welch

GC Comsumables

Quality, Innovation, Competitive Price

www.welch-us.com

Welch Materials is a multinational company that develops and manufactures chromatography consumables including analytical and preparative HPLC columns, Solid Phase Extraction (SPE) columns, GC columns, bulk packing materials, and protein purification products.

Welch Materials was established in 2003 at Shanghai, China and Welch Materials (Zhejiang) was opened in 2011 at Jinhua, Zhejiang, China. Welch has established operations at Welch Materials, Inc., at West Haven, CT, USA and Welch Materials, India Pvt. Ltd., at Gurgaon.

Welch strength lies in our deep experience in particle surface modification science. We are experts in bonding chemistry and innovative packing materials for chromatography applications. Utilizing and optimizing our resources, we have developed many innovative products including five series of HPLC columns including Ultisil®, Welchrom®, Xtimate®, Topsil®, and Boltimate™ and market and support these products on worldwide basis.

Content

Outline of GC Column

Welch Materials have concentrated on GC R&D and production for many years, and each column would be tested strictly before selling with attached column report. Welch columns are characterized by stable properties, high column efficiency and good reproducibility. Welch Gas column can be divided into two types: WM Series High Performance GC Column and WEL Series Economical GC Column, which can meet the analysis requirements of various customers.

Welch also provides services as sample analysis, method development, column recommendation, after-sales support and training for customers.

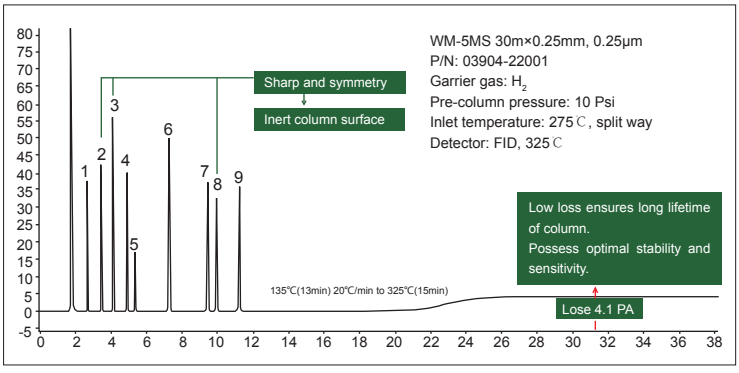
With good product performance and perfect after-sales service system, our GC columns have been widely used in universities, research institutes, pharmaceutical, petrochemical, brewing, environmental protection or other industries.

1.1 WM Series High Performance GC Column

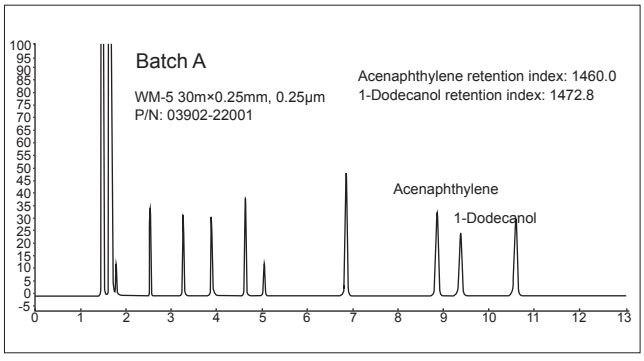
WM series of capillary columns adopt strict technique and performance detection with strength in super inertness, low loss, high column efficiency, high selectivity, stable reproducibility and long lifetime.

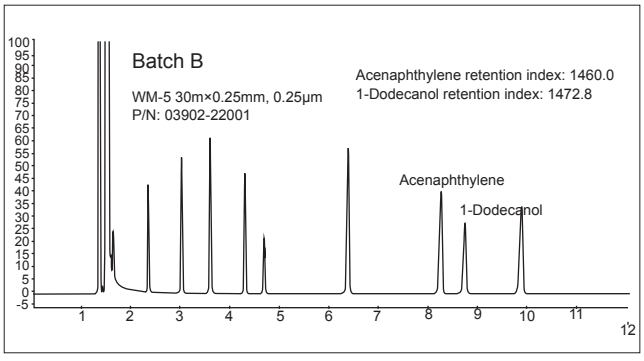
(1) Super Inertness and Low Loss GC/MS Column

- The unique surface deactivating technique ensures the super high inertness of column, and the peak type of separation component is sharp and symmetrical.
- Bonding and cross-linking technology allow the column to keep a low loss level at higher temperature with good stability and long lifetime.



(2) Exceptional lot-to-lot reproducibility



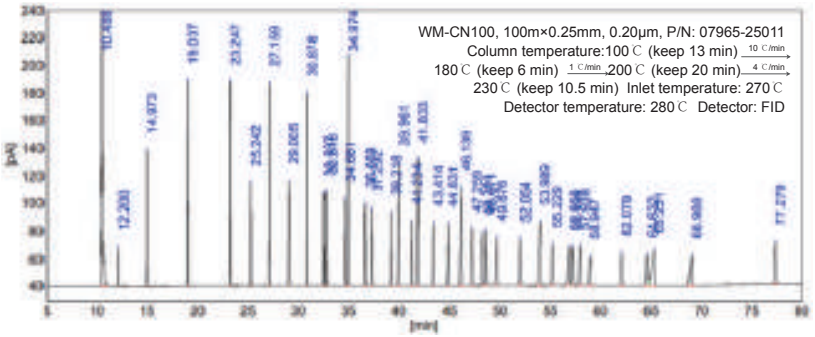


- The consistency of column inertness and superior inter-column reproducibility can be guaranteed by mixed standards samples test.
- Higher detection sensitivity and more accurate analysis results.

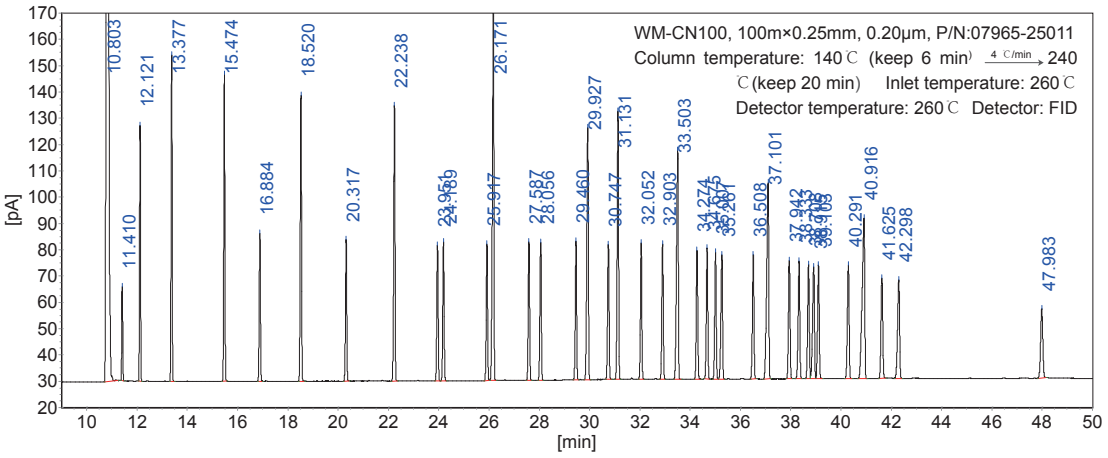
Case of Excellent Performance of WM Column

Determination of 37 fatty acids

Welch has released 37 fatty acid dedicated columns with excellent separation performance and reproducibility. Benefited from the optimized method, the analysis time can be greatly shortened without losing the resolution and the customer's analysis cost can be saved.



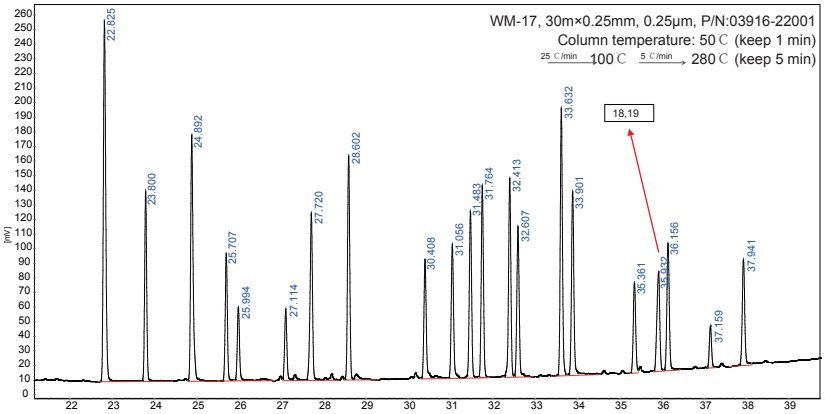
Method Optimization



Determination of 22 Kinds of Organochlorine Pesticide Residues

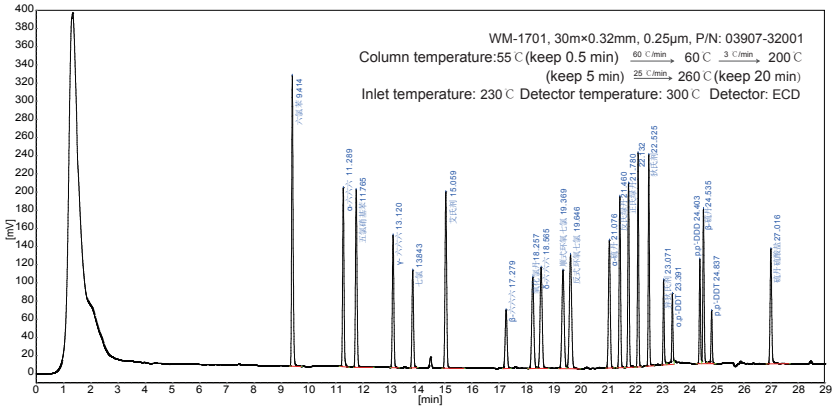
Welch provides an overall solution for the determination of 22 kinds of organochlorine pesticide residues, including sample pretreatment, chromatographic analysis, a complete set of products and technical support. The corresponding chromatographic analysis column and verification column are ideal substitution for named columns of the same specification.

P/N	Specification	Note
03916-22001	WM-17 30m×0.25mm, 0.25μm	Analysis column
03901-22001	WM-1 30m×0.25mm, 0.25μm	Verificaiton column



No.	Component	No.	Component
1	Hexachlorobenzene	12	Trans-chlordane
2	α- benzene hexachloride	13	Cis-chlordane
3	Quintozene	14	α-endosulfan
4	γ- benzene hexachloride	15	p,p'-DDE
5	β- benzene hexachloride	16	Dieldrin
6	Heptachlor	17	Endrin
7	δ- benzene hexachloride	18	o,p'-DDT+ p,p'-DDD
8	Aldrin	19	o,p'-DDT+ p,p'-DDD
9	Oxychlordane	20	β-endosulfan
10	Heptachlor epoxide	21	p,p'-DDT
11	Trans-heptachlor epoxide	22	Endosulfan sulfate

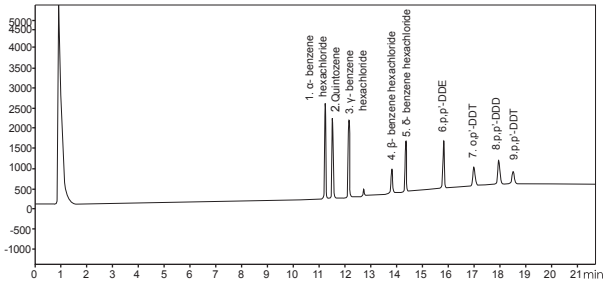
(Names of components in chromatogram are inferred according to files and experience)



No.	Component	No.	Component
1	Hexachlorobenzene	12	Trans-chlordane
2	α- benzene hexachloride	13	Cis-chlordane
3	Quintozene	14	α-endosulfan
4	γ- benzene hexachloride	15	p,p'-DDE
5	β- benzene hexachloride	16	Dieldrin
6	Heptachlor	17	Endrin
7	δ- benzene hexachloride	18	o,p'-DDT+ p,p'-DDD
8	Aldrin	19	o,p'-DDT+ p,p'-DDD
9	Oxychlordane	20	β-endosulfan
10	Heptachlor epoxide	21	p,p'-DDT
11	Trans-heptachlor epoxide	22	Endosulfan sulfate

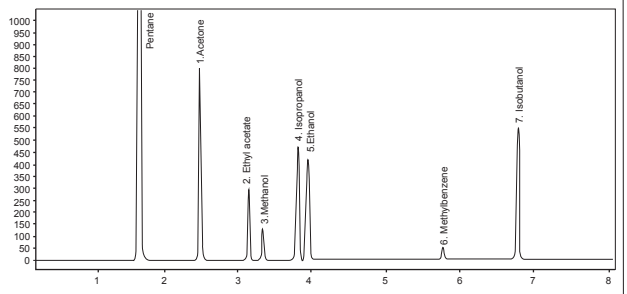
(Names of components in chromatogram are inferred according to files and experience)

Determination of 9 Kinds of Organochlorine Pesticides Residues



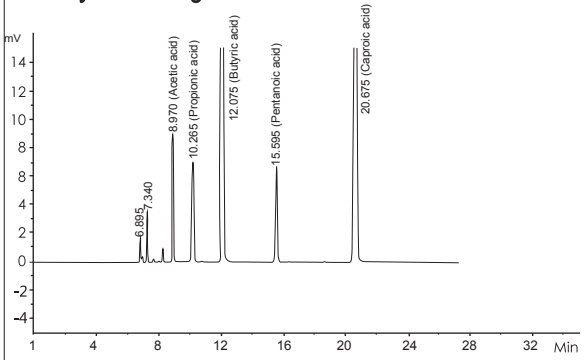
WM-1701, 30m×0.32mm, 0.25μm, P/N: 05907-32001
Temperature program: 100℃ 10℃/min 220℃ 8℃/min 250℃ (keep 10 min)
Inlet temperature: 250℃ Detector temperature: 300℃ Detector: ECD

WM-INOWAX Column with Excellent Selectivity and Separation Degree



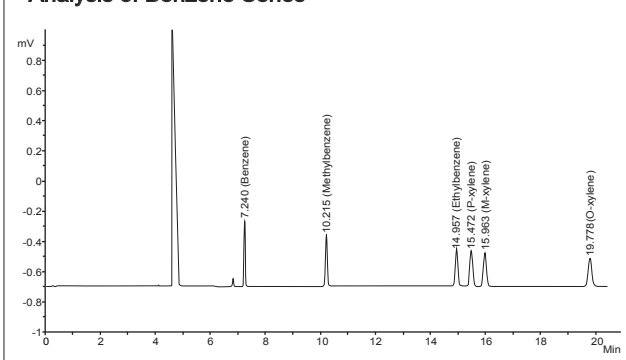
WM-INOWAX, 30 m×0.25 mm, 0.25 μm, P/N: 03909-22001
Temperature program: 37℃(keep 1 min) 2℃/min 41℃(keep 2 min) 10℃/min 80℃
Inlet temperature: 220℃ Detector temperature: 250℃ Detector: FID

