SHIMADZU
Excellence in Science

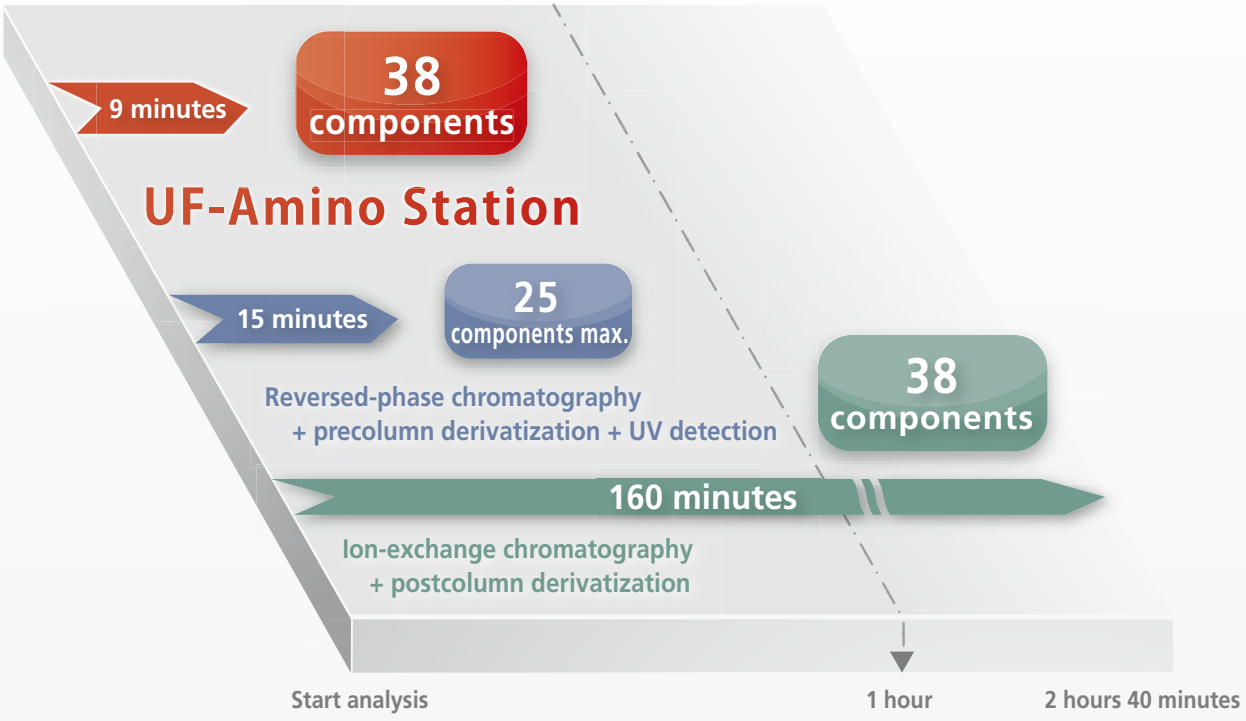
C190-E154

LC/MS Ultra Fast Amino Acid Analysis System

UF-Amino Station

New UF-Amino Station Offers Simultaneous

Analyze 38 amino acid components in just nine minutes!



Two major problems exist with traditional amino acid analysis techniques. The first technique (ion-exchange chromatography with postcolumn derivatization) allows many components to be analyzed at once but the method run times are long. The second technique (reverse-phase HPLC with pre-column derivatization) enables faster analysis but the number of analyzed components is limited. As a result, chemists are forced to make a decision to either analyze a large number of components or have a fast method. UF-Amino Station overcomes these limitations. Jointly developed by Shimadzu and Ajinomoto Co., Inc., it features a special-purpose, fast analysis column and a LCMS-2020 mass spectrometer, which supports ultra-fast analysis speeds, to achieve the simultaneous analysis of 38 amino acid and amino acid-related components* in just nine minutes. Additionally, it automates the derivatization reaction to eliminate the need for cumbersome pretreatment procedures by manual operation. UF-Amino Station is an excellent tool for the analysis of food products, such as meat and fermented foods containing many impurity components, and for the biochemical analysis of culture fluid.

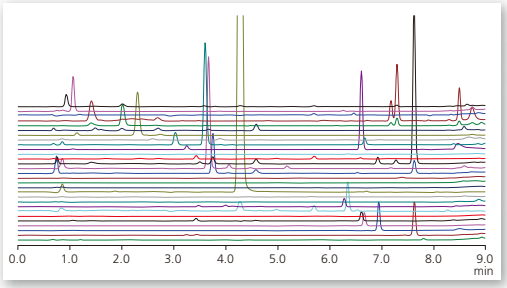
* Permits the analysis of 38 amino acid-related components, such as anserine, citrulline, taurine, and GABA (γ-aminobutyric acid), in addition to the 20 major amino acid components.

Multicomponent Analysis for Enhanced Throughput

Opening Up a New World of Amino Acid Analysis

Fast Simultaneous Analysis of 38 Amino Acid Components in Nine Minutes

The combination of a special-purpose, fast-analysis column and LC/MS allows for shorter analysis times than conventional techniques.



