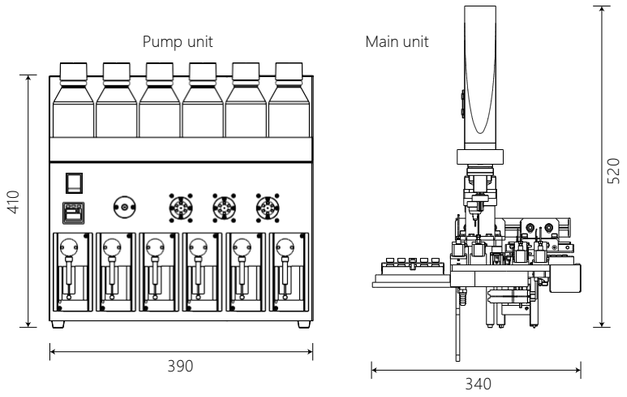
☐ Dimensional drawing (units : mm)



☐ SPL-M100 specifications

Size	Main unit: Width=340 mm, Depth=560 mm, Height=520 mm (from installation surface) Pump unit: Width=390 mm, Depth=570 mm, Height=410 mm
Power supply	100 V
Power consumption	500 VA
Computer OS	Windows 7 or later
Number of samples	Maximum 50 samples
Liquid handling	Syringe
Gas type	Nitrogen gas or inert gas
Installation environment	Temperature: 18-28℃ Humidity: 40-70%RH (no condensation). Other: An environment with minimal disturbances factors such as dust, vibration, spatial noise, and corrosive gases is preferable. A GC large volume injection port LVI-S250 (sold separately) is required. (If you have LVI-S200, this can be upgraded)

For product inquiries, please contact our company or agents.

AiSTI SCIENCE Co., Ltd.

【Head Office】
18-3 Arimoto, Wakayama City,
Wakayama 640-8390 Japan
TEL: +81-73-475-0033 FAX: +81-73-497-5011

【East Japan Sales Office】
Advanec 610, 1-1-31 Hamasaki, Asaka City,
Saitama 351-0033 Japan
TEL: +81-48-424-8384

www.aisti.co.jp

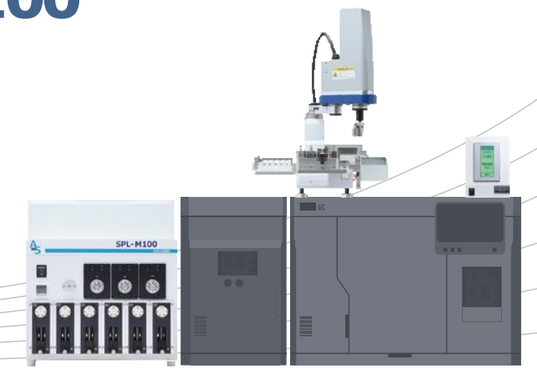
Guidebook of solid-phase derivatization

Online SPE-GC system for metabolome analysis

SPL-M100

SPL-M100

AiSTI SCIENCE
Beyond your Imagination



What is Metabolomics?

Metabolomics is a term for the comprehensive analysis of metabolites (metabolome) synthesized and consumed in living organisms (omics), and refers to the analytical techniques used in its study. By researching how metabolites, such as low-molecular-weight organic acids and amino acids, are metabolized in vivo, it is applied to early detection of specific diseases and investigation of drug effects in biological samples such as plasma and serum, and to quality control of food samples.

Challenges and Objectives of Metabolomiscs

Pretreatment for metabolome analysis is difficult and takes time to master analytical techniques. In metabolomics, it is preferable to comprehensively measure many compounds at once in order to understand the metabolism. Typical metabolites, such as amino acids, organic acids, and sugars, are non-volatile substances with high polarity and are usually measured by LC, but since they have different physical properties, it is difficult to analyze them all at once in LC.

Pretreatment operations

It requires complicated and time-consuming processes like centrifugal concentration, lyophilization, and derivatization.

Multiple measurement

When multiple samples are derivatized in a batch processing, the time from derivatization to measurement differs for each sample.

Acceleration of PDCA cycle in R&D

- Faster R&D by shorter cycle time
- Precise assessment through improved accuracy of analysis
- Obtain more information by high throughput analysis

The improved accuracy and speed of the new technology will not only contribute to R&D in various fields, but will also help people's lives and industry, especially in the field of life science, to solve problems in life, food, and the environment, and can make a significant contribution.

To achieve labor savings, efficiency, and high sensitivity

Solid-phase derivatization + Automation

SPE-GC enables online operation from derivatization to measurement

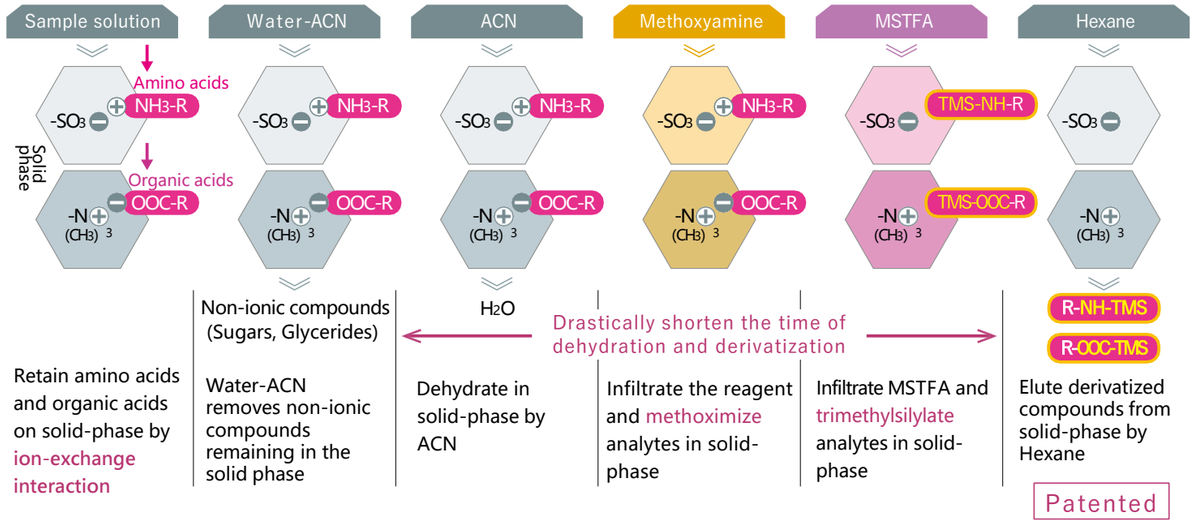
In solid-phase derivatization, simultaneous analysis by GC can be conducted to alter non-volatiles to volatiles. This is important because amino acids, organic acids, and sugars can be analyzed comprehensively.