Analysis of Organic Acids



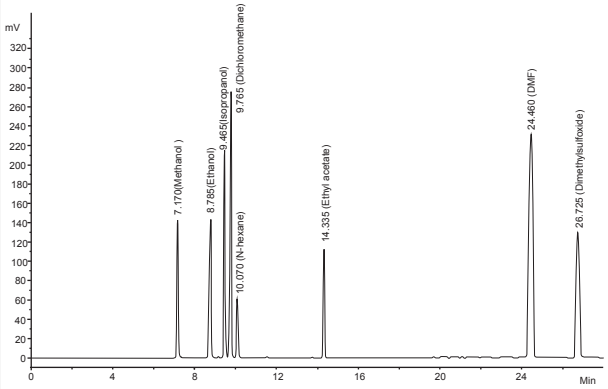
WM-FFAP, 30m×0.32mm, 0.5μm, P/N: 05911-32002
Column temperature: 170℃ Inlet temperature: 250℃
Detector temperature: 250℃ Detector: FID

Analysis of Benzene Series



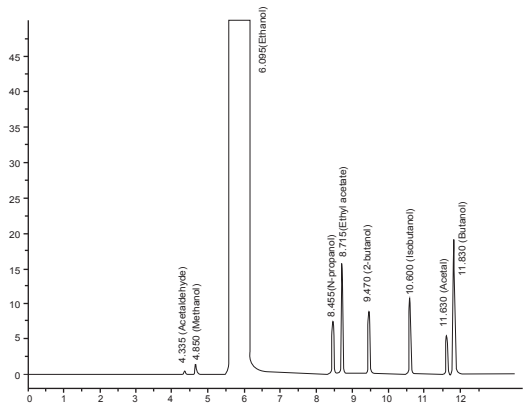
WM-PEG20M, 50m×0.32mm, 0.5μm, P/N: 05918-33002
Column temperature: 70℃ Inlet temperature: 250℃
Detector temperature: 250℃ Detector: FID

Determination of Organic Substances Residues



WM-1701, 30m×0.32mm, 0.5μm, P/N: 05907-32002
Temperature program: 40℃ (keep 13min) $\xrightarrow{20\,℃/min}$ 180℃ (keep 10 min)
Inlet temperature: 180℃ Detector temperature: 200℃ Detector: FID

Determination of Volatile Impurities in Ethanol



Analytical column for liquor, 30m×0.32mm, 0.5μm, P/N: 05941-32002
Temperature program: 40℃(keep 6min) $\xrightarrow{10\,℃/min}$ 150℃
Inlet temperature: 210℃ Detector temperature: 230℃ Detector: FID

Cross Reference

Stationary Liquid	USP	Similar Stationary Liquid
WM-1	G2	DB-1, HP-1, OV-1, BP-1, Rtx-1, OV-101, SPB-1, CP-Sil 5CB
WM-1MS	G2	DB-1MS, HP-1MS, OV-1MS, OV-1MS
WM-5	G27	BP-5, ZB-5, CP-Sil 8CB, DB-5, HP-5, SPB-5, Rtx-5, OV-5
WM-5MS	G27	ZB-5MS, DB-5MS, HP-5MS, OV-5MS
WM-35	G42	DB-35, HP-35, SPB-35, Rtx-35, PE-35, AT-35
WM-1301	G43	DB-1301, HP-1301, PE-1301, Rtx-1301
WM-1701	G46	BP-10, CB-1701, CP-Sil 19CB, DB-1701, Rtx-1701
WM-225	G7	007-225, DB-225, BP-225, HP-225, CP-Sil 43CB, Rtx-225
WM-624	G43	007-624, AT-624, CP-624, DB-624, HP-624, Rtx-502.2, VOCOL
WM-INOWAX	G16	CP-Wax, DB-Wax, HP-Innowax, PE-Wax, Rtx-Wax
WM-FFAP	G35	BP-21, HP-FFAP, PE-FFAP, CP-FFAP, DB-FFAP, Nukol
WM-17	G3	DB-17, HP-17, HP-50, Rtx-50, AT-50, SPB-50, SP-2250

Guideline of Selecting WM High Performance Series Capillary Column

WM Type	Staionary Phase Type	Polarity	Temp. limit (℃)	Application Range
WM-1,WM-1MS	100% Dimethyl Polysiloxan	Nonpolarity	-60 to 325/350	Hydrocarbons, Aromatics, Pesticides, Phenols, Herbicides, Amines, Fatty Acid Methyl Esters, etc.
WM-5,WM-5MS	5% Phenyl, 95% Dimethyl Polysiloxane	Weak polarity	-60 to 325/350	Hydrocarbons, Aromatics, Pesticides, Herbicides, Drugs, Biodiesel, etc.
WM-1301	6% Cyanopropyl-phenyl, 94% Dimethyl Polysiloxane	Moderate polarity	-20 to 280/300	Alcohols, Pesticides, VOCs, iodines, Pesticide Residues, etc.
WM-35,WM-35MS	35% Phenyl, 65% Dimethyl Polysiloxane	Moderate polarity	40 to 300/320	Alcohols, Pesticides, Drugs
WM-17,WM-17MS	14% Cyanopropyl-phenyl, 86% Dimethyl Polysiloxane	Moderate polarity	40 to 300/320	Drugs, ethylene glycol, steroids, herbicides, pesticides
WM-1701	6% Cyanopropyl, 94% Dimethyl Polysiloxane	Moderate polarity	-20 to 280/300	Aromatic chlorine, insecticide, herbicide
WM-624	6% Cyanopropyl, 94% Dimethyl polysiloxane	Moderate polarity	-20 to 260	Solvent residual, volatile compounds
WM-225	50% Cyanopropyl, 50% Dimethyl polysiloxane	Moderate polarity	40 to 220/240	Neutral sterols, sugar alcohol acetate

WM Type	Staionary Phase Type	Polarity	Temp. limit (℃)	Application Range
WM-INOWAX	Polyethylene glycol	Strong polarity	40 to 260/280	Alcohols, Free Acids, Fatty Acid Methyl Esters, Polynuclears, Aromatics, Solvents, Essential Oils etc.
WM-FFAP	Polyethylene glycol modified by p-Phthalic acid	Strong polarity	50 to 260	Alcohols, Free Acids, Fatty Acid Methyl Esters, Aldehydes, Acrylic Esters, Ketones, etc.

WM High Performance Series Capillary Column WM-1, WM-1MS

- ➤ 100% Dimethyl polysiloxane stationary liquid
- ➤ General nonpolar stationary phase
- ➤ Thermal stability is up to 350℃
- ➤ Chemically bonded crosslinked columns can be flushed with solvent
- ➤ Polarity is similar to stationary phases of DB-1, SPB-1, HP-1, SE-30
- ➤ Comply with USP G2 specific stationary liquid
- ➤ As a kind of low-loss column, it can be used with MS detector

WM-1 capillary column which formed by the crosslink of 100% polydimethylsiloxane can separate samples by boiling point, so it is suitable in a wide range of temperature. Due to the covalent crosslinking method, WM-1 column is able to tolerate large injection volume while keeping a long lifetime.

Through a more rigorous manufacturing technique, WM-1MS capillary column has low loss rate. Before being a qualified product, each column needs to be strictly tested, which is assuring. With good inertness to active compounds, Ultra-low loss WM-1MS column can effectively improve the detection performance of MS, ECD and NPD.

WM-1 Ordering Information

Specification	P/N
WM-1 10m×0.18mm×0.18μm	03901-80018
WM-1 20m×0.18mm×0.18μm	03901-89018
WM-1 20m×0.18mm×0.36μm	03901-89028
WM-1 20m×0.18mm×0.4μm	03901-89022
WM-1 25m×0.2mm×0.11μm	03901-18029

Specification	P/N
WM-1 25m×0.2mm×0.33μm	03901-18021
WM-1 25m×0.2mm×0.5μm	03901-18002
WM-1 30m×0.25mm×0.1μm	03901-22007
WM-1 30m×0.25mm×0.25μm	03901-22001
WM-1 30m×0.25mm×0.5μm	03901-22002

Specification	P/N
WM-1 50m×0.32mm×0.17μm	03901-33030
WM-1 15m×0.2mm×0.25μm	05901-11001
WM-1 15m×0.2mm×0.5μm	05901-11002
WM-1 15m×0.25mm×0.25μm	05901-21001
WM-1 15m×0.25mm×0.5μm	05901-21002
WM-1 15m×0.32mm×0.25μm	05901-31001
WM-1 15m×0.32mm×0.5μm	05901-31002
WM-1 15m×0.53mm×0.5μm	05901-51002
WM-1 30m×0.2mm×0.25μm	05901-12001

Specification	P/N
WM-1 30m×0.2mm×0.5μm	05901-12002
WM-1 30m×0.25mm×0.25μm	05901-22001
WM-1 30m×0.25mm×0.5μm	05901-22002
WM-1 30m×0.32mm×0.25μm	05901-32001
WM-1 30m×0.32mm×0.5μm	05901-32002
WM-1 30m×0.32mm×1μm	05901-32003
WM-1 30m×0.53mm×0.5μm	05901-52002
WM-1 30m×0.53mm×1.0μm	05901-52003

WM-1MS Ordering Information

Specification	P/N
WM-1MS 20m×0.18mm×0.18μm	03903-89018
WM-1MS 20m×0.18mm×0.36μm	03903-89028
WM-1MS 20m×0.18mm×0.4μm	03903-89022
WM-1MS 15m×0.20mm×0.33μm	03903-11021
WM-1MS 25m×0.20mm×0.33μm	03903-18021
WM-1MS 15m×0.25mm×0.25μm	03903-21001
WM-1MS 30m×0.25mm×0.1μm	03903-22007
WM-1MS 30m×0.25mm×0.25μm	03903-22001
WM-1MS 30m×0.25mm×0.5μm	03903-22002

Specification	P/N
WM-1MS 30m×0.25mm×1.0μm	03903-22003
WM-1MS 60m×0.25mm×0.25μm	03903-24001
WM-1MS 15m×0.32mm×0.25μm	03903-31001
WM-1MS 25m×0.32mm×0.52μm	03903-38024
WM-1MS 30m×0.32mm×0.1μm	03903-32007
WM-1MS 30m×0.32mm×0.25μm	03903-32001
WM-1MS 30m×0.32mm×1.0μm	03903-32003
WM-1MS 60m×0.32mm×0.25μm	03903-34001
WM-1MS 60m×0.32mm×1.0μm	03903-34003

WM-5,WM-54,WM-5MS

- 5% Diphenyl 95% dimethyl polysiloxane stationary liquid
- General low-polarity stationary phase
- Thermal stability is up to 350℃
- Chemically bonded crosslinked columns can be flushed with solvent
- Polarity is similar to stationary phases of DB-5, SPB-5, HP-5, Rtx-5
- Comply with USP G27 specific stationary liquid
- With low-loss, excellent inertness and high column efficiency,
- WM-5MS can be used with MS detector

Due to the addition of 5% diphenyl in polydimethylsiloxane, WM-5 column has higher polarity than WM-1 capillary column and has better selectivity to aromatic compounds. In most cases, it will be the type of column you first consider. Beside, WM-5 capillary column also has excellent reproducibility and high column efficiency.

Through a more rigorous manufacturing technique, WM-5MS capillary column has low loss rate. Before being a qualified product, each column needs to be strictly tested, which is assuring. With good inertness to active compounds, ultra-low loss WM-5MS column can effectively improve the detection performance of MS, ECD and NPD.

Specification	P/N
WM-5 30m×0.25mm×0.25μm	05902-22001
WM-5 50m×0.25mm×0.25μm	05902-23001
WM-5 60m×0.25mm×0.5μm	05902-24002
WM-5 30m×0.32mm×0.25μm	05902-32001
WM-5 30m×0.32m×0.5μm	05902-32002

Specification	P/N
WM-5 50m×0.32m×0.5μm	05902-33002
WM-54 15m×0.2mm×0.25μm	05915-11001
WM-54 15m×0.25mm×0.25μm	05915-21001
WM-54 30m×0.25mm×0.25μm	05915-22001
WM-54 30m×0.25mm×0.5μm	05915-22002

Specification	P/N
WM-54 50m×0.25mm×0.5μm	05915-23002
WM-54 30m×0.32mm×0.25μm	05915-32001
WM-54 30m×0.32mm×0.5μm	05915-32002
WM-54 30m×0.32mm×1.0μm	05915-32003
WM-54 30m×0.53mm×0.5μm	05915-52002
WM-54 30m×0.53mm×3.0μm	05915-52006
WM-5 10m×0.18mm×0.18μm	03902-80018

Specification	P/N
WM-5 10m×0.18mm×0.36μm	03902-80028
WM-5 10m×0.18mm×0.4μm	03902-80022
WM-5 20m×0.18mm×0.18μm	03902-89018
WM-5 20m×0.18mm×0.4μm	03902-89022
WM-5 25m×0.20mm×0.11μm	03902-18029
WM-5 25m×0.20mm×0.33μm	03902-18021

Specification	P/N
WM-54 50m×0.25mm×0.5μm	05915-23002
WM-54 30m×0.32mm×0.25μm	05915-32001
WM-54 30m×0.32mm×0.5μm	05915-32002
WM-54 30m×0.32mm×1.0μm	05915-32003
WM-54 30m×0.53mm×0.5μm	05915-52002
WM-54 30m×0.53mm×3.0μm	05915-52006
WM-5 10m×0.18mm×0.18μm	03902-80018

Specification	P/N
WM-5 10m×0.18mm×0.36μm	03902-80028
WM-5 10m×0.18mm×0.4μm	03902-80022
WM-5 20m×0.18mm×0.18μm	03902-89018
WM-5 20m×0.18mm×0.4μm	03902-89022
WM-5 25m×0.20mm×0.11μm	03902-18029
WM-5 25m×0.20mm×0.33μm	03902-18021

WM-5MS Ordering Infomation:

Specification	P/N
WM-5MS 10m×0.1mm×0.1μm	03904-00007
WM-5MS 10m×0.18mm×0.18μm	03904-80018
WM-5MS 20m×0.18mm×0.18μm	03904-89018
WM-5MS 20m×0.18mm×0.36μm	03904-89028
WM-5MS 25m×0.20mm×0.33μm	03904-18021
WM-5MS 15m×0.25mm×0.1μm	03904-21007
WM-5MS 15m×0.25mm×0.25μm	03904-21001
WM-5MS 15m×0.25mm×0.5μm	03904-21002
WM-5MS 15m×0.25mm×1.0μm	03904-21003
WM-5MS 30m×0.25mm×0.1μm	03904-22007
WM-5MS 30m×0.25mm×0.25μm	03904-22001
WM-5MS 30m×0.25mm×0.5μm	03904-22002
WM-5MS 30m×0.25mm×1.0μm	03904-22003
WM-5MS 60m×0.25mm×0.1μm	03904-24007
WM-5MS 60m×0.25mm×0.25μm	03904-24001