Analysis of 38 components in nine minutes

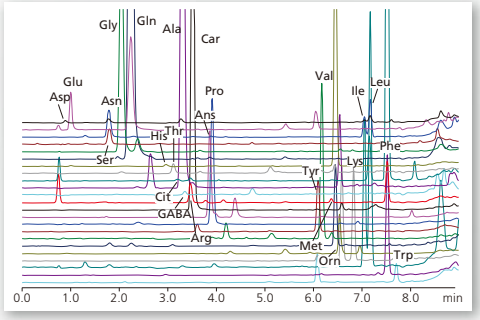
AmiNavi™ Software Simplifies Operation

Analyze a sample quickly and efficiently with AmiNavi dedicated software, which provides complete support for the full range of analysis operations.

AmiNavi Software

LC/MS Offers Superb Detection Selectivity

Using an LC/MS instrument provides accurate analytical results even with difficult samples containing many impurities.



Amino acid analysis of meat extract

Automated Derivatization Improves Efficiency and Reliability

A fully automated derivatization can occur by using an autosampler to automatically pretreat the sample, eliminating concerns about human error during the derivatization process.

Automated derivatization reaction using an autosampler

Fast Simultaneous Analysis of 38 Amino Acid Components in Nine Minutes

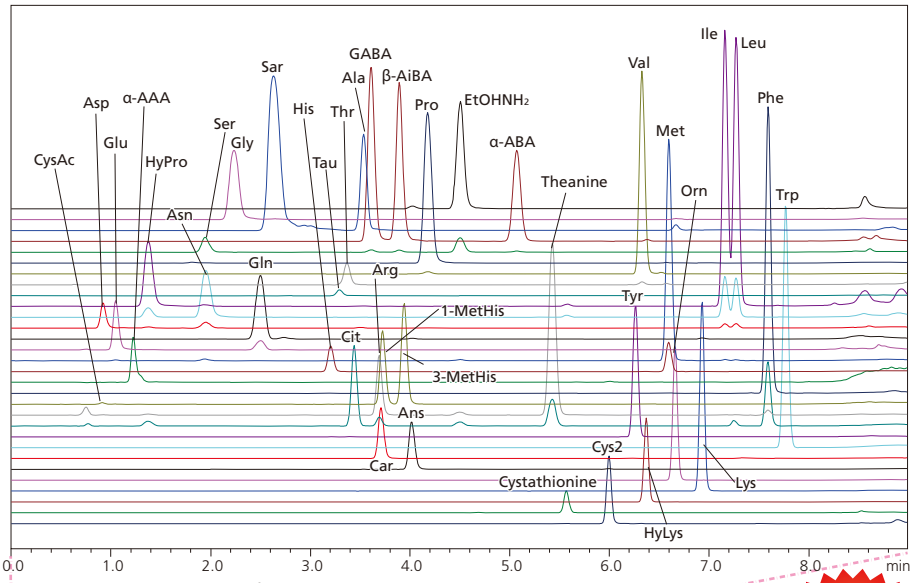
Rapid separation combined with LC/MS detection results in the simultaneous analysis of 38 biogenic amino acid components in just nine minutes. The ability to analyze up to 96 samples in 24 hours ensures exceptional performance for multi-sample analysis.

The increased speed supports new applications, such as real-time amino acid composition analysis in culture fluid, that were difficult to handle using conventional techniques.

About 18 Times Faster

Biogenic amino acid analysis using a combination of ion-exchange chromatography and postcolumn derivatization requires over two hours to achieve multicomponent separation. In contrast, UF-Amino Station can analyze 38 biogenic amino acid components in just nine minutes. This analysis time is about 18 times shorter, enabling a significant improvement in throughput and productivity.

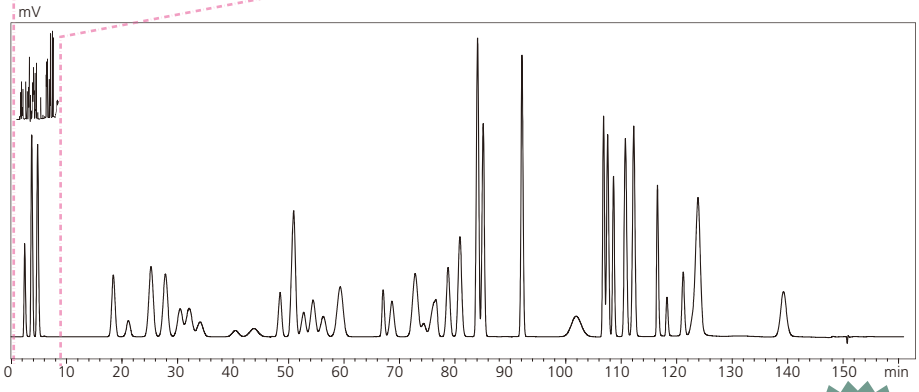
UF-Amino Station



Analysis of 38 Amino Acid Components by UF-Amino Station

9 minutes

Ion-exchange chromatography + postcolumn derivatization + fluorescence detector



Analysis of 38 Amino Acid Components by Ion-exchange Chromatography (Li type) and Postcolumn Derivatization