Medical/Pharmaceutical　Food/Beverage　Agriculture/Stockbreeding

Principle of online solid-phase derivatization

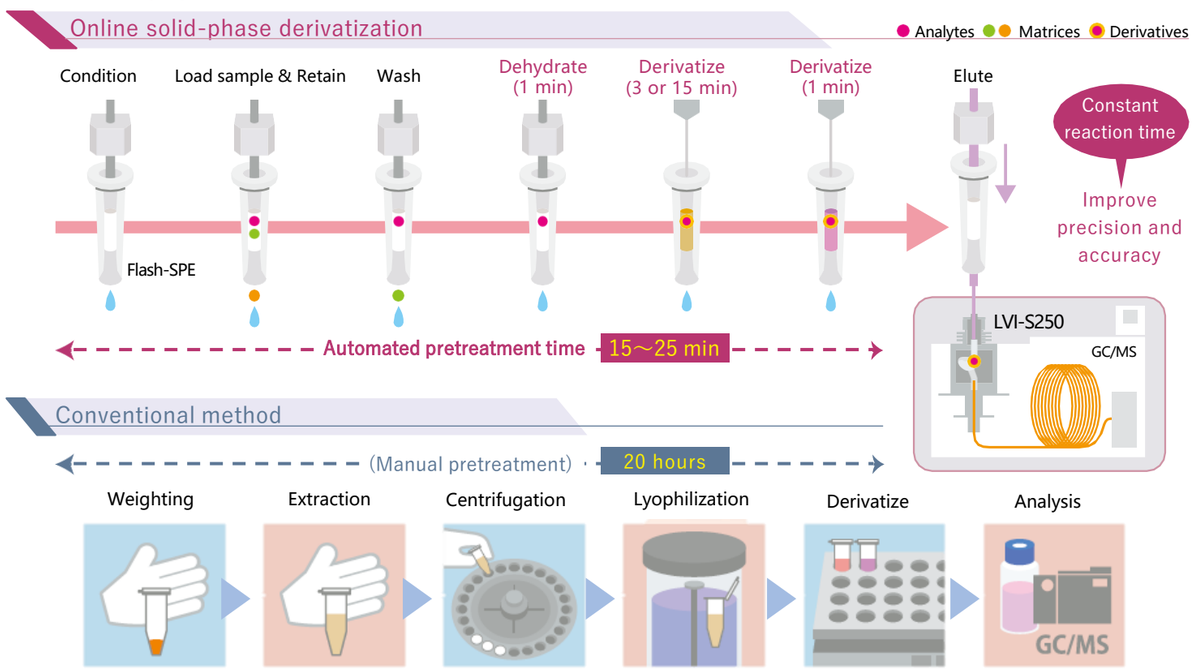
Trimethylsilylation of amino acids and organic acid

Trimethylsilylation enables analysis by GC/MS, altering non-volatilize analytes to easily vaporized ones.



Patented

Comparison of conventional method and this method



Conventional method is complicated and time-consuming. Additionally, when samples are derivatized in a batch, the time from derivatization to measurement varies for each sample.

Target compounds by solid-phase derivatization

250 metabolites or more

Amino acid: AMI-a
- Alanine
- Glycine
- Proline
- Threonine
- Methionine
- Phenylalanine
- Serine
- Tyrosine
- Lysine
- Valine
- Leucine
- Isoleucine
- Cystine
- Aspartic acid
- Glutamic acid

Amino acid: AMI-b
- Asparagine
- Cysteine
- Diiodotyrosine
- Histidine
- Homocystein
- Homoserine
- Kynurenine
- 1-Methylhistidine
- Monoiodotyrosine
- N-Acetylglycine
- Norleucine
- Norvaline
- Ornithine
- Tryptophan
- Hydroxylysine
- 2-Aminoadipic acid
- 2-Aminobutyric acid
- 5-Hydroxytryptophan

Amino acid: AMI-c
- Alanyl-glycine
- Cysteamine
- Cysteinylglycine
- Ethanolamine
- Dihydrobiopterin
- Carbamoylaspartic acid
- Glycylglycine
- Homocystine
- N2-acetylornithine
- N-Acetylglutamine
- Urea

Phenylamine: AMI-Ph
- Histamine
- Phenethylamine
- N-methyltyramine
- N-Methylphenethylamine
- Synephrine
- Tyramine
- 3-Methoxytyramine

Polyamine: PAM
- Cadaverine
- Putrescine
- Spermidine
- Spermine

Catecol: CT
- Adrenaline
- Noradrenaline
- Gallic acid
- Dihydroxymandelic acid
- Dihydroxyphenylacetic acid
- Dopamine
- Dopa

Organophosphate: PE
- Pyrophosphoric acid
- Pyridoxal phosphate
- Phosphohydroxypyruvic acid
- Phosphoserine