Specification	P/N
WM-5MS 60m×0.25mm×0.5μm	03904-24002
WM-5MS 60m×0.25mm×1.0μm	03904-24003
WM-5MS 15m×0.32mm×0.1μm	03904-31007
WM-5MS 15m×0.32mm×0.25μm	03904-31001
WM-5MS 15m×0.32mm×0.5μm	03904-31002
WM-5MS 15m×0.32mm×1.0μm	03904-31003
WM-5MS 25m×0.32mm×0.52μm	03904-38024
WM-5MS 30m×0.32mm×0.1μm	03904-32007
WM-5MS,30m×0.32mm×0.25μm	03904-32001
WM-5MS 30m×0.32mm×0.5μm	03904-32002
WM-5MS 30m×0.32mm×1.0μm	03904-32003
WM-5MS 60m×0.32mm×0.1μm	03904-34007
WM-5MS 60m×0.32mm×0.25μm	03904-34001
WM-5MS 60m×0.32mm×0.5μm	03904-34002
WM-5MS 60m×0.32mm×1.0μm	03904-34003

WM-1301,WM-624

- 6% Cyanopropyl phenyl,94% dimethyl polysiloxane
- Comply with USP G43 specific stationary liquid
- It is specially used for the analysis of volatile organic compounds and residual solvents in drugs
- Bond and crosslink with medium polarity
- Has Excellent inertness for most compounds
- Temperature range: -20 to 260℃
- Polarity is similar to stationary phases of DB-624, SPB-1301, HP-624, Elite-1301, Rtx-624.
- WM-624 is specially designed for EPA method

WM-1301 Ordering Infomation:

Specification	P/N
WM-1301 15m×0.25mm×0.25μm	03905-21001
WM-1301 30m×0.25mm×0.25μm	03905-22001
WM-1301 30m×0.25mm×0.5μm	03905-22002

Specification	P/N
WM-1301 30m×0.25mm×1.0μm	03905-22003
WM-1301 60m×0.25mm×0.25μm	03905-24001
WM-1301 60m×0.25mm×1.0μm	03905-24003

Specification	P/N
WM-1301 60m×0.25mm×1.4μm	03905-24009
WM-1301 15m×0.32mm×0.25μm	03905-31001
WM-1301 15m×0.32mm×0.5μm	03905-31002
WM-1301 30m×0.32mm×0.25μm	03905-32001
WM-1301 30m×0.32mm×0.5μm	03905-32002
WM-1301 30m×0.32mm×1.0μm	03905-32003
WM-1301 15m×0.2mm×0.25μm	05905-11001
WM-1301 15m×0.2mm×0.5μm	05905-11002
WM-1301 15m×0.25mm×0.25μm	05905-21001
WM-1301 15m×0.25mm×0.5μm	05905-21002
WM-1301 30m×0.25mm×1μm	05905-22003
WM-1301 15m×0.32mm×0.25μm	05905-31001

Specification	P/N
WM-1301 15m×0.32mm×0.5μm	05905-31002
WM-1301 15m×0.53mm×0.5μm	05905-51002
WM-1301 30m×0.2mm×0.25μm	05905-12001
WM-1301 30m×0.2mm×0.5μm	05905-12002
WM-1301 30m×0.25mm×0.25μm	05905-22001
WM-1301 30m×0.25mm×0.5μm	05905-22002
WM-1301 30m×0.25mm×1.4μm	05905-22009
WM-1301 30m×0.32mm×0.25μm	05905-32001
WM-1301 30m×0.32mm×0.5μm	05905-32002
WM-1301 50m×0.2mm×0.5μm	05905-13002
WM-1301 50m×0.25mm×0.25μm	05905-23001

WM-624 Ordering Infomation:

Specification	P/N	Product
WM-624 30m×0.25mm×1.4μm	03908-22009	GC capillary column
WM-624 60m×0.25mm×1.4μm	03908-24009	GC capillary column
WM-624 30m×0.32mm×0.25μm	03908-32001	GC capillary column
WM-624 30m×0.32mm×1.8μm	03908-32004	GC capillary column
WM-624 60m×0.32mm×1.8μm	03908-34004	GC capillary column
WM-624 30m×0.53mm×3.0μm	03908-52006	GC capillary column
WM-624 60m×0.53mm×3.0μm	03908-54006	GC capillary column
WM-624 60m×0.53mm×3.0μm	05908-54006	GC capillary column
WM-624 20m×0.18mm×1.0μm	03908-89003	GC capillary column
WM-624 75m×0.53mm×3.0μm	03908-512006	GC capillary column

WM-35,WM-35MS

- ➤ 35% Diphenyl 65% dimethyl polysiloxane stationary liquid
- ➤ General low-polarity stationary phase
- ➤ Thermal stability is up to 320℃
- ➤ Chemically bonded crosslinked columns can be flushed with solvent
- ➤ Polarity is similar to stationary phases of DB-35, SPB-35, HP-35, Rtx-35, PE-35
- ➤ Comply with USP G42 specific stationary liquid
- ➤ As a kind of low-loss column, it can be used with MS detector

Due to the addition of 35% diphenyl in polydimethylsiloxane, WM-35 column is suitable for the analysis of compounds with medium polarity. Besides, WM-35 capillary column has excellent reproducibility and high column efficiency.

Through a more rigorous manufacturing technique, WM-35MS capillary has low loss rate. Before being a qualified product, each column needs to be strictly tested, which is assuring. With good inertness to active compounds, Ultra-low loss WM-35MS column can effectively improve the detection performance of MS, ECD and NPD.

WM-35 Ordering Infomation:

Specification	P/N
WM-35 20m×0.18mm×0.18μm	03921-89018
WM-35 15m×0.20mm×0.33μm	03921-11021
WM-35 25m×0.20mm×0.33μm	03921-18021
WM-35 30m×0.25mm×0.15μm	03921-22008
WM-35 30m×0.25mm×0.5μm	03921-22002
WM-35 60m×0.25mm×0.25μm	03921-24001
WM-35 60m×0.32mm×0.25μm	03921-24002
WM-35 15m×0.32mm×0.25μm	03921-31001

Specification	P/N
WM-35 30m×0.32mm×0.25μm	03921-32001
WM-35 30m×0.32mm×1.0μm	03921-32003
WM-35 60m×0.32mm×0.25μm	03921-34001
WM-35 60m×0.32mm×0.5μm	03921-34002
WM-35 30m×0.53mm×0.5μm	03921-52002
WM-35 30m×0.53mm×1.5μm	03921-52025
WM-35 60m×0.53mm×0.5μm	03921-54002

WM-35MS Ordering Infomation:

Specification	P/N
WM-35MS 20m×0.18mm×0.18μm	03906-89018
WM-35MS 15m×0.20mm×0.33μm	03906-11021
WM-35MS 25m×0.20mm×0.33μm	03906-18021
WM-35MS 15m×0.25mm×0.25μm	03906-21001
WM-35MS 30m×0.25mm×0.15μm	03906-22008
WM-35MS 30m×0.25mm×0.25μm	03906-22001

Specification	P/N
WM-35MS 60m×0.25mm×0.25μm	03906-24001
WM-35MS 15m×0.32mm×0.25μm	03906-31001
WM-35MS 30m×0.32mm×0.25μm	03906-32001
WM-35MS 30m×0.53mm×0.5μm	03906-52002
WM-35MS 30m×0.53mm×1.0μm	03906-52003

WM-17,WM-17MS

- 50% diphenyl 50% dimethyl polysiloxane
- General low-polarity stationary phase
- Thermal stability is up to 320℃
- Chemically bonded crosslinked columns can be flushed with solvent
- Polarity is similar to stationary phases of DB-17, HP-17, SPB-50
- Comply with USP G3 specific stationary liquid
- Low-loss WM-17MS can be used with MS detector

Due to the addition of 50% diphenyl in polydimethylsiloxane, WM-17 column is suitable for the analysis of compounds with medium polarity. Besides, WM-17 capillary column has excellent reproducibility and high column efficiency.

Through a more rigorous manufacturing technique, WM-17 capillary column has low loss rate. Before being a qualified product, each column needs to be strictly tested, which is assuring. With good inertness to active compounds, ultra-low loss WM-17 column can effectively improve the detection performance of MS, ECD and NPD.

Specification	P/N
WM-17 20m×0.18mm×0.18μm	03916-89018
WM-17 20m×0.18mm×0.3μm	03916-89013
WM-17 15m×0.25mm×0.15μm	03916-21008
WM-17 15m×0.25mm×0.25μm	03916-21001
WM-17 15m×0.25mm×0.5μm	03916-21002
WM-17 30m×0.25mm×0.15μm	03916-22008
WM-17 30m×0.25mm×0.25μm	03916-22001

Specification	P/N
WM-17 15m×0.32mm×0.15μm	03916-31008
WM-17 15m×0.32mm×0.25μm	03916-31001
WM-17 15m×0.32mm×0.5μm	03916-31002
WM-17 30m×0.32mm×0.15μm	03916-32008
WM-17 30m×0.32mm×0.25μm	03916-32001
WM-17 60m×0.32mm×0.5μm	05916-34002
WM-17 30m×0.53mm×1.0μm	05916-52003

Specification	P/N
WM-17 30m×0.25mm×0.5μm	03916-22002
WM-17 60m×0.25mm×0.25μm	03916-24001

Specification	P/N
WM-17 30m×0.25mm×0.25μm	05916-22001
WM-17 30m×0.32mm×0.25μm	05916-32001

WM-17MS Ordering Information:

Specification	P/N
WM-17MS 20m×0.18mm×0.18μm	03947-89018
WM-17MS 15m×0.25mm×0.15μm	03947-21008
WM-17MS 15m×0.25mm×0.25μm	03947-21001
WM-17MS 30m×0.25mm×0.15μm	03947-22008
WM-17MS 30m×0.25mm×0.25μm	03947-22001
WM-17MS 60m×0.25mm×0.25μm	03947-24001

Specification	P/N
WM-17MS 15m×0.32mm×0.25μm	03947-31001
WM-17MS 30m×0.32mm×0.25μm	03947-32001
WM-17MS 60m×0.32mm×0.25μm	03947-34001
WM-17MS 30m×0.53mm×0.5μm	03947-52002
WM-17MS 15m×0.53mm×1.0μm	03947-51003

WM-1701

- 14% Cyanopropylphenyl 86% dimethyl polysiloxane
- General medium-polarity stationary phase
- Thermal stability is up to 300℃
- Chemically bonded crosslinked columns can be flushed with solvent
- Polarity is similar to stationary phases of DB-1701, SPB-1701, HP-1701
- Comply with USP G46 specific stationary liquid

WM-1701 Ordering Information:

Specification	P/N
WM-1701 30m×0.25mm×0.25μm	05907-22001
WM-1701 30m×0.25mm×0.5μm	05907-22002
WM-1701 15m×0.32mm×0.25μm	05907-31001
WM-1701 30m×0.32mm×0.25μm	05907-32001
WM-1701 30m×0.32mm×0.5μm	05907-32002
WM-1701 30m×0.32mm×2.65μm	05907-32034
WM-1701 50m×0.32mm×0.5μm	05907-33002
WM-1701 15m×0.53mm×0.5μm	05907-51002
WM-1701 20m×0.18mm×0.18μm	03907-89018
WM-1701 25m×0.20mm×0.2μm	03907-18011
WM-1701 15m×0.25mm×0.25μm	03907-21001
WM-1701 30m×0.25mm×0.25μm	03907-22001

Specification	P/N
WM-1701 30m×0.25mm×0.5μm	03907-22002
WM-1701 30m×0.25mm×1.0μm	03907-22003
WM-1701 60m×0.25mm×0.25μm	03907-24001
WM-1701 60m×0.25mm×0.5μm	03907-24002
WM-1701 15m×0.32mm×0.25μm	03907-31001
WM-1701 15m×0.32mm×0.5μm	03907-31002
WM-1701 30m×0.32mm×0.25μm	03907-32001
WM-1701 30m×0.32mm×0.5μm	03907-32002
WM-1701 30m×0.32mm×1.0μm	03907-32003
WM-1701 60m×0.32mm×0.25μm	03907-34001
WM-1701 60m×0.32mm×0.5μm	03907-34002
WM-1701 60m×0.32mm×1.0μm	03907-34003

WM-225

- 50% Cyanopropylphenyl, 50% dimethyl polysiloxane
- Bonded crosslinked column
- Thermal stability is up to 240℃
- Equivalent to USP stationary G7
- Stationary phase with medium polarity, suitable for separation of Cis or trans fatty acid methyl ester
- Polarity is similar to DB-225, HP-225, Rtx-225

WM-225 Ordering Information:

Specification	P/N	Product
WM-225 30m×0.53mm×1.0μm	05919-52003	GC capillary column

WM-INOWAX

- Bonded crosslinked polyethylene glycol (PEG)
- General stationary phase with polarity
- With antioxidant properties
- Thermal stability is up to 280℃
- Chemically bonded crosslinked columns can be flushed with solvent
- Polarity is similar to stationary phases of HP-INNOWax, CP-WAX 52CB
- Comply with USP G16 specific stationary liquid

WM-INOWAX Ordering Information

Specification	P/N
WM-INOWAX 10m×0.18mm×0.18μm	03909-80018
WM-INOWAX 20m×0.18mm×0.18μm	03909-89018
WM-INOWAX 25m×0.20mm×0.2μm	03909-18011
WM-INOWAX 25m×0.20mm×0.4μm	03909-18022
WM-INOWAX 50m×0.20mm×0.2μm	03909-13011
WM-INOWAX 50m×0.20mm×0.4μm	03909-13022
WM-INOWAX 15m×0.25mm×0.25μm	03909-21001
WM-INOWAX 15m×0.25mm×0.5μm	03909-21002
WM-INOWAX 30m×0.25mm×0.15μm	03909-22008
WM-INOWAX 30m×0.25mm×0.25μm	03909-22001
WM-INOWAX 30m×0.25mm×0.5μm	03909-22002
WM-INOWAX 60m×0.25mm×0.15μm	03909-24008
WM-INOWAX 60m×0.25mm×0.25μm	03909-24001

