chromatography Technology: Simultaneous Determination of 7 Compounds with Higher Accuracy

I. Introduction

During food processing and storage, organic acids play a vital compositional role. They have a significant impact on the color, aroma, and taste of food. Moreover, a higher content of organic acids in food leads to a lower pH, which helps preserve the product. Therefore, determining the content of organic acids in food is of great importance. In this application, the Leaps Duo Parallel Liquid Chromatography System was used to establish a highly efficient method for determining the content of seven organic acids in food. This method allows simultaneous analysis of all seven compounds, reducing analysis time and significantly improving work efficiency.

一、II. Experimental Conditions

1. Instruments: Leaps Duo (P60 dual ternary gradient pumps, A10D dual-valve autosampler, C10 column oven, D10×2 UV detectors)

2. Reference standards: Seven organic acid reference standards (Tartaric acid, Malic acid, Lactic acid, Citric acid, Succinic acid, Fumaric acid, Adipic acid)

III. Chromatographic Conditions for Group I

1. Column: Lotus C18 (4.6 × 250 mm, 5μm)
2. Column Temperature: 40 ℃
3. Injection Volume: 20 μL
4. Detection Wavelength: 210 nm
5. Mobile Phase:：A：0.1 %phosphoric acid solution—methanol = 97.5 + 2.5 (v/v),

B： Methanol

6. Gradient Table:：

Time（min）	Pump（mL/min）	A%
0	1.0	100
10.0	1.0	100
10.1	1.0	0
15.0	1.0	0
15.1	1.0	100

IV. Injection Volume: 20 μL

1. Detection Wavelength: 210 nm
2. Temperature: 40 ℃
3. Injection Volume: 20 μL
4. Detection Wavelength: 210 nm
5. Phase: 0.1% phosphoric acid solution—methanol = 75 + 25 (v/v), isocratic

elution for 10 minutes

V. Experimental Results

1. Chromatogram of Standard Solution

In this application, all compounds in Group I and Group II exhibited good peak shapes and high resolution. The chromatogram of the standard solution is shown in Figure 1.

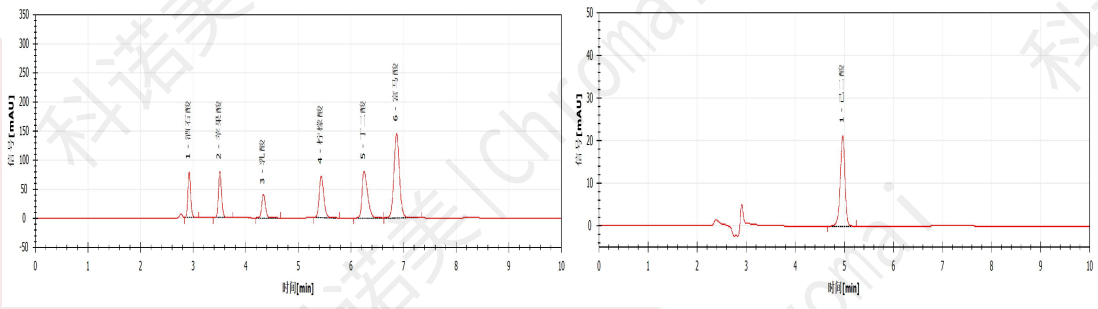

Figure 1 Spectra of standard solutions (left: Group I; right: Group II)

Table 1 System suitability results

Group	Peak	Compound	Concentration (μg/mL)	Retention Time	Column Efficiency	Resolution
I	1	Tartaric Acid	200	2.929	16486.432	–
	2	Malic Acid	400	3.513	17195.517	5.882
	3	Lactic Acid	400	4.341	20576.119	7.254
	4	Citric Acid	400	5.439	18499.184	7.815
	5	Succinic Acid	1000	6.254	18218.550	4.717

	6	Fumaric Acid	0.4	6.873	20731.148	3.287
II	1	Adipic Acid	200	4.972	13940.497	–

2. Calibration Curve and Detection Limit

Standard working solutions were injected sequentially from low to high concentrations. The standard curve was plotted with the concentration of each point on the x-axis and the corresponding peak area on the y-axis. Each compound showed excellent linearity within its concentration range, with a correlation coefficient (R^2) of 1.0000.