160 minutes

LC/MS Offers Superb Detection Selectivity

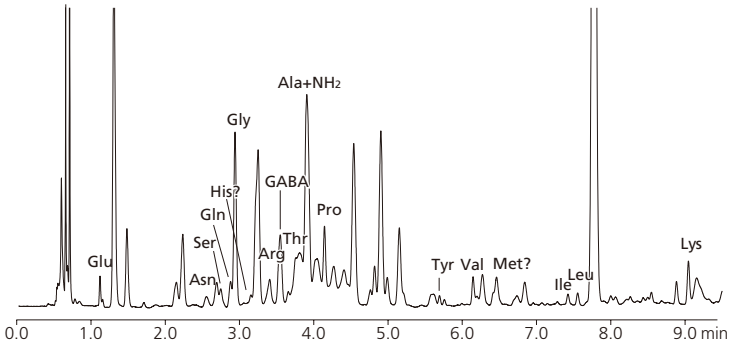
A method using precolumn derivatization and UV detection combined with reversed-phase column separation can be used to reduce analysis times. However, it may not achieve adequate separation and the reliability of the analysis results may be limited in cases with numerous target components, such as biogenic amino acids, or if the sample contains many impurities. By using an LC/MS instrument as the detector, UF-Amino Station permits highly reliable analysis even when analyzing a large number of target components or if the sample contains a complex matrix.

LC/MS Permits Qualification and Quantitation of Peaks that Cannot be Separated by HPLC

Since analysis by pre-column derivatization and UV detection lacks selectivity, quantitation can be adversely affected by inadequate separation on the column. As shown in the diagram below, commercially available skim milk powder can be difficult to analyze via pre-column derivatization using PTC and UV detection because of the difficulty in the separation of multiple amino acid components and impurities. UF-Amino Station utilizes LC/MS technology for quantitation by using particular mass to charge ratios for each amino acid.

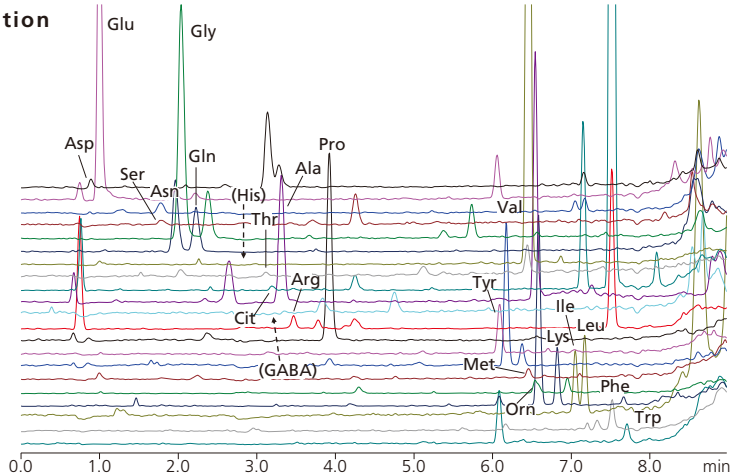
By utilizing LC/MS the UF-Amino Station delivers the benefits of a highly selective detector, allowing for better analytical results.

PTC precolumn derivatization + UV detection



Amino Acid Analysis of Commercial Skim Milk Powder (PTC precolumn derivatization + UV detection)

UF-Amino Station



Amino Acid Analysis of Commercial Skim Milk Powder (UF-Amino Station)

AmiNavi™ Dedicated Software Simplifies Operation

AmiNavi software supports all operations from analysis setup to checking quantitation results.

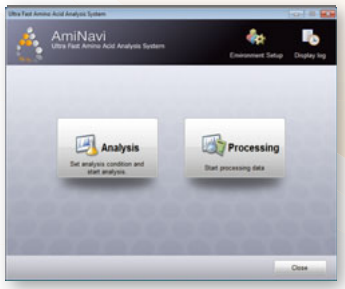
AmiNavi completely eliminates the need or time to create complex method files or sequence files. Simply install the column, the mobile phase, and the autosampler rinse solution on the system and then run AmiNavi. The software guides the user through the rest of the parameters in order to create an analytical sequence. Once completed, load the samples and reaction reagents as directed and allow the software to run so that it can sequentially analyze the samples. The system will automatically shut down after completing analysis in order to conserve both power and mobile phase.

Simply follow the on-screen wizard to create analysis sequences, check analysis results, or print reports.

Analysis Operation

Step 1

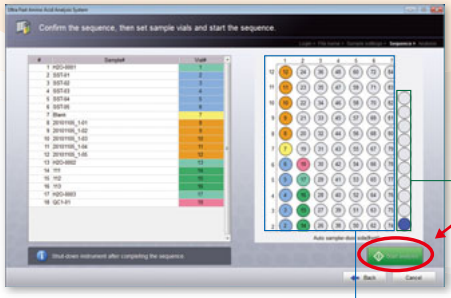
Run AmiNavi.



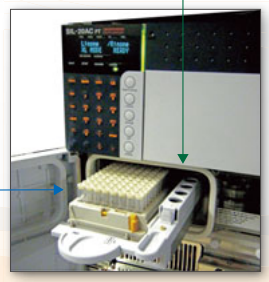
Step 2

Load vials and start analysis.