Sugar phosphate: SUP
- Fluctose-6-phosphate
- Glucose-6-phosphate
- Glucopyranose-1-phosphate
- Ribose-5-phosphate
- Glucopyranose-6-phosphate
- 6-Phosphogluconic acid

Sugar acid: SUC
- Galacturonic acid
- Glucaric acid
- Threonic acid
- N-Acetylmuramic acid
- N-Acetylneuraminic acid
- Glucaric acid-g-lactone
- Glyceric acid
- Gluconic acid
- Glucuronic acid

Carboxylic acid: CA-a
- *cis*-Aconitic acid
- Citric acid
- Ethylmalonic acid
- Fumaric acid
- Glutaric acid
- Isocitric acid
- Maleic acid
- Malic acid
- Malonic acid
- Methylmalonic acid
- Oxalic acid
- Oxoglutaric acid
- Succinic acid
- Tartaric acid

Aminocarboxylate: CA-AM
- Creatinine
- Hippuric acid
- Hydroxyproline
- Pipecolic acid
- 3-Aminoisobutyric acid
- 4-Aminobutanoic acid
- Urocanic acid
- Sarcosine
- N-Acetylaspartate
- N-Carbamoylaspartate
- Carbamoylaspartic acid
- 5-Aminolevulinic acid

Phenylcarboxylate: CA-Ph
- Homovanilic acid
- Xanthurenic acid
- Kynurenic acid
- Nicotinic acid
- Vanillylmandelic acid
- Hydroxyphenyllactic acid
- Phthalic acid
- Picolinic acid
- Quinolinic acid
- Orotic acid

Hydroxycarboxylate: CAH
- Glycolic acid
- Mevalonic acid
- 2-Hydroxybutyric acid
- 3-Hydroxybutyric acid
- 2-Hydroxy-2-methylbutyric acid
- Lactic acid
- Hydroxypropionic acid
- 2-Hydroxyisobutyric acid
- 3-Hydroxyisovaleric acid

Keto acid: CAMO
- Glyoxylic acid
- Ketoisoleucine
- 2-Oxobutyric acid
- 4-Hydroxyphenylpyruvic acid
- Pyruvic acid
- Phenylpyruvic acid
- 2-Oxoisocaproic acid

Shotr chain fatty acid: FAS
- Propanoic acid
- Isobutyric acid
- Butyric acid
- Isovaleric acid
- Valeric acid
- Hexanoic acid
- Heptanoic acid
- Octanoic acid
- Nonanoic acid
- Decanoic acid

Long chain fatty acid: FAL
- Undecanoic acid (C11)
- Dodecanoic acid (C12)
- Tridecanoic acid (C13)
- Myristic acid (C14)
- Pentadecanoic acid (C15)
- Palmitic acid (C16)
- Palmitoleic acid (C16:1n-7)
- Heptadecanoic acid (C17)
- Stearic acid (C18)
- Oleic acid (C18:1, n-9)
- Linoleic acid (C18:2, n-6)
- α-Linolenic acid (C18:3, n-3)
- γ-Linolenic acid (C18:3n-6)
- Nonadecanoic acid (C19)
- Arachidic acid (C20)
- Dihomo-γ-linolenic acid (C20:3n-6)
- Arachidonic acid (C20:4,n-6)
- Eicosapentaeoic acid (C20:5, n-3)
- Heneicosanoic acid (C21)
- Docosapentaenoic acid (C22:n-3)
- Docosahexaenoic acid (C22:n-3)

Nucleobase: NUB
- Adenine
- Cytosine
- Guanine
- Xanthine

Nucleoside: NUS
- Adenosine
- Deoxyguanosine
- Deoxyinosine
- Xanthosine

Monosaccharide: SUG1
- Arabinose
- Fructose
- Fucose
- Galactitol
- Galactose
- Glucitol
- Glucopyranose
- Glucose
- Lyxose
- Mannitol
- Mannose
- *myo*-Inositol
- Rhamnose
- Ribitol
- Ribose
- Xylitol
- Xylose
- 2-Deoxyglucose

Disaccharide: SUG2
- Galactinol
- Lactose
- Maltose
- Melibiose
- Sucrose
- Trehalose

Bile acid: BA
- Cholic acid
- Lithocholic acid
- Ursodeoxycholic acid
- Deoxycholic acid
- Hyodeoxycholic acid
- Chenodeoxycholic acid

Sterol: ST1
- Androstenedione
- Androsterone
- Testosterone
- Progesterone
- Dihydrotestosterone
- Estriol
- Estrone
- Estradiol
- Pregnenolone
- Dehydroepiandrosterone

Sterol: ST2
- β-Sitosterol
- Brassicasterol
- Campesterol
- Cholecarciferol
- Cholesterol
- Dihydrolanosterol
- Ergosterol
- Lanosterol
- Stigmasterol
- 7-Dehydrocholesterol

Flavonoid: FLV
- Daidzein
- Formononetin
- Genistein
- Glycitein
- Quercetin

Hydrophobic vitamin: V-DK
- Phytonadione
- α-Tocopherol
- γ-Tocopherol
- δ-Tocopherol

Amino acids & Organic acids analysis

Pretreatment workflow

- Vials
  - Conditioning ACN-Water (1/1)
- Flash-SPE ACXs
  - Loading［Retaining］ Extract 50μL
  - Washing ACN-Water (1/1)
  - Dewatering ACN
  - Infiltration 0.5% Methoxyamine-Pyridine
- Derivatization Methoximation, 3min
  - Infiltration MSTFA-Hexane (1/1)
- Derivaization Trimethylsilylation, 1min
  - Elution Hexane
- GC/MS Split 1:50