Group	Peak	Compound	Concentration (μg/mL)	Regression equation	Correlation coefficient	LOD (μg/mL)	LOQ (μg/mL)
I	1	Tartaric Acid	50~1000	y = 1.4077x – 1.8706	r=1.0000	0.248	0.826
	2	Malic Acid	100~2000	y = 0.8127x – 0.3724	r=1.0000	0.480	1.602
	3	Lactic Acid	100~2000	y = 0.4853x – 2.7158	r=1.0000	0.959	3.197
	4	Citric Acid	100~2000	y = 1.102x – 0.1203	r=1.0000	0.536	1.786
	5	Succinic Acid	250~5000	y = 0.5676x + 0.3392	r=1.0000	1.128	3.762
	6	Fumaric Acid	0.1~2	y = 2683.9x – 5.6228	r=1.0000	0.000262	0.000874
II	1	Adipic Acid	10~200	y = 0.8473x – 0.2872	r=1.0000	0.484	1.613

Table 2. Results of Calibration Curve and Detection Limit

3. Precision

The standard solution was injected six consecutive times. The relative standard deviation (RSD%) of retention time was less than 0.15%, and the RSD% of peak area was less than 0.6%, indicating excellent system precision.

Table 3. Results of Precision Test

Group	Concentration	Compound	Retention time RSD%	Peak area RSD%
I	100μg/mL	Tartaric Acid	0.09%	0.16%
	200μg/mL	Malic Acid	0.08%	0.17%
	200μg/mL	Lactic Acid	0.07%	0.53%
	200μg/mL	Citric Acid	0.13%	0.15%
	500μg/mL	Succinic Acid	0.11%	0.09%
	0.2μg/mL	Fumaric Acid	0.09%	0.21%
II	20μg/mL	Adipic Acid	0.08%	0.56%

4. Actual Sample Test (Orange Juice from a Certain Brand)

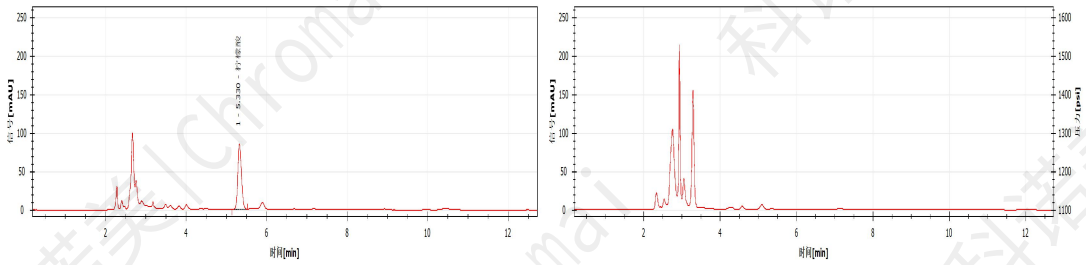

Figure 2. Chromatogram of the actual sample test (Left: Group I; Right: Group II)

Table 4. Results of the actual sample test

Group	Peak	Compound	Peak area (mAU.s)	Content (g/kg)
I	1	Tartaric Acid	Not detected	/
	2	Malic Acid	Not detected	/
	3	Lactic Acid	Not detected	/
	4	Citric Acid	527.819	2.395
	5	Succinic Acid	Not detected	/
	6	Fumaric Acid	Not detected	/
II	1	Adipic Acid	Not detected	/

VI. Conclusion

In this application, the Chromai Leaps Duo Parallel Liquid Chromatography System was used to establish a rapid method for determining the content of seven organic acids in food. Tests were performed for the standard curve, detection limit, and precision, all of which met the requirements of the national standard for the determination of organic acids. The Chromai Leaps Duo Dual-Injection High-Performance Liquid Chromatography System enables simultaneous analysis of different items from the same sample, reducing analysis time by half and significantly improving work efficiency.