Sequence Check Screen

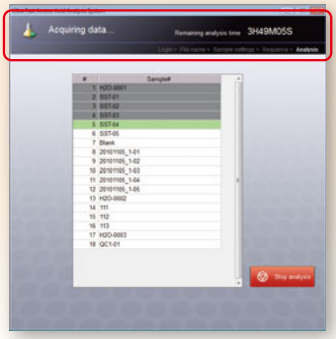


Start analysis



Load the sample vials and reaction reagent vials in the graphically displayed positions. Click [Start] to start the automated analysis.
The status and time remaining are displayed during the analysis.

Analysis Screen



Displays run status and time remaining

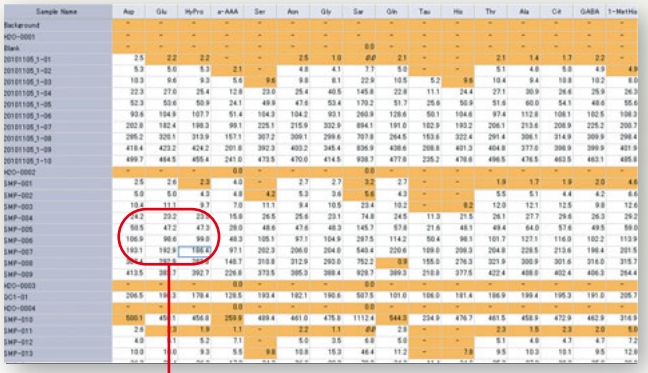
AmiNavi displays the quantitation results when the analysis is complete. It automatically identifies standard sample peaks, creates the calibration curve, and performs quantitation of the sample solution. This makes it simple to observe the quantitation results for multiple samples without the need to perform any difficult or time-consuming analysis operations. The report template can be used to generate a quantitation results report with just one click.

Checking the Analytical Results

Step 3

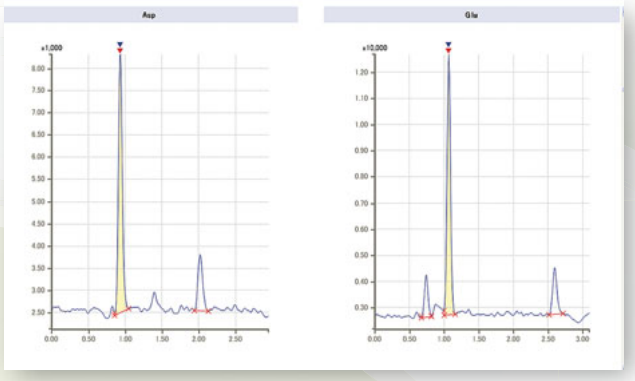
Display of analytical results

Table Displaying the Analytical Results



The amino acid content of each sample is displayed as a table.

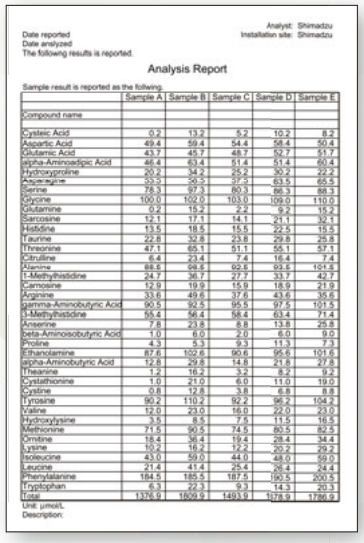
Quantitation Data Check Screen



The analytical data can be viewed as a table or as chromatograms for each component.

Step 4

Generate quantitation results report.



Analyst: Shimadzu
Installation site: Shimadzu

Date reported
Date analyzed
The following results is reported.

Analysis Report

Sample result is reported as the following.

Compound name	Sample A	Sample B	Sample C	Sample D	Sample E
Cysteic Acid	0.2	13.2	5.2	10.2	8.2
Aspartic Acid	49.4	59.4	54.4	58.4	50.4
Glutamic Acid	43.7	45.7	48.7	52.7	51.7
alpha-Aminoadipic Acid	46.4	63.4	51.4	51.4	60.4
Hydroxyproline	29.2	34.2	25.2	30.2	22.2
Asparagine	53.5	56.5	57.5	63.5	65.5
Serine	78.3	97.1	80.3	86.3	88.3
Glycine	100.0	102.0	103.0	109.0	110.0
Glutamine	9.2	15.2	2.2	9.2	15.2
Sarcosine	12.1	17.1	14.1	21.1	32.1
Histidine	13.5	18.5	15.5	22.5	15.5
Taurine	22.8	32.8	23.8	29.8	25.8
Threonine	47.1	65.1	51.1	55.1	57.1
Citrulline	6.4	23.4	7.4	16.4	7.4
Alanine	88.6	98.6	92.6	93.6	101.6
1-Methylhistidine	24.7	36.7	27.7	33.7	42.7
Carnosine	12.9	19.9	15.9	18.9	21.9
Arginine	33.6	49.6	37.6	43.6	35.6
gamma-Aminobutyric Acid	90.5	92.5	95.5	97.5	101.5
3-Methylhistidine	55.4	56.4	58.4	63.4	71.4
Anserine	7.8	23.8	8.8	13.8	25.8
beta-Aminoisobutyric Acid	1.0	6.0	2.0	6.0	9.0
Proline	4.3	5.3	9.3	11.3	7.3
Ethanolamine	87.6	102.6	90.6	95.6	101.6
alpha-Aminobutyric Acid	12.8	29.8	14.8	21.8	27.8
Theanine	1.2	16.2	3.2	8.2	9.2
Cystathionine	1.0	21.0	6.0	11.0	19.0
Cystine	0.8	12.8	3.8	6.8	8.8
Tyrosine	90.2	110.2	92.2	96.2	104.2
Valine	12.0	23.0	16.0	22.0	23.0
Hydroxylysine	3.5	8.5	7.5	11.5	16.5
Methionine	71.5	90.5	74.5	80.5	82.5
Ornithine	18.4	36.4	19.4	28.4	34.4
Lysine	10.2	16.2	12.2	20.2	29.2
Isoleucine	43.0	59.0	44.0	48.0	59.0
Leucine	21.4	41.4	25.4	26.4	34.4
Phenylalanine	184.5	185.5	187.5	190.5	200.5
Tryptophan	6.3	22.3	9.3	14.3	20.3
Total	1376.9	1609.9	1493.9	1578.9	1786.9