Specification	P/N
WM-INOWAX 60m×0.25mm×0.5μm	03909-24002
WM-INOWAX 15m×0.32mm×0.25μm	03909-31001
WM-INOWAX 15m×0.32mm×0.5μm	03909-31002
WM-INOWAX 30m×0.32mm×0.15μm	03909-32008
WM-INOWAX 30m×0.32mm×0.25μm	03909-32001
WM-INOWAX 30m×0.32mm×0.5μm	03909-32002
WM-INOWAX 30m×0.32mm×1.0μm	03909-32003
WM-INOWAX 60m×0.32mm×0.15μm	03909-34008
WM-INOWAX 30m×0.53mm×1.0μm	03909-52003
WM-INOWAX 60m×0.53mm×0.5μm	03909-54002
WM-INOWAX 50m×0.53mm×2.0μm	05909-53005
WM-INOWAX 30m×0.25mm×0.25μm	05909-22001

WM-FFAP

- Nitroterephthalic acid modified polyethylene glycol
- Stationary phase has strong polarity
- Has special advantagesIn the analysis of volatile fatty acids and phenol and other substances
- Thermal stability is is up to 260℃
- Polarity is similar to stationary phases of DB-FFAP, HP-FFAP, Stabilwax-DA
- Comply with USP G35 specific stationary liquid

WM-FFAP Ordering Information

Specification	P/N
WM-FFAP 30m×0.20mm×0.25μm	05911-12001
WM-FFAP 30m×0.25mm×0.25μm	05911-22001
WM-FFAP 60m×0.25mm×0.25μm	05911-24001
WM-FFAP 30m×0.32mm×0.25μm	05911-32001
WM-FFAP 30m×0.32mm×0.5μm	05911-32002
WM-FFAP 30m×0.32mm×1.0μm	05911-32003

Specification	P/N
WM-FFAP 50m×0.20mm×0.3μm	03911-13013
WM-FFAP 15m×0.25mm×0.25μm	03911-21001
WM-FFAP 30m×0.25mm×0.25μm	03911-22001
WM-FFAP 30m×0.20mm×0.25μm	03911-12001
WM-FFAP 50m×0.25mm×0.25μm	03911-23001
WM-FFAP 15m×0.32mm×0.25μm	03911-31001

Specification	P/N
WM-FFAP 30m×0.53mm×0.5μm	05911-52002
WM-FFAP 30m×0.53mm×1.0μm	05911-52003
WM-FFAP 20m×0.18mm×0.18μm	03911-89018
WM-FFAP 25m×0.20mm×0.3μm	03911-18013

Specification	P/N
WM-FFAP 25m×0.32mm×0.5μm	03911-38002
WM-FFAP 30m×0.32mm×0.25μm	03911-32001
WM-FFAP 30m×0.32mm×0.5μm	03911-32002
WM-FFAP 30m×0.32mm×1.0μm	03911-32003

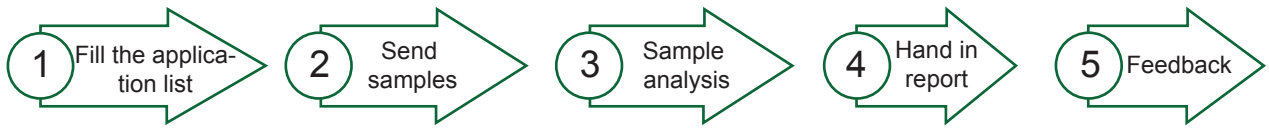
Specification	P/N
WM-FFAP 50m×0.32mm×0.5μm	03911-33002
WM-FFAP 60m×0.32mm×0.25μm	03911-34001

Specification	P/N
WM-FFAP 10m×0.53mm×1.0μm	03911-50003

1.2 WEL Series Economical GC Column

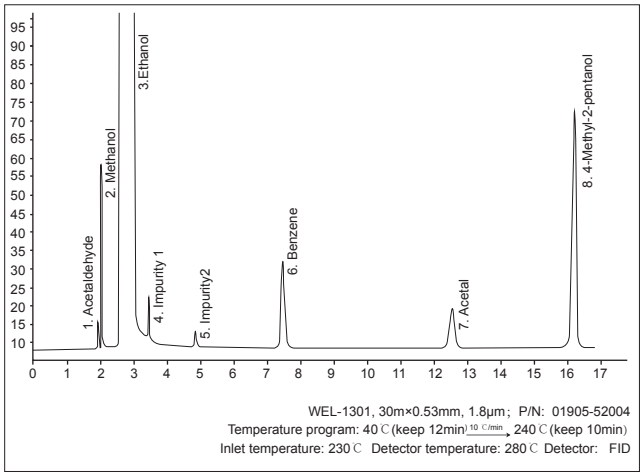
Each of the WEL series of capillary columns has been strictly tested with attached evaluation chromatogram. For high column efficiency and sensitivity, our products are popular among new and regular customers. We can provide sample analysis for customers to ensure the superior performance of columns and various dedicated columns for some test items with higher column efficiency and separation effect, which can help in the qualitative and quantitative analysis.

Sample analysis flow

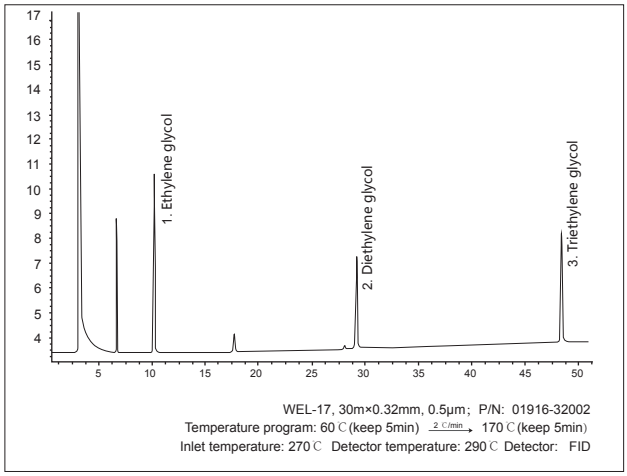


Chromatogram of Typical Applications

1. Detection of Volatile Impurities in Ethanol

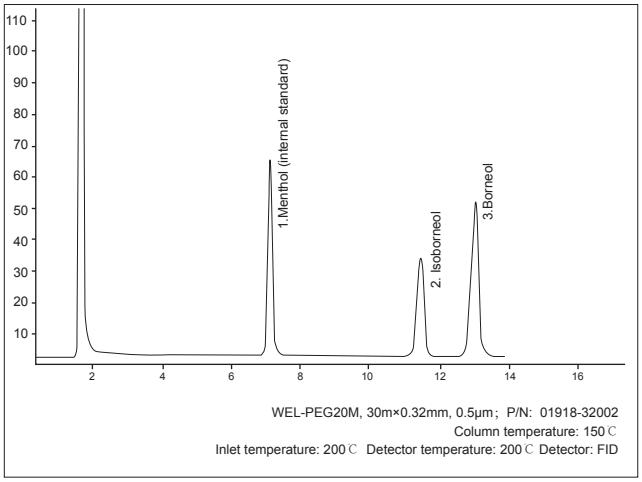


2. Detection of Ethylene Glycol, Diethylene Glycol and Triethylene Glycol in Polyethylene Glycol 400

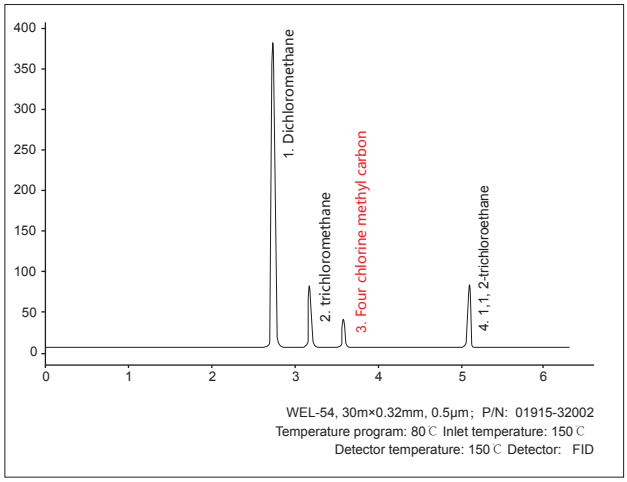


3) Determination of Effective Composition of Borneol

4) Analysis of Chloroalkanes

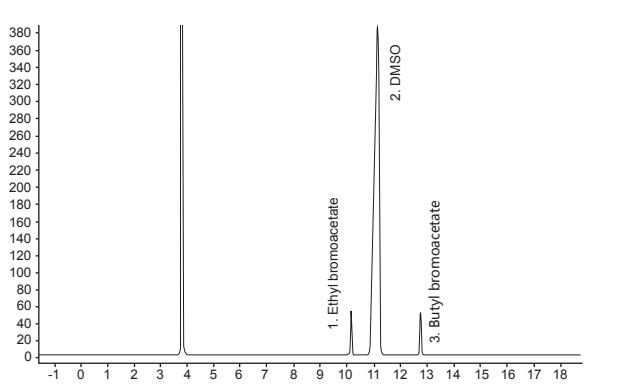


WEL-PEG20M, 30m×0.32mm, 0.5μm; P/N: 01918-32002
Column temperature: 150℃
Inlet temperature: 200℃ Detector temperature: 200℃ Detector: FID



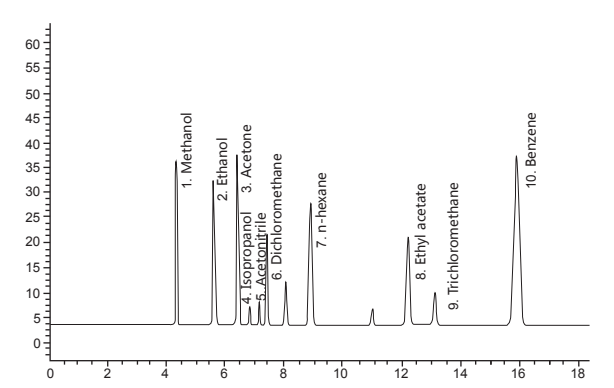
WEL-54, 30m×0.32mm, 0.5μm; P/N: 01915-32002
Temperature program: 80℃ Inlet temperature: 150℃
Detector temperature: 150℃ Detector: FID

5) Determination of Ethyl Bromoacetate



WEL-1701, 30m×0.32mm, 0.5μm; P/N: 01907-32002
Temperature program: 60℃ (keep 3 min) 15℃/min 150℃ 30℃/min 230℃
Inlet temperature: 220℃ Detector temperature: 220℃ Detector: FID

6) Determination of Organic Solvent Residue



WEL-624, 30m×0.53mm, 2μm; P/N: 01908-52005
Temperature program: 40℃
Inlet temperature: 200℃ Detector temperature: 240℃ Detector: FID

Ordering Information

Specification	P/N
WEL-1 30m×0.25mm×0.25μm	01901-22001
WEL-1 30m×0.25mm×0.5μm	01901-22002
WEL-1 30m×0.25mm×1.0μm	01901-22003
WEL-1 50m×0.25mm×0.25μm	01901-23001
WEL-1 50m×0.25mm×0.5μm	01901-23002
WEL-1 50m×0.25mm×1.0μm	01901-23003
WEL-1 60m×0.25mm×0.25μm	01901-24001
WEL-1 60m×0.25mm×0.5μm	01901-24002
WEL-1 60m×0.25mm×1.0μm	01901-24003
WEL-5 30m×0.32mm×0.25μm	01902-32001
WEL-5 30m×0.32mm×0.5μm	01902-32002
WEL-5 30m×0.32mm×1.0μm	01902-32003
WEL-5 30m×0.32mm×3.0μm	01902-32006

Specification	P/N
WEL-1701 50m×0.25mm×0.25μm	01907-23001
WEL-1701 50m×0.25mm×0.5μm	01907-23002
WEL-1701 50m×0.25mm×1.0μm	01907-23003
WEL-1701 60m×0.25mm×0.25μm	01907-24001
WEL-1701 60m×0.25mm×0.5μm	01907-24002
WEL-624 30m×0.25mm×0.25μm	01908-22001
WEL-624 30m×0.25mm×0.5μm	01908-22002
WEL-624 30m×0.25mm×1.0μm	01908-22003
WEL-624 30m×0.25mm×1.4μm	01908-22004
WEL-624 50m×0.25mm×0.25μm	01908-23001
WEL-624 50m×0.25mm×0.5μm	01908-23002
WEL-624 50m×0.25mm×1.0μm	01908-23003
WEL-624 60m×0.25mm×0.25μm	01908-24001

Specification	P/N
WEL-5 15m×0.53mm×1.0μm	01902-51003
WEL-5 30m×0.53mm×1.0μm	01902-52003
WEL-5 50m×0.53mm×1.0μm	01902-53003
WEL-1301 60m×0.25mm×1.8μm	01905-24004
WEL-1301 30m×0.32mm×1.8μm	01905-32004
WEL-1301 30m×0.53mm×1.8μm	01905-52004
WEL-1301 50m×0.53mm×2.0μm	01905-53005
WEL-1301 30m×0.53mm×2.0μm	01905-52005
WEL-1701 30m×0.25mm×0.25μm	01907-22001
WEL-1701 30m×0.25mm×0.5μm	01907-22002
WEL-1701 30m×0.25mm×1.0μm	01907-22003

Specification	P/N
WEL-624 60m×0.25mm×0.5μm	01908-24002
WEL-624 60m×0.25mm×1.0μm	01908-24003
WEL-624 25m×0.25mm×0.2μm	01908-28011
WEL-624 30m×0.32mm×0.25μm	01908-32001
WEL-624 30m×0.32mm×0.5μm	01908-32002
WEL-FFAP 30m×0.25mm×0.25μm	01911-22001
WEL-FFAP 30m×0.25mm×0.5μm	01911-22002
WEL-FFAP 30m×0.25mm×1.0μm	01911-22003
WEL-FFAP 50m×0.25mm×0.5μm	01911-23002
WEL-FFAP 50mm×0.25mm×1.0μm	01911-23003
WEL-FFAP 60m×0.25mm×0.25μm	01911-24001

Specification	P/N
WEL-FFAP 60m×0.25mm×0.5μm	01911-24002
WEL-FFAP 60m×0.25mm×1.0μm	01911-24003
WEL-FFAP 30m×0.32mm×0.25μm	01911-32001
WEL-FFAP 30m×0.32mm×0.5μm	01911-32002
WEL-FFAP 30m×0.32mm×1.0μm	01911-32003
WEL-FFAP 50m×0.32mm×0.25μm	01911-33001
WEL-FFAP 50m×0.32mm×0.5μm	01911-33002
WEL-FFAP 50m×0.32mm×1.0μm	01911-33003
WEL-30 30m×0.25mm×0.25μm	01912-22001
WEL-30 30m×0.25mm×0.5μm	01912-22002
WEL-30 30m×0.25mm×1.0μm	01912-22003
WEL-30 50m×0.25mm×0.25μm	01912-23001
WEL-30 50m×0.25mm×0.5μm	01912-23002
WEL-30 50m×0.25mm×1.0μm	01912-23003
WEL-30 60m×0.25mm×0.25μm	01912-24001
WEL-30 60m×0.25mm×0.5μm	01912-24002
WEL-30 60m×0.25mm×1.0μm	01912-24003
WEL-30 30m×0.32mm×0.25μm	01912-32001
WEL-30 30m×0.32mm×0.5μm	01912-32002