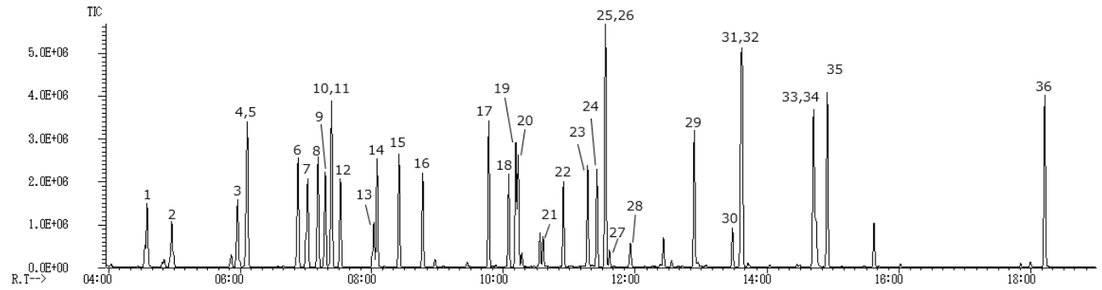
Injection condition

SPE-GC Interface	SPL-M100 (AiSTI SCIENCE)
SPE Cartridge	Flash-SPE ACXs
Sampling Volume	50μL
PTV Injector	LVI-S250 (AiSTI Science)
Insert Type	Spiral Insert
Injector Temp.	220℃(0.5min)-50℃/min-290℃(16min)

GC/MS condition

GC	
Inlet Mode	Split 1:50
Flow Mode	Constant Flow, 1mL/min
Pre-Column	0.25mm i.d. x 1m
Column	Vf-5ms, 0.25mm i.d. x 30m, df;0.25μm
Oven Temp.	100℃(2min) - 10℃/min - 320℃(2min)
Trans. Line Temp.	290℃
MS	
MS Method	SCAN, m/z;70-600

Chromatogram



1. Alanine_2TMS
2. Oxalic acid_2TMS
3. Malonic acid_2TMS
4. Valine_2TMS
5. Methylmalonic acid, 2TMS
6. Leucine_2TMS
7. Ethylmalonic acid_2TMS
8. Isoleucine_2TMS
9. Proline_2TMS
10. maleic acid, 2TMS
11. Glycine_3TMS
12. Succinic acid_2TMS
13. Fumaric acid_2TMS
14. Serine_3TMS
15. Threonine_3TMS
16. Glutaric acid_2TMS
17. Malic acid_3TMS
18. Adipic acid_2TMS
19. Aspartic acid_3TMS
20. Methionine_2TMS
21. Oxoglutaric acid_1MO_2TMS_1
22. Oxoglutaric acid_1MO_2TMS_2
23. Pimelic acid_2TMS
24. Glutamic acid_3TMS
25. Tartaric acid_4TMS
26. Phenylalanine_2TMS
27. 2-Oxoadipic acid_1MeOX_2TMS_1
28. 2-Oxoadipic acid_1MeOX_2TMS_2
29. cis-Aconitic acid_3TMS
30. Azelaic acid_2TMS
31. Citric acid_4TMS
32. Isocitric acid_4TMS
33. Lysine_4TMS
34. Histidine_
35. Tyrosine_3TMS
36. Cystine_4TMS

Repeatability

No.	Compound name	RT	Solid phase derivatization of amino acids/organic acids, peak area and RSD (n=6%)							
		min	1	2	3	4	5	6	*Ave.*	***RSD, %***
1	Alanine_2TMS	4.59	2,796,457	2,740,757	2,908,211	2,987,506	3,004,500	2,819,434	*2,876,144*	***3.7***
2	Oxalic acid_2TMS	4.97	1,433,569	1,467,446	1,612,087	1,621,832	1,673,343	1,574,603	*1,563,813*	***6.0***
3	Malonic acid_2TMS	5.97	2,885,096	2,856,364	3,118,479	2,949,609	3,159,205	2,819,550	*2,964,717*	***4.8***
4	Valine_2TMS	6.11	579,229	575,750	600,898	615,348	618,040	579,793	*594,843*	***3.2***
5	Methylmalonic acid_2TMS	6.11	3,246,706	3,269,490	3,432,962	3,315,929	3,491,980	3,233,253	*3,331,720*	***3.2***
6	Leucine_2TMS	6.88	3,881,185	3,822,130	4,066,306	4,153,562	4,171,868	3,904,054	*3,999,851*	***3.7***
7	Ethylmalonic acid_2TMS	7.02	3,047,504	3,084,252	3,211,158	3,076,174	3,326,485	2,989,030	*3,122,434*	***4.0***
8	Isoleucine_2TMS	7.18	3,663,868	3,606,025	3,827,550	3,904,952	3,902,472	3,669,337	*3,762,367*	***3.5***
9	Proline_2TMS	7.30	3,976,149	4,021,867	4,173,805	4,297,605	4,400,630	4,076,584	*4,157,773*	***4.0***
10	maleic acid_2TMS	7.38	187,564	182,938	190,539	186,127	189,306	175,356	*185,305*	***3.0***
11	Glycine_3TMS	7.38	441,766	411,880	435,644	485,230	418,364	473,858	*444,457*	***6.6***
12	Succinic acid_2TMS	7.52	3,249,928	3,318,058	3,425,971	3,252,991	3,559,463	3,175,138	*3,330,258*	***4.2***
13	Fumaric acid_2TMS	8.02	873,768	883,647	922,253	879,591	957,324	838,431	*892,502*	***4.6***
14	Serine_3TMS	8.07	1,674,335	1,752,221	1,772,483	1,788,152	1,917,059	1,683,341	*1,764,599*	***5.0***
15	Threonine_3TMS	8.40	846,598	878,908	879,263	886,326	957,675	835,527	*880,716*	***4.9***
16	Glutaric acid_2TMS	8.76	1,892,273	1,943,032	1,972,436	1,872,551	2,070,120	1,826,859	*1,929,545*	***4.5***
17	Malic acid_3TMS	9.77	1,898,685	1,902,816	1,950,773	1,871,083	2,025,701	1,832,427	*1,913,581*	***3.5***
18	Adipic acid_2TMS	10.07	267,676	270,067	276,389	252,531	288,724	255,179	*268,428*	***5.0***