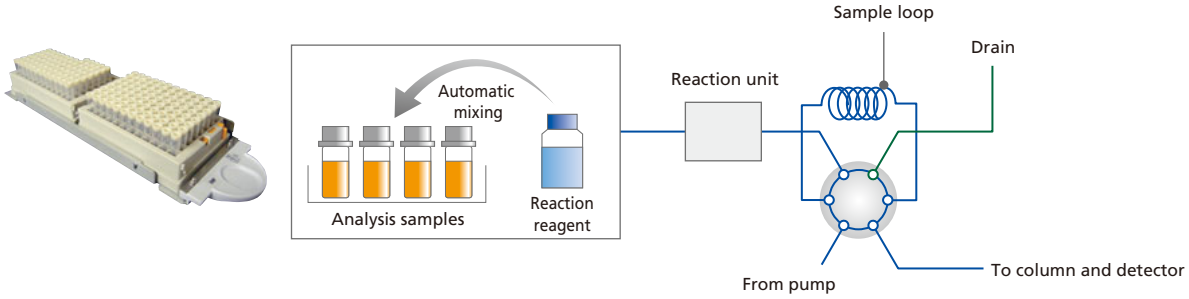
Unit: μmol/L
Description:

The template can be edited to generate reports in the required format.

Automated Derivatization Improves Efficiency and Reliability

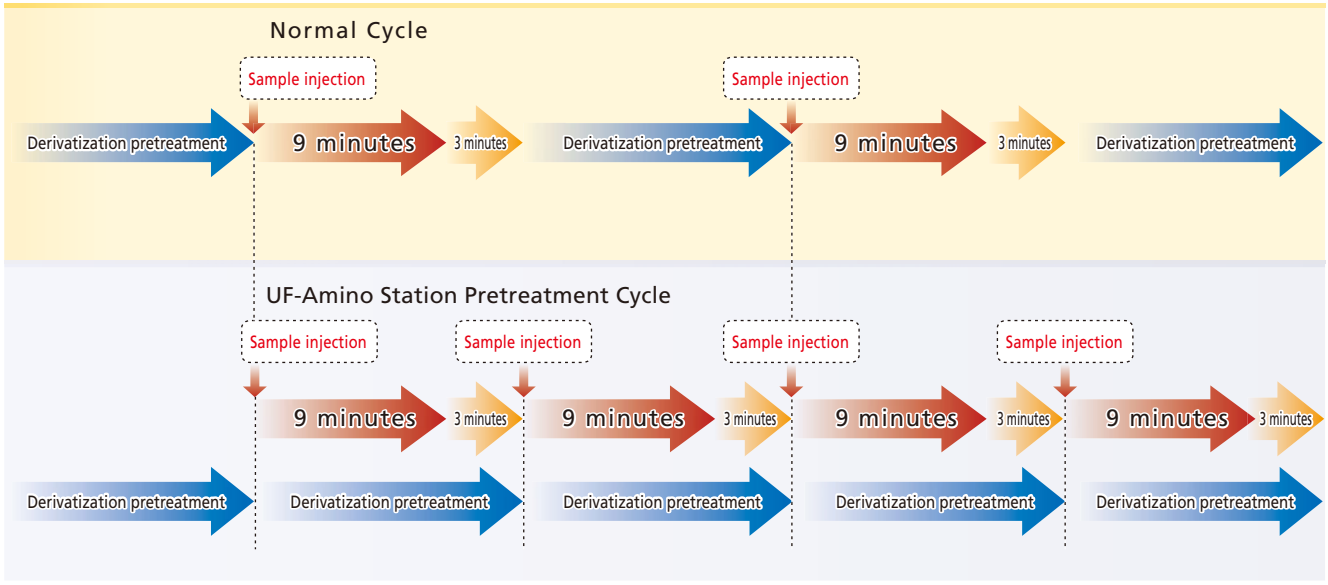
The UF-Amino Station automatic pretreatment functions improve the efficiency of the derivatization process and enhance the reliability of the results. Simply load the samples and reaction reagents, and the instrument automatically completes the series of operations from derivatization to injection into the HPLC.