Specification	P/N
WEL-30 30m×0.32mm×1.0μm	01912-32003
WEL-30 50m×0.32mm×0.25μm	01912-33001
WEL-101 30m×0.25mm×0.25μm	01913-22001
WEL-101 30m×0.25mm×0.5μm	01913-22002
WEL-101 30m×0.25mm×1.0μm	01913-22003
WEL-101 50m×0.25mm×0.25μm	01913-23001
WEL-101 50m×0.25mm×0.5μm	01913-23002
WEL-101 50m×0.25mm×1.0μm	01913-23003
WEL-101 60m×0.25mm×0.25μm	01913-24001
WEL-101 60m×0.25mm×0.5μm	01913-24002
WEL-101 60m×0.25mm×1.0μm	01913-24003
WEL-101 30m×0.32mm×0.25μm	01913-32001
WEL-101 30m×0.32mm×0.5μm	01913-32002
WEL-101 30m×0.32mm×1.0μm	01913-32003
WEL-101 50m×0.32mm×0.25μm	01913-33001
WEL-101 50m×0.32mm×0.5μm	01913-33002
WEL-52 30m×0.32mm×0.25μm	01914-32001
WEL-54 50m×0.25mm×0.25μm	01915-23001
WEL-54 50m×0.25mm×0.5μm	01915-23002

Specification	P/N
WEL-17 50m×0.25mm×1.0μm	01916-23003
WEL-17 60m×0.25mm×0.25μm	01916-24001
WEL-17 60m×0.25mm×0.5μm	01916-24002
WEL-54 60m×0.25mm×1.0μm	01915-24003

Specification	P/N
WEL-XE60 50m×0.32mm×0.5μm	01917-33002
WEL-XE60 50m×0.32mm×1.0μm	01917-33003
WEL-225 30m×0.25mm×0.25μm	01919-22001
WEL-17 30m×0.32mm×1.0μm	01916-32003

Specification	P/N
WEL-54 30m×0.32mm×0.25μm	01915-32001
WEL-54 30m×0.32mm×0.5μm	01915-32002
WEL-54 30m×0.32mm×1.0μm	01915-32003
WEL-54 50m×0.32mm×0.25μm	01915-33001
WEL-54 50m×0.32mm×0.5μm	01915-33002
WEL-54 50m×0.32mm×1.0μm	01915-33003
WEL-17 30m×0.25mm×0.25μm	01916-22001
WEL-17 30m×0.25mm×0.5μm	01916-22002
WEL-17 30m×0.25mm×1.0μm	01916-22003
WEL-17 50m×0.25mm×0.25μm	01916-23001
WEL-17 50m×0.25mm×0.5μm	01916-23002
WEL-17 50m×0.25mm×1.0μm	01916-23003
WEL-17 60m×0.25mm×0.25μm	01916-24001
WEL-17 60m×0.25mm×0.5μm	01916-24002

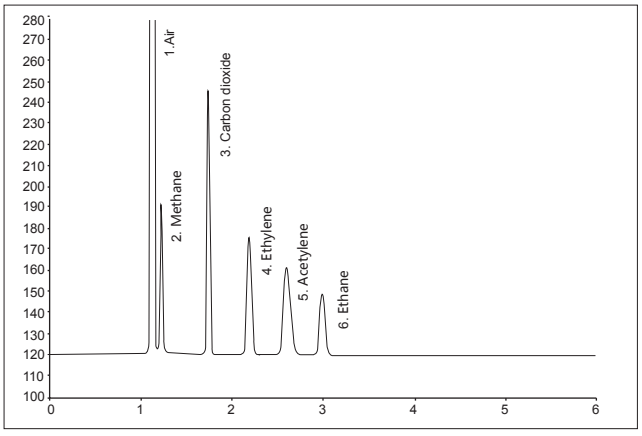
Specification	P/N
WEL-XE60 30m×0.25mm×0.25μm	01917-22001
WEL-XE60 30m×0.25mm×0.5μm	01917-22002
WEL-XE60 30m×0.25mm×1.0μm	01917-22003
WEL-XE60 50m×0.25mm×0.25μm	01917-23001
WEL-XE60 50m×0.25mm×0.5μm	01917-23002
WEL-XE60 60m×0.25mm×0.25μm	01917-24001
WEL-XE60 60m×0.25mm×0.5μm	01917-24002
WEL-XE60 60m×0.25mm×1.0μm	01917-24003
WEL-XE60 30m×0.32mm×0.5μm	01917-32002
WEL-XE60 30m×0.32mm×1.0μm	01917-32003
WEL-XE60 50m×0.32mm×0.25μm	01917-33001
WEL-XE60 50m×0.32mm×0.5μm	01917-33002
WEL-XE60 50m×0.32mm×1.0μm	01917-33003
WEL-225 30m×0.25mm×0.25μm	01919-22001

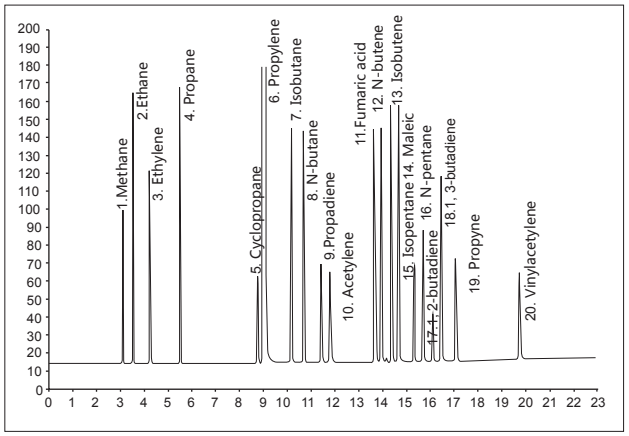
Specification	P/N
WEL-225 30m×0.25mm×0.5μm	01919-22002
WEL-225 30m×0.25mm×1.0μm	01919-22003
WEL-225 50m×0.25mm×0.25μm	01919-23001
WEL-225 50m×0.25mm×0.5μm	01919-23002
WEL-225 50m×0.25mm×1.0μm	01919-23003
WEL-225 60m×0.25mm×0.25μm	01919-24001
WEL-225 60m×0.25mm×0.5μm	01919-24002

Specification	P/N
WEL-225 60m×0.25mm×1.0μm	01919-24003
WEL-225 30m×0.32mm×0.25μm	01919-32001
WEL-225 30m×0.32mm×0.5μm	01919-32002
WEL-225 30m×0.32mm×1.0μm	01919-32003
WEL-35 30m×0.25mm×0.25mm	01921-22001
WEL-35 30m×0.32mm×0.25μm	01921-32001
WEL-35 30m×0.20mm×0.25mm	01921-12001

PLOT Column

PLOT column has small granular material bonded on the pipe wall. Welch provides high quality PLOT columns which applied the unique integrated synthesis technology. Commonly used PLOT column stationary phases include styrene and its derivatives, molecular sieves and alumina, which are suitable for the separation and analysis of permanent gas and low molecular weight hydrocarbon isomers.





WEL-PLOT Q, 30m×0.53mm, 40μm； P/N: 06928-52026
Column temperature: 35℃
Inlet temperature: 250℃ Detector temperature: 250℃ Detector: TCD

WEL-PLOT Al2O3, 50m×0.53mm, 25μm； P/N: 06946-53027
Temperature program: 80℃(keep 5 min)$\xrightarrow{8\,℃/min}$180℃
Inlet temperature: 250℃ Detector temperature: 250℃ Detector: FID

PLOT Capillary Column

Use Alumina as the stationary phase, alumina columns can be divided into the following three kinds according to the surface treatment of alumina.

- WEL-PLOT AL_2O_3/KCL (Modified KCl)
- WEL-AL_2O_3/S (Na_2SO_4)
- WEL-AL_2O_3/M (Modified Na_2MoO_4)
- Polarity is similar to GS-Alumina, HP PLOT S, HP PLOT M, Alumina-PLOT, AT-Alumina, CP-Al_2O_3/Na_2SO_4

Use divinylbenzene - polystyrene as the stationary phase

Used for analysis of alkanes, methane, air/carbon monoxide, oxides and sulfides of C1-C3 isomers, to C12.

- PLOT Q

Use molecular sieve as the stationary phase (Carbon molecular sieve, 5A molecular sieve)

Mainly used for the detection of permanent gases, such as nitrogen, oxygen, carbon monoxide, methane and other gases.

- WEL-PLOT Molesieve

PLOT Column Ordering Information

Specification	P/N
WEL-PLOT Q 30m×0.32mm×20μm	06928-32014
WEL-PLOT Q 30m×0.32mm×10μm	06928-32040

Specification	P/N
WEL-PLOT Q 30m×0.53mm×20um	06928-52014
WEL-PLOT Q 30m×0.53mm×40μm	06928-52026

Specification	P/N
WEL-PLOT Al_2O_3/S 50m×0.53mm×25μm	06951-53027
WEL-PLOT Al_2O_3/M 50m×0.53mm×0.25μm	06952-53001
WEL-PLOT Q 30m×0.53mm×25μm	06928-52027
WEL-PLOT Al_2O_3/S 30m×0.53mm×20μm	01951-52020

Specification	P/N
WEL-PLOT Al_2O_3/S 30m×0.53mm×20μm	05951-52020
WEL-PLOT Al_2O_3/S 50m×0.53mm×20μm	05951-53020
WEL-PLOT Al_2O_3/S 50m×0.32mm×8μm	01951-33037

1.3 Dedicated Capillary Column

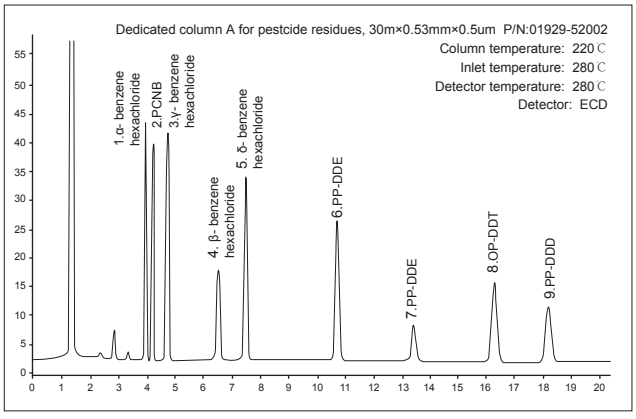
For separation problem of some complex samples, Welch developed the dedicated column which can be applied to pesticide analysis, volatile organic compounds analysis, petrochemical analysis, liquor analysis and other aspects with unique performance. It requires short analysis time with good separation effect, and it is convenient for better qualitative and quantitative analysis.

P/N	Product	Length×Inner Size×Membrane m×mm×μm	Application
01929-32002	Dedicated column A for pestcide residues	30m×0.32mm×0.5μm	Organochlorine pesticide
01929-52002		30m×0.53mm×0.5μm	
01937-32002	Dedicated column B for pestcide residues	30m×0.32mm×0.5μm	Organophosphorus pesticide
01937-52002		30m×0.53mm×0.5μm	
01932-22023	BPX-70	30m×0.25mm×0.22μm	Analysis of evening primrose oil
05935-33003	TVOC dedicated column	50m×0.32mm×1.0μm	Total volatile organic compounds (VOCs) in indoor air

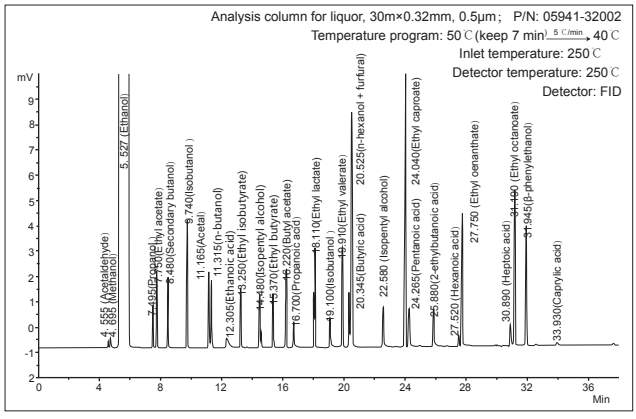
P/N	Product	Length×Inner Size×Membrane m×mm×μm	Application
01936-13002	PONA dedicated column	50m×0.20mm×0.5μm	Analysis of gasoline and diesel component
01936-23002		50m×0.25mm×0.5μm	
05941-32002	Dedicated column for wine analysis	30m×0.32mm×0.5μm	Composition analysis of liquor and beer

P/N	Product	Length×Inner Size×Membrane m×mm×μm	Application
01929-32002	Dedicated column A for pestcide residues	30m×0.32mm×0.5μm	Organochlorine pesticide
01929-52002		30m×0.53mm×0.5μm	
01937-32002	Dedicated column B for pestcide residues	30m×0.32mm×0.5μm	Organophosphorus pesticide
01937-52002		30m×0.53mm×0.5μm	
01932-22023	BPX-70	30m×0.25mm×0.22μm	Analysis of evening primrose oil
05935-33003	TVOC dedicated column	50m×0.32mm×1.0μm	Total volatile organic compounds (VOCs) in indoor air
01936-13002	PONA dedicated column	50m×0.20mm×0.5μm	Gasoline and diesel component analysis
01936-23002	Dedicated column for wine analysis	50m×0.25mm×0.5μm	Composition analysis of liquor and beer
05941-32002		30m×0.32mm×0.5μm	

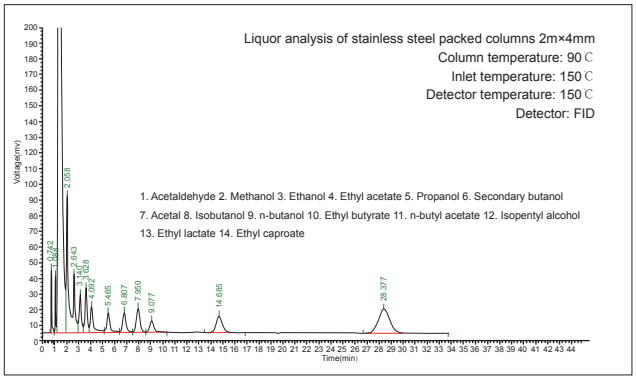
Analysis of Organochlorine Pesticide Residues