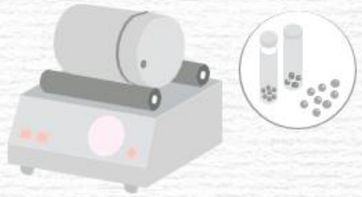
No.	Compound name	RT	Solid phase derivatization of amino acids/organic acids, peak area and RSD (n=6%)							
		min	1	2	3	4	5	6	*Ave.*	***RSD, %***
19	Aspartic acid_3TMS	10.18	2,073,616	2,057,755	2,105,653	2,047,118	2,253,268	1,976,365	*2,085,629*	***4.4***
20	Methionine_2TMS	10.22	2,102,155	2,045,739	2,134,686	2,138,921	2,209,420	2,017,018	*2,107,990*	***3.3***
21	Oxoglutaric acid_MO_2TMS	10.60	194,061	171,180	181,426	186,296	188,760	190,227	*185,325*	***4.4***
22	Oxoglutaric acid_MO_2TMS	10.90	563,402	506,070	600,138	562,836	628,315	545,493	*567,709*	***7.5***
23	Pimelic acid_2TMS	11.27	949,060	950,102	992,660	923,898	1,027,899	931,097	*962,453*	***4.2***
24	Glutamic acid_3TMS	11.40	1,616,891	1,512,525	1,623,064	1,572,957	1,667,557	1,493,032	*1,581,004*	***4.3***
25	Tartaric acid_4TMS	11.54	1,150,168	1,136,548	1,166,379	1,131,077	1,175,842	1,099,986	*1,143,333*	***2.4***
26	L-Phenylalanine_2TMS	11.54	1,784,337	1,722,138	1,807,079	1,793,271	1,845,791	1,718,739	*1,778,559*	***2.8***
27	2-Oxoadipic acid_MeOX_2TMS	11.60	86,824	80,582	99,366	91,980	104,581	93,235	*92,761*	***9.2***
28	2-Oxoadipic acid_MeOX_2TMS	11.92	141,037	128,203	152,500	147,414	169,723	147,440	*147,720*	***9.2***
29	cis-Aconitic acid_3TMS	12.88	948,599	933,617	989,232	924,903	1,012,133	905,734	*952,370*	***4.3***
30	Azelaic acid_2TMS	13.46	89,252	93,415	96,004	86,490	101,419	87,494	*92,346*	***6.2***
31	Citric acid_4TMS	13.60	347,136	343,898	350,436	343,549	347,426	332,581	*344,171*	***1.8***
32	Isocitric acid_4TMS	13.62	1,164,276	1,166,799	1,204,285	1,162,976	1,183,800	1,127,241	*1,168,230*	***2.2***
33	Lysine_4TMS	14.70	384,160	355,654	386,336	424,543	372,317	422,343	*390,892*	***7.0***
34	Histidine_3TMS	14.73	453,526	420,048	489,843	519,435	423,086	484,064	*465,000*	***8.5***
35	Tyrosine_3TMS	14.91	4,586,160	4,691,735	4,737,119	4,663,853	4,957,822	4,691,567	*4,721,376*	***2.7***
36	Cystine_4TMS	18.20	2,406,871	2,663,673	2,525,474	2,669,877	2,754,298	2,836,933	*2,642,854*	***5.9***

Grinding and Extraction

One of the important points common to food analysis is "sample uniformity". For example, in residual pesticide analysis, if pesticide residues in food are unevenly distributed or scattered, poor sample uniformity leads directly to poor quantitation. Even if the same sample is aliquoted, which may give different quantitative values in each analysis, it becomes difficult to compare maximum residual limits. In addition, in recent years, the amount of analytical samples has decreased along with the achievement of higher sensitivity by analytical instruments. Therefore making sample uniformity even more important

Beads grinding

- For small samples
- Crushes hard tissue by impact as beads
- Capable of processing multiple samples



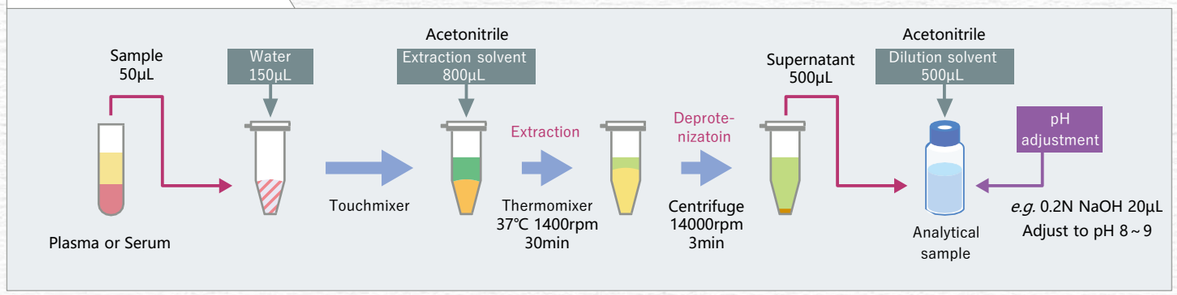
Pre-cooled freeze grinder

- Processing with water in samples
- High capacity for whole sample
- Suitable for analyzing component concentrations containing water