Derivatization by Automatic Pretreatment



The autosampler pretreatment functions are used to draw in the sample and reaction reagent and to mix them with the reaction solution.
The mixed sample is loaded into the heated reaction unit where it is heated to promote the derivatization reaction. The reacted sample is then introduced into the sample loop and injected.
The automated pretreatment process enhances the reproducibility of the derivatization and improves efficiency.

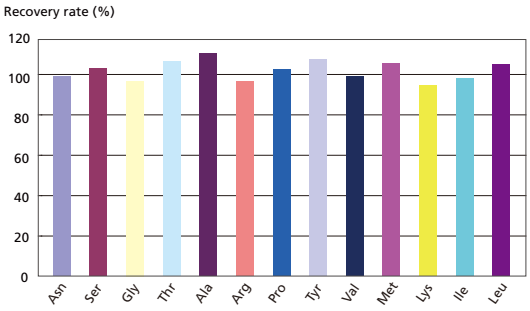
Analysis and Pretreatment in Parallel Improves Efficiency



When the sample solution that was derivatized by automatic pretreatment is injected into the column and analysis starts, the autosampler starts the derivatization of the next sample. While chromatographic analysis is being performed on the one sample, the next sample, derivatization reagent, and reaction solution are mixed and introduced into the reaction unit. This process eliminates time losses and improves analytical efficiency. In addition, the short analysis times and low mobile phase flow rate (0.3 mL/minute) reduce the mobile phase consumption. This reduces running costs and lowers the environmental impact.

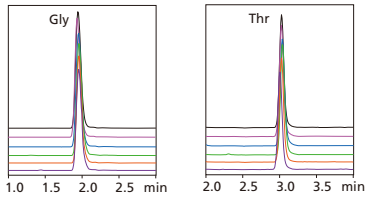
Automatic Pretreatment Enhances Reliability of Analysis Results

UF-Amino Station uses automatic pretreatment to ensure a more stable derivatization reaction. The excellent selectivity of LC/MS detection achieves high recovery rates for complex samples such as skim milk powder.
Correction by an internal standard ensures adequate reproducibility and calibration curve linearity.



Amino Acid Recovery Rates for Commercial Skim Milk Powder

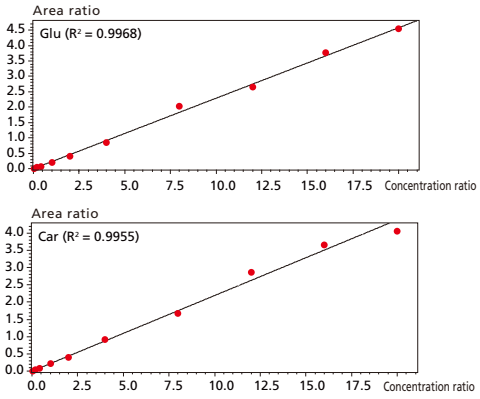
The graph above shows the recovery rates from a commercial skimmed milk powder sample spiked with amino acids. It indicates that excellent recovery rates between 80% and 120% can be obtained, even from a complex sample.



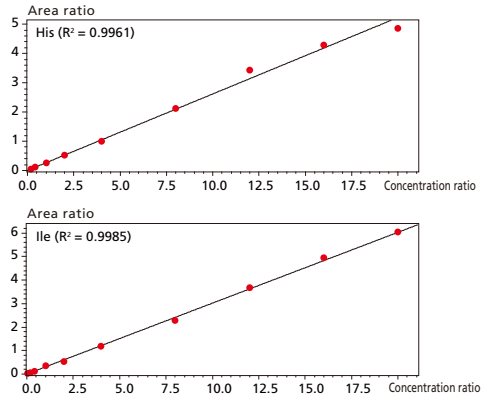
%RSD	Asp	Gly	Thr	Arg	Val
Retention time	0.139	0.319	0.338	0.822	0.108
Area ratio	1.131	2.783	1.967	3.274	3.059

Reproducibility of Area Ratio and Retention Time
(n=6, concentration=500 nmol/mL, each component)
(Internal Standard Correction)

The diagrams above show the retention time and area ratio reproducibility for major amino acid components.
Quantitation is performed using a designated internal standard to ensure peak area ratio reproducibility.



The graphs above show the calibration curves from 1 nmol/mL to 500 nmol/mL concentration for analysis of major amino acid components.



Good linearity is achieved with more than 0.995 coefficient of determination.