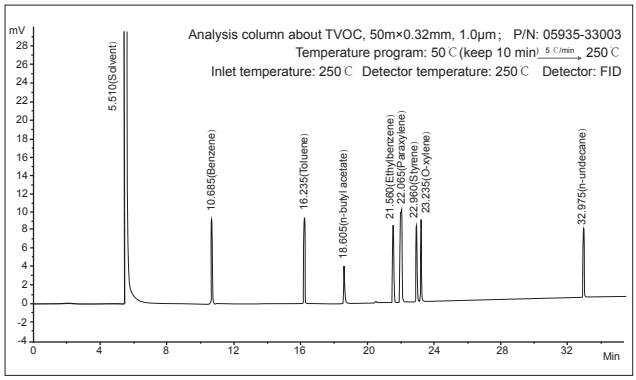
Analysis of Liquor



Analysis of Liquor 2



TVOC Analysis



WEL-PONA

- Dedicated column for analysis of complex hydrocarbon
- Polarity is similar to Petrocol DH, DB-Petro, HP-PONA column

WEL-PONA Ordering Information:

Specification	P/N
WEL-PONA, 50m×0.2mm×0.5μm	01936-13002

WM-TVOC

- Dedicated column, used for determination of total volatile organic compounds (TVOC) in indoor air

WM-TVOC Ordering information:

Specification	P/N
WM-TVOC, 40m×0.32mm×0.33μm	05935-30021

WM-PEG20M, WEL-PEG20M

- Polyethylene glycol column
- Bond and crosslink with strong polarity
- Recommended for fatty acids

WM-PEG20M,WEL-PEG20M Ordering Information

Specification	P/N
WM-PEG20M 15m×0.2mm×0.25μm	05918-11001
WM-PEG20M 15m×0.2mm×0.5μm	05918-11002
WM-PEG20M 15m×0.25mm×0.25μm	05918-21001
WM-PEG20M 15m×0.25mm×0.5μm	05918-21002
WM-PEG20M 15m×0.32mm×0.25μm	05918-31001
WM-PEG20M 30m×0.2mm×0.25μm	05918-12001
WM-PEG20M 30m×0.2mm×0.5μm	05918-12002
WM-PEG20M 30m×0.25mm×0.25μm	05918-22001
WM-PEG20M 30m×0.25mm×0.5μm	05918-22002
WM-PEG20M 30m×0.32mm×0.25μm	05918-32001
WM-PEG20M 30m×0.32mm×0.5μm	05918-32002
WM-PEG20M 50m×0.2mm×0.25μm	05918-13001
WM-PEG20M 50m×0.2mm×0.5μm	05918-13002
WM-PEG20M 50m×0.25mm×0.25μm	05918-23001
WM-PEG20M 50m×0.25mm×0.5μm	05918-23002
WM-PEG20M 50m×0.32mm×0.25μm	05918-33001
WM-PEG20M 50m×0.32mm×0.5μm	05918-33002

Specification	P/N
WM-PEG20M 50m×0.53mm×0.5μm	05918-53002
WM-PEG20M 60m×0.2mm×0.25μm	05918-14001
WM-PEG20M 60m×0.2mm×0.5μm	05918-14002
WM-PEG20M 60m×0.25mm×0.25mm	05918-24001
WM-PEG20M 60m×0.32mm×0.5μm	05918-34002
WEL-PEG20M 30m×0.25mm×0.25μm	01918-22001
WEL-PEG20M 30m×0.25mm×0.5μm	01918-22002
WEL-PEG20M 30m×0.25mm×1.0μm	01918-22003
WEL-PEG20M 50m×0.25mm×0.25μm	01918-23001
WEL-PEG20M 50m×0.25mm×0.5μm	01918-23002
WEL-PEG20M 50m×0.25mm×1.0μm	01918-23003
WEL-PEG20M 50m×0.25mm×0.4μm	01918-23022
WEL-PEG20M 60m×0.25mm×0.25μm	01918-24001
WEL-PEG20M 60m×0.25mm×0.5μm	01918-24002
WEL-PEG20M 30m×0.32mm×0.25μm	01918-32001
WEL-PEG20M 30m×0.32mm×0.5μm	01918-32002
WEL-PEG20M 30m×0.32mm×1.0μm	01918-32003

Dedicated column for 37 kinds of fatty acids

Specification	P/N
WM-CN100 100m×0.25mm×0.2μm	07965-25011

Dedicated column for liquor analysis column

Specification	P/N
30m×0.32mm×0.5μm	05941-32002

Column pharmaceutical ethanol analysis

Specification	P/N
30m×0.32mm×1.0μm	05941-32003-1

Dedicated column for alkyl mercury

Specification	P/N
15m×0.53mm×0.5μm	05971-51002

Column for organic phosphorus agricultural residue

Specification	P/N
30m×0.32mm×0.5μm	05939-32002

1.4 GC Packed Column

Stationary liquid: OV-1, OV-17, OV-101, OV-225, SE-30, SE-52, SE-54, PRG-400, PEG-600, PEG-1500, PEG-4000, PEG-6000, PEG-20M, DEGS, EGA, EGS, QF-1, FFAP, DNP, β, β- Diethoxyacetonitrile, silicone oil, apiezon, squalane, DC series and etc.

Support: Aiatomite (Chrosorb series and others), organic support

Adsorbent and polymer microspheres: Porapak series, Proasil series, GDX series, HDG series, SD series, molecular sieve, carbon molecular sieve, graphitized carbon black, silica gel, aluminium oxide, etc.

Specification: Inner diameter 2-4 mm, length: 0.5-9 m.

◇ Welch also offers custom-made GC packed columns. Please provide GC model number, column tube type, stationary phase composition, type and particle size of the solid support, inner diameter and length, and the targeted samples.

GC Packed Column Ordering Information:

1.

Packing Materials	
Support (e.g. Chromosorb WAW DMCS)	
Mesh Number	
Stationary Phase A	
Stationary Phase A Coated Amount/%	
Stationary Phase B	
Stationary Phase B Coated Amount/%	

2.

Tube materials	□Stainless Steel □Passivated stainless steel □Glass □PP

3.

Instrument Model (e.g. Agilent 7890A/ Shimadzu 2014 C)	

4.

Dimension		Note
Length/m		
OD/mm		For Stainless Steel GC packed column, OD is required.
ID/mm		For glass packed column, ID is required
Center Distance/mm		For glass packed column, Center distance is required

Note:

Before ordering a packed column, first verify that the GAS chromatograph instrument has a column inlet for injecting.
When ordering stainless steel packed column, please provide the instrument type and the outer diameter of the packed column.
When ordering glass packed column, please provide the instrument type and the center distance between the injector and the detector.

Application of GC Column

2.1 Application of GC Column in Chemical Energy Field

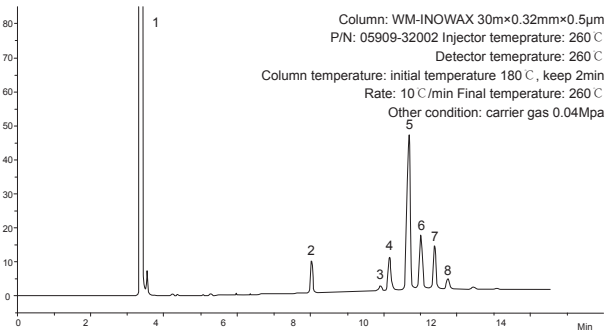
Analysis of high carbon fatty acid methyl ester by high temperature resistant crosslinked polar column

Charactertics: The high carbon fatty acid methyl ester can be analyzed to solve the difficulty of high temperature resistance of polar column. The maximum temperature of modified column can reach 320℃.

Analysis of Biodiesel on High-carbon Fatty Acid Methyl Ester Column

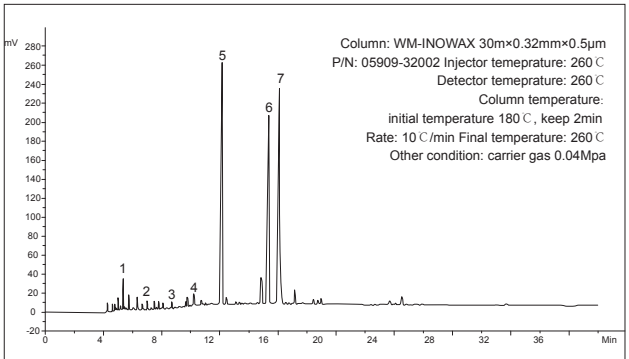
Charactertics: The high carbon fatty acid methyl ester in biodiesel was analyzed to solve the difficulty of high temperature resistance of polar column. The maximum temperature of modified column could reach 320℃.

High Temperature Resistant Crosslinked Polar Column



No.	Component	No.	Component
1	Solvent	5	Linolenic acid methyl ester
2	Methyl palmitate	6	γ-linolenic acid methyl ester
3	Methyl stearatev	7	α-linolenic acid methyl ester
4	Methyl oleate	8	Linolenic acid methyl ester

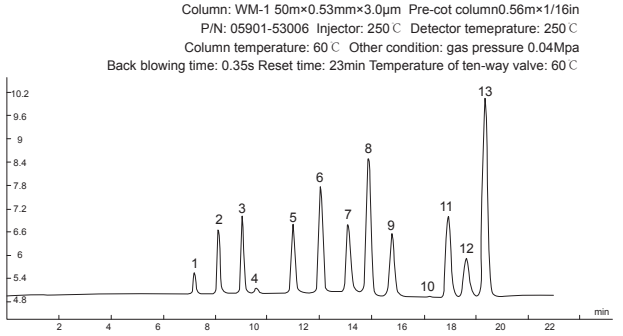
High-carbon Fatty Acid Methyl Ester Column



No.	Component	No.	Component
1	N-dodecane	5	Methyl hexadecanoate
2	N-tridecane	6	Methyl stearate
3	N-heptadecane	7	Methyl linoleate
4	N-nonadecane		

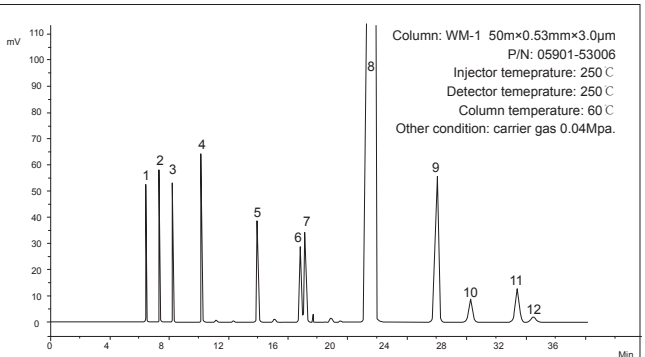
Analysis of Oxidation and Aromatics in Gasoline

Charactertics: comply with SH/T 0663 analysis requirements for alcohols and ethers in gasoline



No.	Component	No.	Component	No.	Component	No.	Component
1	Methanol	5	Propanol	9	Isobutanol	13	Benzene
2	Ethanol	6	Methyl tert-butyl ether	10	N-hexane		
3	Isopropanol	7	2-butyl alcohol	11	1,2-Dimethoxyethane		
4	Impurity	8	Diisopropyl ether	12	1-butanol		

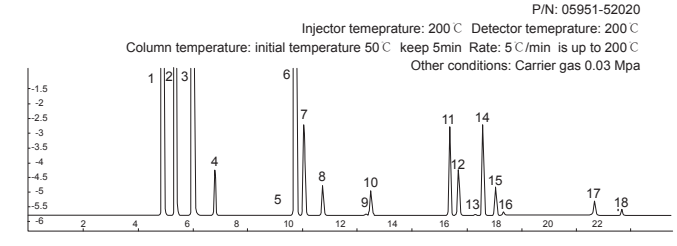
Charactertics: comply with SH/T 0693 aromatics analysis requirements in gasoline



No.	Component	No.	Component	No.	Component
1	Methanol	5	Isobutanol	9	Toluene
2	Ethanol	6	Butanol	10	Ethylbenzene
3	Isopropanol	7	Benzene	11	Dimethylbenzene
4	Impurity	8	Solvent	12	Mesitylene

Chromatogram of Pyrolysis Gas Group Analyzed by Capillary Column

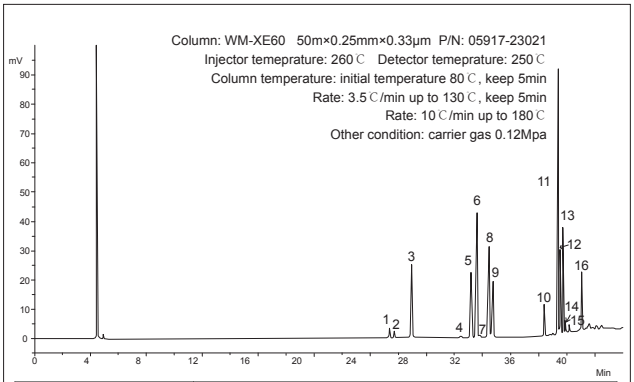
Charactertics: analyze C1-C7, the olefins are effectively separated from the olefins



No.	Component	No.	Component
1	Methane	10	Acetylene
2	Ethane	11	n-butene
3	Ethylene	12	Trans Butene
4	Propane	13	Isopentane
5	Cyclopropane	14	Isobutene
6	Propylene	15	Cis-Butene
7	Isobutane	16	n-pentane
8	n-butane	17	1,3-Butadiene
9	Propadiene	18	Propyne

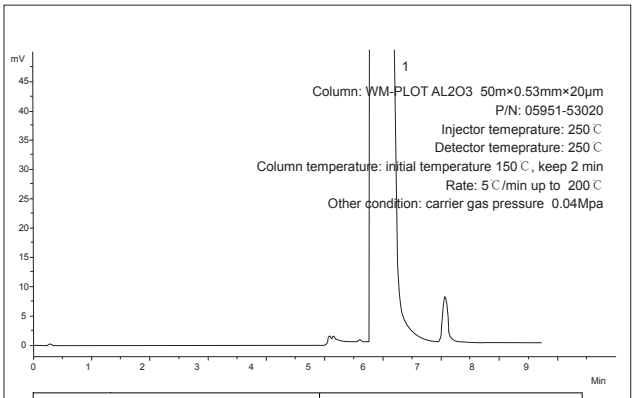
Analyze Industrial Phenols by Dedicated Column

Charactertics: analyze the components of phenolic products



No.	Component	No.	Component	No.	Component	No.	Component
1	2,6-Dimethylphenol	5	p-Cresol	9	2,5-dimethyl phenol	13	Ethyl between phenol
2	Phenol	6	m-Cresol	10	2, 3 dimethyl phenol	14	Unknown components
3	O-cresol	7	2-Ethylphenol	11	3, 5 dimethyl phenol	15	Unknown components
4	2,4,6-Trimethylphenol	8	2,4-Dimethylphenol	12	4-Ethylphenol	16	3,4 dicresol