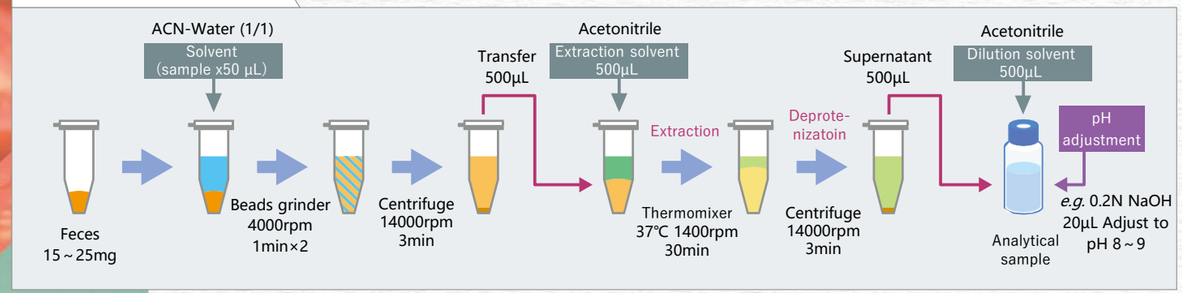
Even samples with a large amount of sinew or fibrous material can be ground to a powder form. Freeze grinder suppresses enzyme activity in the sample and prevents the decomposition of metabolites.

Examples of extraction procedure

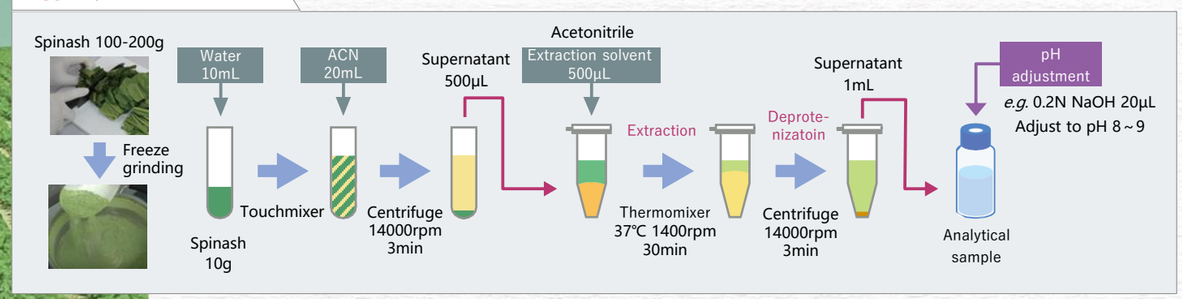
Plasma, Serum



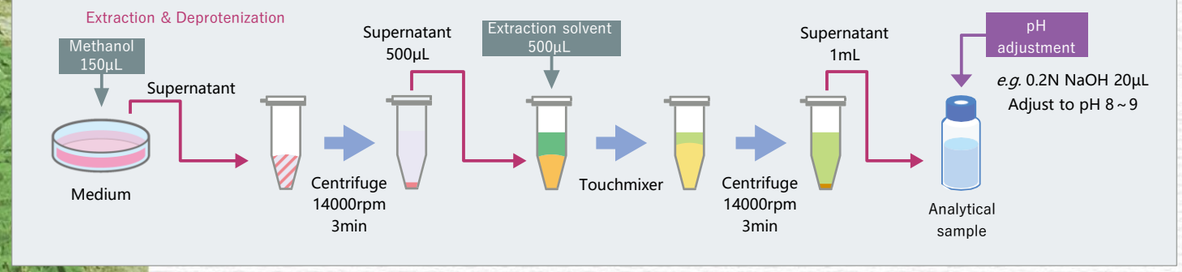
Feces (Mouse)



Spinach

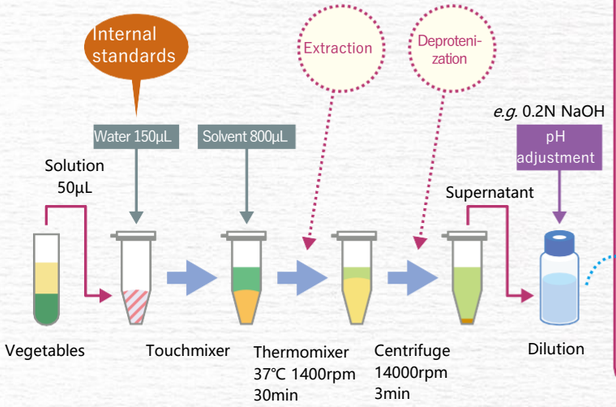


Medium

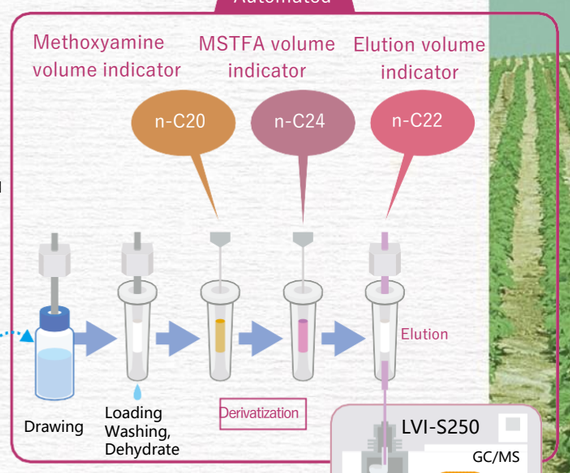


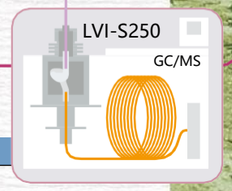
Pretreatment flow for analysis of ionic compounds

Extraction and Deprotenization



Automated





Validation reagents

*The table above is one example of monitoring indicators for process control.