Shim-pack UF-Amino Column

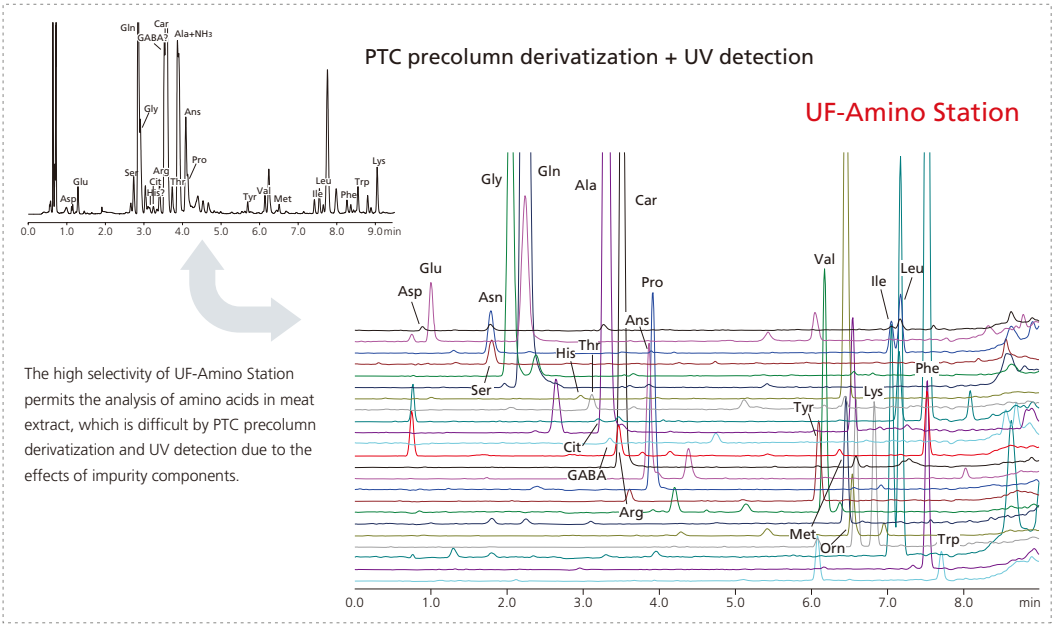
Shim-pack UF-Amino is a specialty optimized for the high-speed, high-resolution analysis of amino acids. Using the specially designated mobile phase* ensures excellent separation performance.

* Mobile phase and reagents can be purchased from Wako Pure Chemical Industries, Ltd.

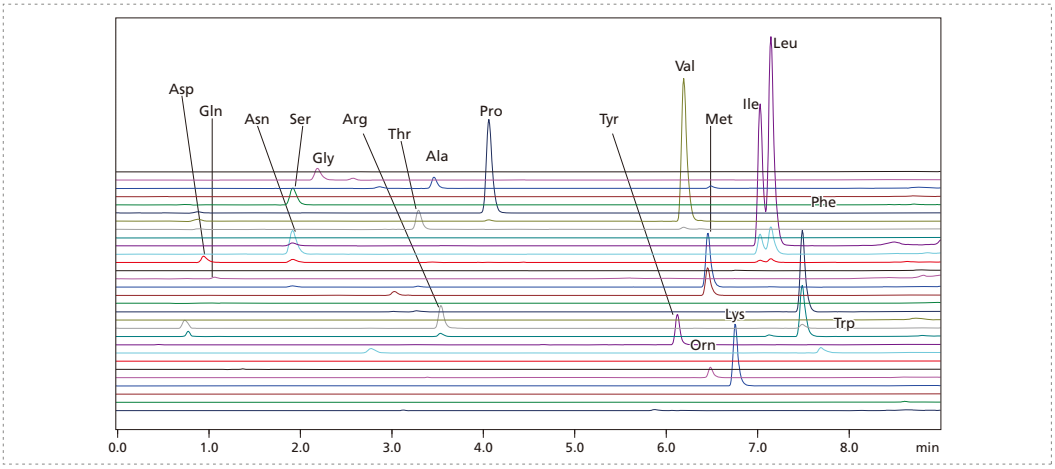
Diverse Applications Using UF-Amino Station

Analysis of meat extracts using PTC pre-column derivatization and UV detection results in amino acid peaks that overlap each other or suffer matrix interference, which often impair the accuracy of quantitation. UF-Amino Station exploits the high selectivity of LC/MS to offer accurate detection and quantitation, even in complex matrices like meat extracts or culture fluids.
Naturally, it can also be applied to the conventional quantitative analysis of amino acids in beverages and fermented foods.

Reliable Analysis of Samples with Significant Impurities



Analysis of Amino Acids in Meat Extract

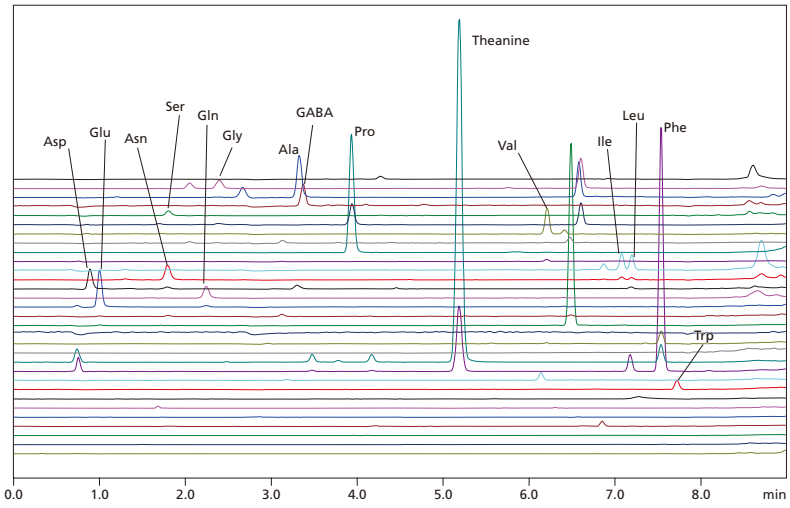


Amino Acid Analysis in Commercial Serum-Free Medium (supplied by Ajinomoto Co., Inc.)