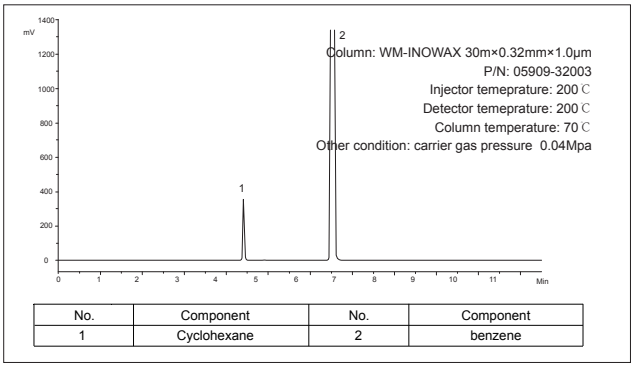
Analyze Refrigerant R22 by Dedicated column



No.	Component
1	R22

Analyze Cyclohexane and Benzene

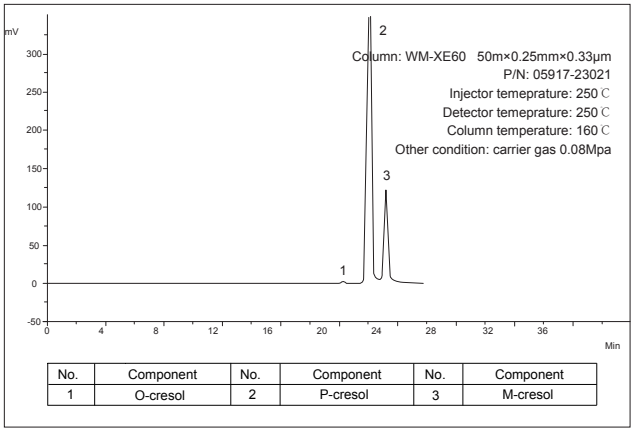
Charactertics: effectively analyze of cyclohexane and benzene. It can be used to detect benzene or benzene in cyclohexane cyclohexane



No.	Component	No.	Component
1	Cyclohexane	2	benzene

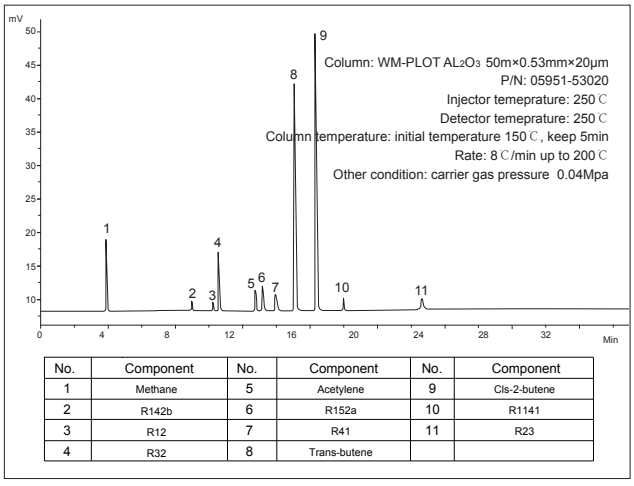
Analyze Purity of P-methoxyphenol by Phenolic Dedicated Column

Charactertics: analyze purity of p-methyl phenol, and achieve baseline separation of o-methyl phenol, p-methyl phenol and m-methyl phenol.



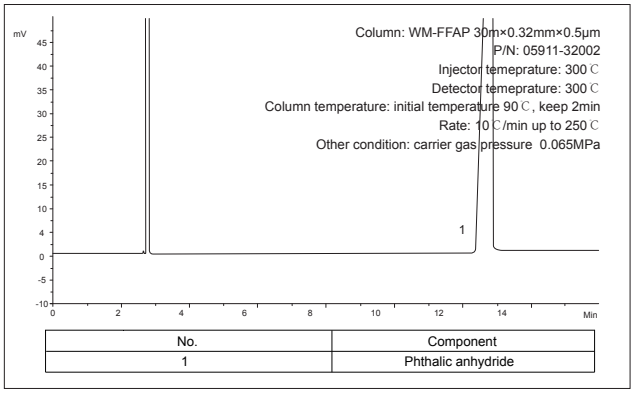
No.	Component	No.	Component	No.	Component
1	O-cresol	2	P-cresol	3	M-cresol

Analyze Mixed Gas Refrigerant by Dedicated Column



No.	Component	No.	Component	No.	Component
1	Methane	5	Acetylene	9	Cis-2-butene
2	R142b	6	R152a	10	R1141
3	R12	7	R41	11	R23
4	R32	8	Trans-butene		

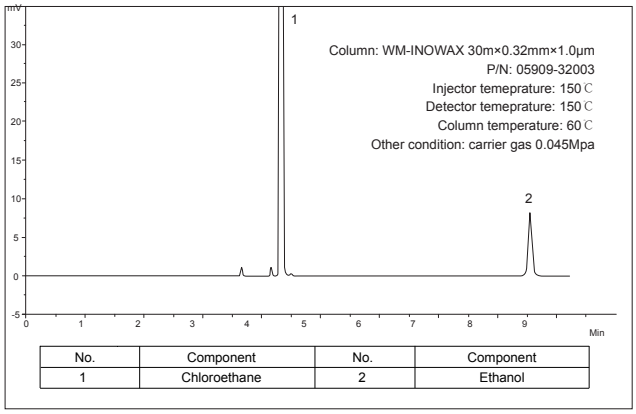
Analyze Purity of p-phthalic Anhydride by Dedicated Column in Chromatographic Way



No.	Component
1	Phthalic anhydride

Analyze Chloroethane Purity by Capillary Column

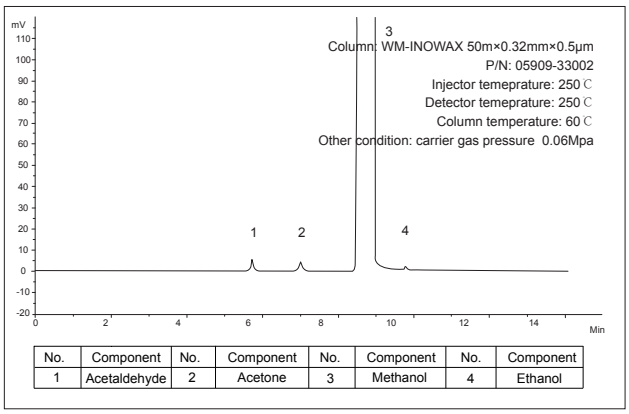
Charactertics: analyze purity of chloroethane and the content of ethanol in chloroethane by capillary column



No.	Component	No.	Component
1	Chloroethane	2	Ethanol

Analyze methanol purity by Capillary Column

Charactertics: if use capillary column to analyze the trace alcohol and related impurities in methanol, the methanol tailing would improve with good separation effect.



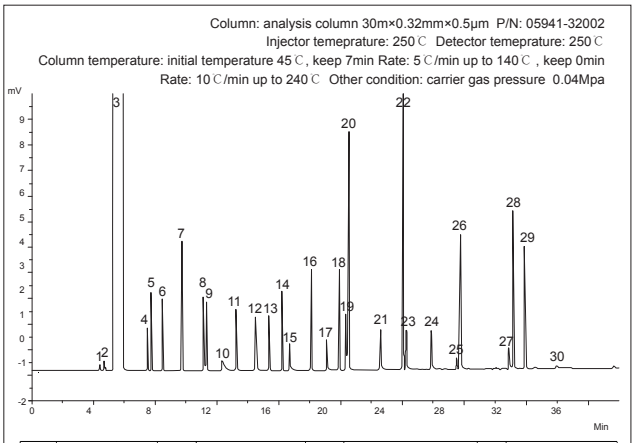
No.	Component	No.	Component	No.	Component	No.	Component
1	Acetaldehyde	2	Acetone	3	Methanol	4	Ethanol

2.2 Application of GC Column in Brewing Field

Charactertics: in addition to alcohols and esters, organic acids, such as acetic acid, butyric acid and pentanoic acid can be well analyzed according to temperature programming. Baseline separation of methanol, acetaldehyde, ethanol and ethyl acetate can be achieved for temperature-programmed analysis of more components. More components also can be analyzed by temperature programming.

Liquor Capillary Column C1

C1 column can be used to analyze various mixed components of liquor, and there are up to 30 qualitative components at present.



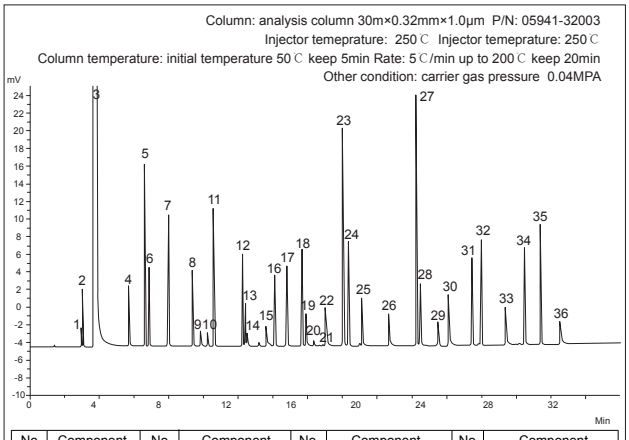
No.	Component	No.	Component	No.	Component	No.	Component
1	Acetaldehyde	9	n-butanol	17	Isobutyric acid	25	Hexanoic acid
2	Methanol	10	Ethanoic acid	18	Ethyl valerate	26	Ethyl oenanthate
3	Ethanol	11	Ethyl isobutyrate	19	Butyrate	27	Heptanoic acid
4	n-propanol	12	Isoamyl alcohol	20	n-hexanol+furfural	28	Ethyl octanoate
5	Ethyl acetate	13	n-butyl butyrate	21	Common valeric acid	29	β-phenylethanol
6	2-butanol	14	n-butyl acetate	22	Ethyl hexanoate	30	Caprylic acid
7	Isobutanol	15	propanoic acid	23	Pentanoic acid		
8	Acetal	16	ethyl lactate	24	2-ethylbutanoic acid		

Analyze with Large Diameter Dediacted Column for Liquor

Charactertics: can be used for thermostatic analysis and completely separate methanol, acetaldehyde, ethyl acetate.

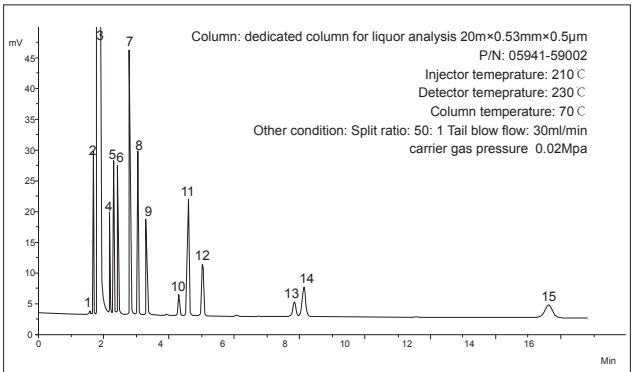
Liquor capillary column C2

C2 column has been upgraded on the basis of Liquor analysis C1 column, which can analyze more components such as 3-methiopropyl alcohol, n-hexanol, etc. Suitable for separation of acids. At present, there are 36 qualitative components

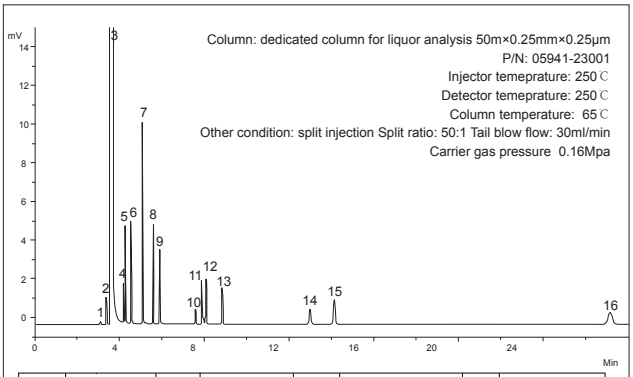


No.	Component	No.	Component	No.	Component	No.	Component
1	Acetaldehyde	10	Unknown	19	Isobutyric acid	28	2-Ethyl butyraldehyde
2	Methanol	11	Acetal	20	Ethyl isovalerate	29	3-Methylthiopropanol
3	Ethanol	12	Ethyl isobutyrate	21	Furfural	30	Hexanoic acid
4	n-propanol	13	Isoamyl alcohol	22	Butyric acid	31	Unknown
5	Ethyl acetate	14	Unknown	23	Hexanol	32	Ethyl heptanoate
6	2-butanol	15	Propanoic acid	24	Ethyl valerate	33	Heptanoic acid
7	Isobutanol	16	Ethyl butyrate	25	Isopropylacetic acid	34	β-phenylethanol
8	n-butanol	17	n-butyl acetate	26	Pentanoic acid	35	Ethyl octanoate
9	Ethanoic acid	18	Ethyl lactate	27	Ethyl hexanoate	36	Caprylic acid

Constant temperature analysis of by Small Diameter Dediacted Column for Liquor



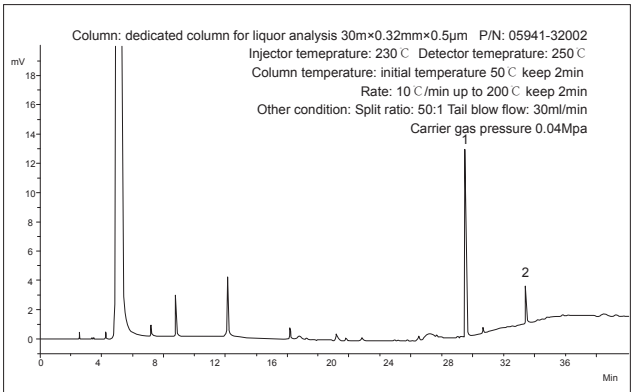
No.	Component	No.	Component	No.	Component	No.	Component
1	Acetaldehyde	5	Ethyl acetate	9	n-butanol	13	Ethyl lactate
2	Methanol	6	2-butanol	10	Isopentanol	14	Ethyl pentanoate
3	Ethanol	7	Isobutanol	11	Ethyl butyrate	15	Ethyl caproate
4	n-propanol	8	Acetal	12	Butyl acetate		



No.	Component	No.	Component	No.	Component	No.	Component
1	Acetaldehyde	5	Ethyl acetate	9	n-butanol	13	Butyl acetate
2	Methanol	6	2-butanol	10	2-methyl-1-butanol	14	Ethyl lactate
3	Ethanol	7	Isobutanol	11	Isoamyl alcohol	15	Ethyl valerate
4	n-propanol	8	Acetal	12	Ethyl butyrate	16	Ethyl caproate

Analyze the Content of β-phenylethanol in Black Rice Wine

Charactertics: determine β-phenylethanol in black rice wine with 2-ethyln-butyric acid as internal standard. This method can also be used for the analysis of other similar yellow rice wine products

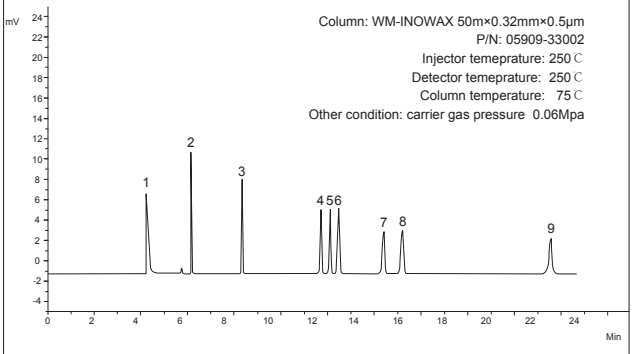


No.	Component	No.	Component
1	2-ethyln-butyric acid	2	β-benzyl ethanol

2.3 Application of GC Columns in Environmental Analysis

Separation of benzene series samples by capillary column

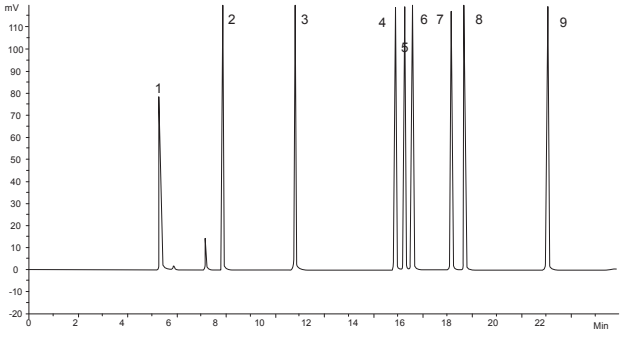
Charactertics: analyze eight kinds of benzene series samples



No.	Component	No.	Component	No.	Component
1	Carbon disulfide	4	Ethylbenzene	7	Isopropyl benzene
2	Benzene	5	P-xylene	8	O-xylene
3	Methylbenzene	6	M-xylene	9	Styrene

Analyze the Benzene Series Samples by High Temperature Resistant Capillary Column

Charactertics: comply with HJ 583/584 standards, analyze the maximum temperature of 8 benzene series samples up to 320℃, more durable than normal benzene column.