Internal standards*

Compounds	Targets
Norleucine	Amino acids
Adipic acid	Organic acids
Ribitol	Sugars
Hexanoic acid-d11	SCFAs

Operation check

Compounds	Assessment
n-C20	Methoxyamine
n-C22	Hexane (elution solvent)
n-C24	MSTFA-Hexane (1/1)

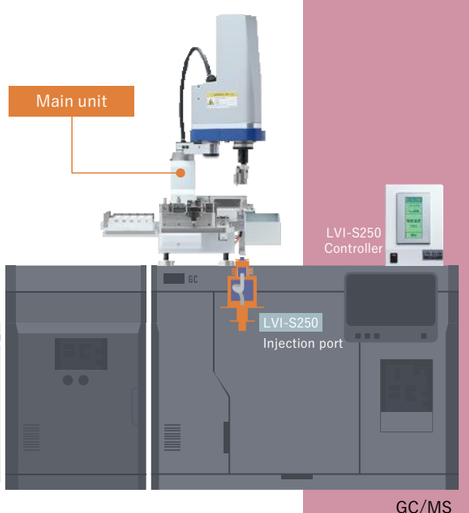
Solid-phase derivatization

Analytes are derivatized on solid-phase, enabling online GC/MS analysis

From solid-phase extraction to GC analysis

Fully automated

"Online" system
means it does not separate pretreatment and measurement, automatically injects directly into GC or LC.



Prepare solvents and SPE cartridges
Just set samples

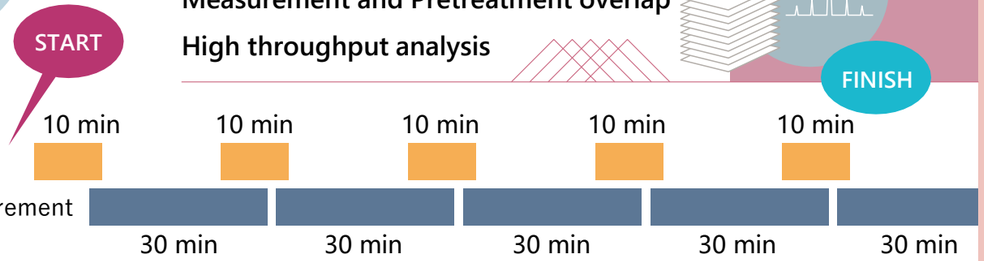
Online SPE-GC system for metabolomics

SPL-M100

For Gas Chromatography

Measurement and Pretreatment overlap

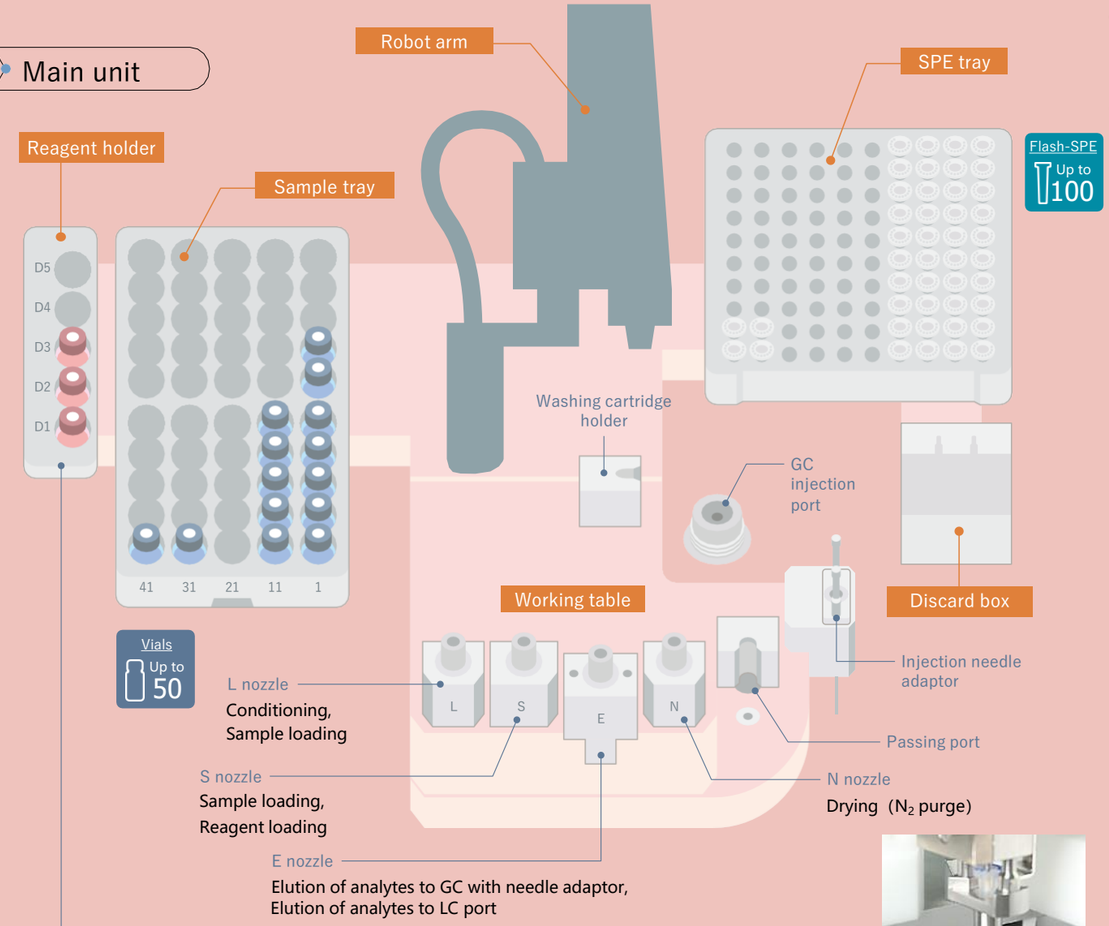
High throughput analysis



Use a normal injector

By removing the working table, a normal injector and injection port (front) can be used to perform analysis.

Main unit



Reagents (Max. 5 vials)
D1：MSTFA-Hexane (1/1)
D2：0.5mg/mL Methoxyamine-pyridine
D3：10mg/mL Methoxyamine-pyridine
D4：MTBSTFA- Hexane (1/1)
D5：n-Alkane mix. (Retention Indecies)

Reagent holder

Each nozzle and passing port

Dedicated nozzles perform operations (conditioning, sample loading, washing, drying, elution).