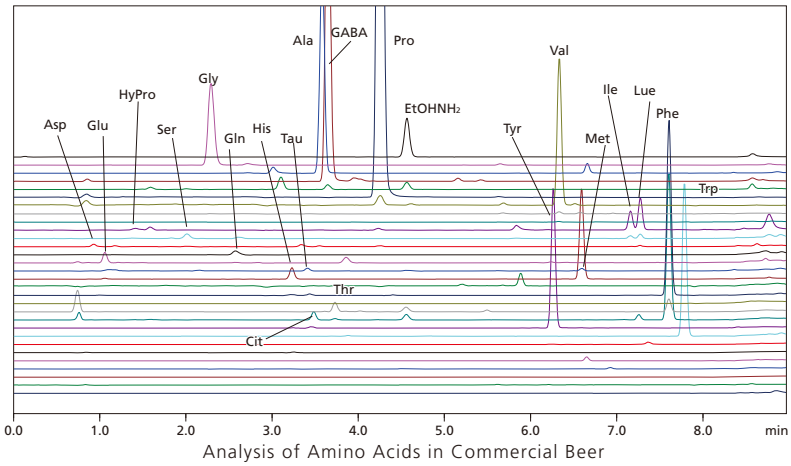
Amino acid concentration is an important indicator for controlling cellular activity in a cell culture medium or culture fluid. UF-Amino Station permits the highly selective detection of target amino acids in such samples that contain a complex matrix including metabolites. The ultrafast, nine-minute analysis time permits real-time monitoring of amino acid concentrations, which vary from moment to moment.

Faster Analysis of Food and Biological Samples

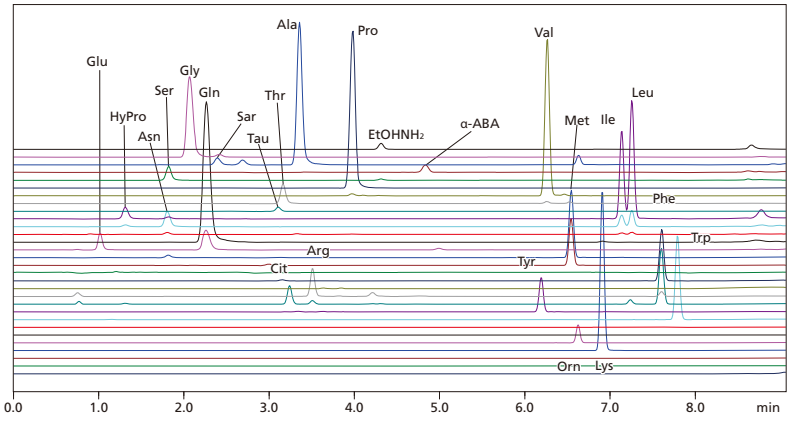
An excellent tool for the analysis of multiple samples in the fields of foods and biochemistry, UF-Amino Station improves analytical efficiency, even for samples such as beverages and blood plasma for which amino acid analysis is already established.



Analysis of Amino Acids in Commercial Tea Drink



Analysis of Amino Acids in Commercial Beer



Analysis of Amino Acids in Rat Blood Plasma

Shimadzu Solutions for Amino Acid Analysis

Besides UF-Amino Station, Shimadzu offers an extensive range of other products suitable for amino acid analysis.

	UF-Amino Station	Shimadzu Postcolumn Amino Acid Analysis System	Shimadzu UFLC System (Precolumn Derivatization)	Shimadzu GC/MS Amino Acid Analysis System (EZ:faast)
I need to analyze hydrolyzed amino acids.	✓✓✓	✓✓✓	✓✓✓	✓✓✓
I need to analyze biogenic amino acids.	✓✓✓	✓✓✓	✓	✓✓✓
I want to use an existing HPLC unit.	✓✓	✓✓	✓✓✓	n/a
I want to share the instrument for other HPLC analysis.	✓✓	✓✓	✓✓✓	n/a
I want to use an existing GC/MS.	n/a	n/a	n/a	✓✓✓
I want to automate the derivatization reaction.	✓✓✓	✓✓✓	✓	n/a
I need to analyze biological samples or culture fluid containing many impurity components.	✓✓✓	✓✓	✓	✓✓✓
I need shorter analysis times.	✓✓✓	n/a	✓✓	✓✓
I want to use software to simplify operation.	✓✓✓	n/a	n/a	n/a
Quantification reproducibility is my major concern.	✓✓	✓✓✓	✓✓✓	✓✓
Selectivity is my major concern.	✓✓✓	✓✓	✓	✓✓✓

✓✓✓ : Best; ✓✓ : OK; ✓ : Partially OK; n/a: Unsuitable
Contact your Shimadzu representative for details.

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