Eluate directly injected

Pump unit

Pumping by syringes

Efficient liquid transfer is enabled by using independent syringe pump for eash solvent

Switching flow path with valves

Valve position can be switch freely depending on the method.

Syringe pumps and valves

Bottle rack

Maintainance

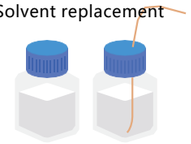
To keep analytical instruments running smoothly, it is necessary to perform daily and regular maintenance properly. Additionally, regularly replacing consumables prevents issues before they occur and leads to stable analysis. This ensures continuous, highly accurate results. Here is a list of the maintenance items required for the SPL-M100.

Daily maintainance

Please check the following items before operating the equipment.

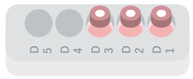
Checking the solvent

- Remaining volume
- Tube insertion depth
- Solvent replacement



Checking the reagent

- Remaining volume
- The position on tray
- Reagent replacement

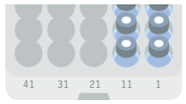


Checking SPE cartridges

- Filling SPE tray
- Discarding used cartridges

Setting samples

- Sample No. on tray
- Using septums with slit

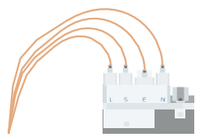


Checking the gas

- Pressure gauge value

Fixing nozzle tubes

- No tangle and hooking



Solvent purging ※ Execute “Purge solvent” in maintenance menu

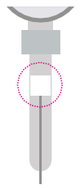
- Retightening the syringe connection
- Removing the air in the syringe barrel
- Dispensing solvents from the nozzle
- No leak from each connection

Regular maintainance

Please check the following items once a week.

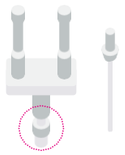
Syringes

Wipe off dirt from the plunger and inside of the barrel.



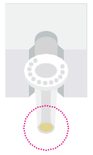
Injection needle adaptor

- Wash the adapter part



Washing cartridge

- Replace every 100 runs



Cleaning of N nozzle

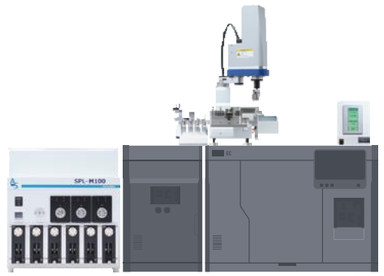
- Wipe the tip of N nozzle

Consumables

Please replace according to recommended frequency or usage status.

- Spiral insert ..... Every 100 injections
- Advanced green septum ..... Every 100 injections
- Precolumn ..... Every 3 months
- Trap filter ..... Every 6 months
- Flash-SPE cartridge for washing..... Every 100 injections
- O-ring for N nozzle ..... Every 6 months
- Batteries for robot arm ..... Every 2 years
- Memory battery for robot ..... Every 4 years

Related products



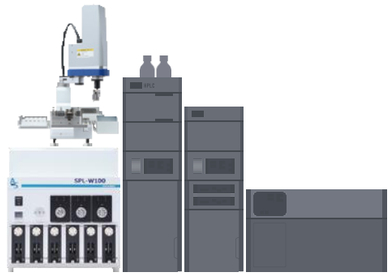
GC/MS

Headspace analysis by solid phase adsorption-solvent elution

Online SPE-GC system for volatiles SPL-M100FE

“Fully automated” from pretreatment to GC/MS analysis

Fields	Odor, strange smell, musty odor
Samples	Foods, bevarages, etc.
Targets	Volatiles



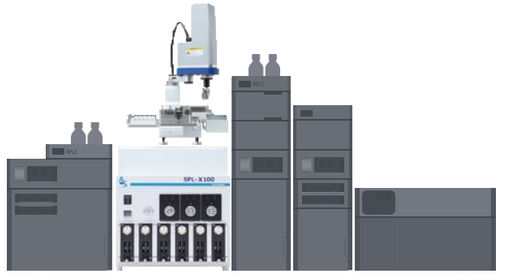
LC/MS

Onlined LC/MS with SPE interface

Online SPE-LC system SPL-W100

“Fully automated” from pretreatment to LC/MS analysis in various fields

Fields	SPE → HPLC, LC/MS
Samples	Liquid samples and extracts
Targets	Detectable compounds in LC



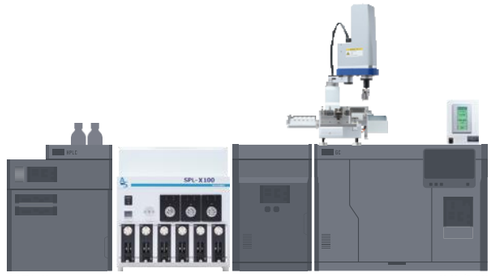
HPLC LC/MS

SPE → Fraction collect by HPLC → LC/MS analysis

Online SPE-LC-LC system SPL-X100L

“Fully automated” targeted analysis in samples with many inpurities

Fields	Isolation, purification
Samples	For complex matrix composition
Targets	Detectable compounds in LC



HPLC GC/MS

SPE → Fraction collect by HPLC → GC/MS analysis

Online SPE-LC-GC system SPL-X100G

“Fully automated” targeted analysis in samples with many inpurities

Fields	Isolation, purification
Samples	For complex matrix composition
Targets	Detectable compounds in GC

Samples into powder

Crushing uniformly from large amounts of sample

Freeze grinder Frestent FST-4000

Supports a variety of samples, including leaves, roots, fruits, meat, and processed foods

Main sets	Main unit, container, lid, cutter
Accessories	Dry ice storage box (up to 20 kg)
	Accessories set (scoop, pre-cooling container, 2 types of sample spoons x5)