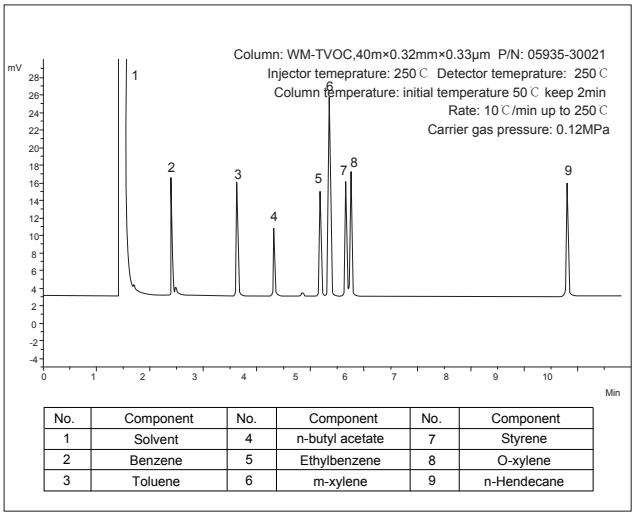


Column: WM-PEG20M-HT 60m×0.32mm×0.5μm
P/N: 05960-34002
Injector temeprature: 280℃
Detector temeprature: 280℃
Column temperature: initial temperature 75℃ keep 12min Rate: 5℃/min up to 280℃
Other conditions: carrier gas pressure: 0.1MPa

No.	Component	No.	Component	No.	Component
1	Carbon disulfide	4	Ethylbenzene	7	Isopropyl benzene
2	Benzene	5	P-xylene	8	O-xylene
3	Toluene	6	M-xylene	9	Styrene

TVOC Column for Rapid Analysis

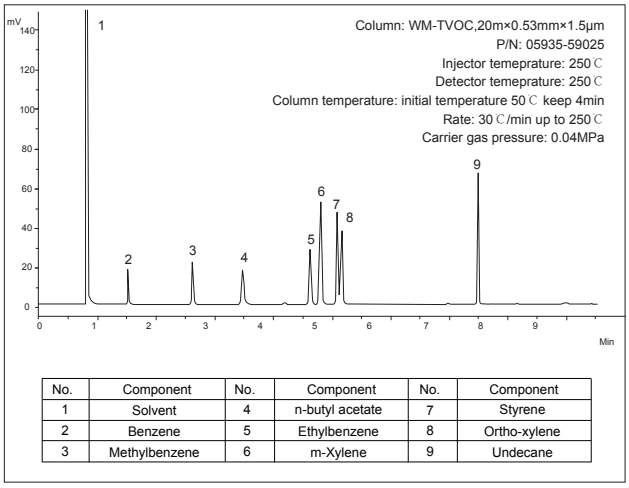
Charactertics: 8 kinds of volatile toxic and harmful substances in the indoor environment can achieve baseline separation within 10 min.



No.	Component	No.	Component	No.	Component
1	Solvent	4	n-butyl acetate	7	Styrene
2	Benzene	5	Ethylbenzene	8	O-xylene
3	Toluene	6	m-xylene	9	n-Hendecane

TVOC Special Capillary Column for Portable Micrometer

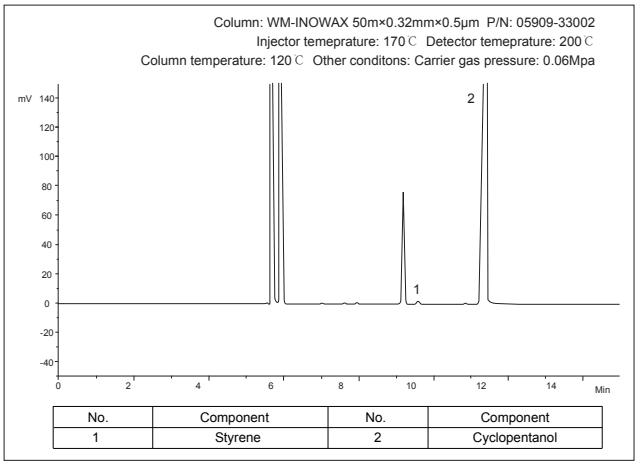
Charactertics: it can be used for portable miniature TVOC detector, which has the advantages of fast speed, good efficiency and convenient analytical conditions, etc., and is specially customized for miniature chromatograph



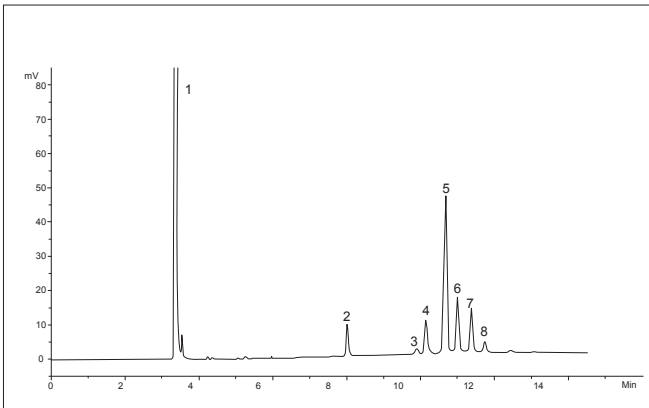
No.	Component	No.	Component	No.	Component
1	Solvent	4	n-butyl acetate	7	Styrene
2	Benzene	5	Ethylbenzene	8	Ortho-xylene
3	Methylbenzene	6	m-Xylene	9	Undecane

Residue Analysis of Styrene

Charactertics: analyze the residue of styrene in polystyrene



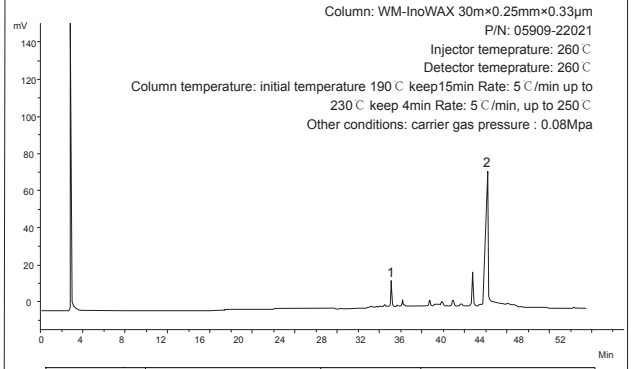
No.	Component	No.	Component
1	Styrene	2	Cyclopentanol



2.4 Application of GC column in Food Field

DHA, EPA Analysis

Charactertics: determine the content of DHA and EPA in fish oil by GC capillary column



No.	Component	No.	Component
1	EPA	2	DHA

Analyze Fatty Acid Component

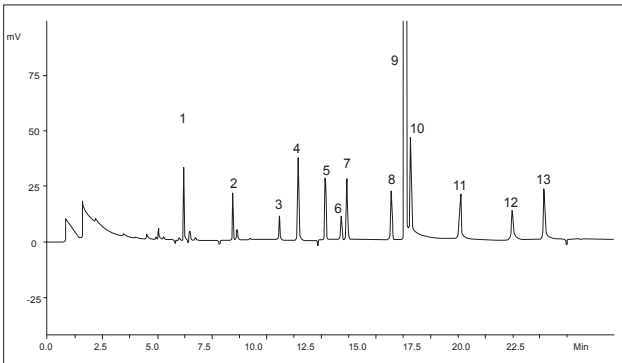
Charactertics: select GC capillary column to detect fatty acid components with good separation effect. The maximum temperature of the column can be up to 320℃

Column: WM-PEG20M-HT 30m×0.32mm×0.5μm P/N: 05960-32002
Injector temeprature: 260℃ Detector temeprature: 260℃
Column temperature: initial temperature 180℃ keep 2min
Rate: 10℃/min up to 260℃
Other conditions: carrier gas pressure : 0.04Mpa

No.	Component	No.	Component	No.	Component
1	Solvent	4	Methyl oleate	7	α-methyl oleate
2	Methyl hexadecanoate	5	Methyl ester	8	Ethyl linolenate
3	Methyl stearate	6	γ-methyl oleate		

Analysis of Organophosphorus Pesticide Residues in Food

Characteristics: according to the pharmacopoeia, the content of menthol and camphor was detected by the capillary column

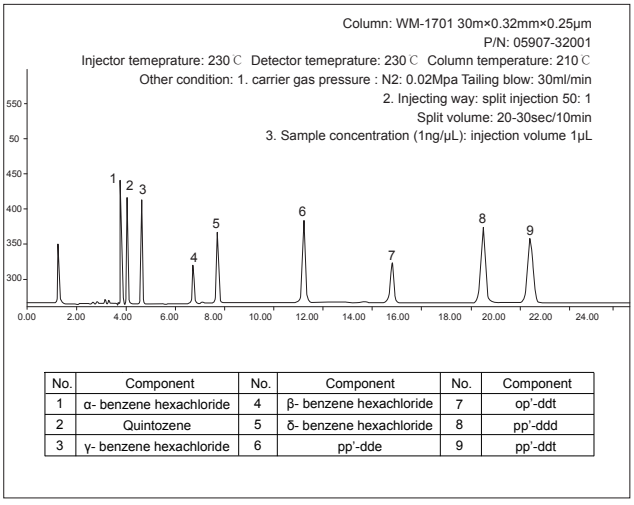


Column: Organic phosphorus pesticide residue analysis column 30m×0.32mm×0.5μm P/N: 05939-32002
Injector temperature: 280℃ Detection temperature: 270℃
Column temperature: initial temperature 80℃ keep 2min Rate: 30℃/min
up to 180℃, keep 0min Rate: 2℃/min, up to 230℃
keep 0min Rate: 10℃/min up to 270℃
Other: 1. carrier gas: N_2: 0.08Mpa H_2: 40ml/min
Air 1: 30ml/min Air 2: 20ml/min tailing blow: 30ml/min
2. Injecting way:splitless injection
3. sample concentration(1ng/ul): injection volume: 4ul

No.	Component	No.	Component	No.	Component	No.	Component
1	Dichlorvos	5	Diazinon	9	Chlorpyrifos	13	Ethion
2	Eliminate scale methamidophos	6	Acetaldehyde phosphate	10	Methyl pyrimidine phosphorus		
3	Phorate	7	Parhamidophos	11	Isocarbophos		
4		8	Pyrimidine	12			

Analysis of Organochlorine Pesticide Residues in Food

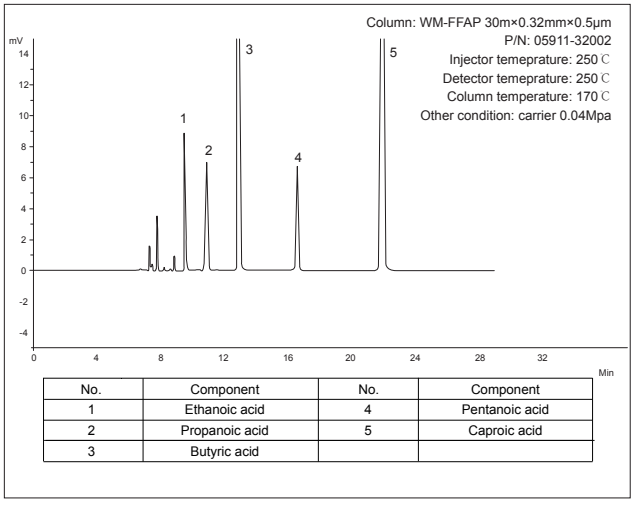
Characteristics: constant temperature analysis of capillary column to achieve baseline separation benzene hexachloridex and DDT eight components



No.	Component	No.	Component	No.	Component
1	α- benzene hexachloride	4	β- benzene hexachloride	7	op'-ddt
2	Quintozene	5	δ- benzene hexachloride	8	pp'-ddd
3	γ- benzene hexachloride	6	pp'-dde	9	pp'-ddt

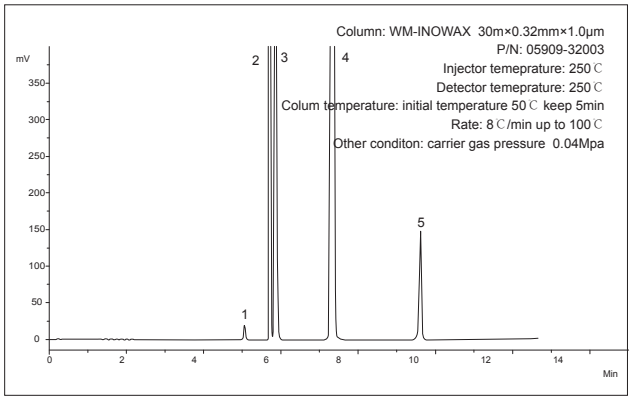
Chromatogram Analysis of C1-C6 Organic Acids

Characteristics: constant temperature analysis of capillary column to achieve baseline separation benzene hexachloridex and DDT eight components

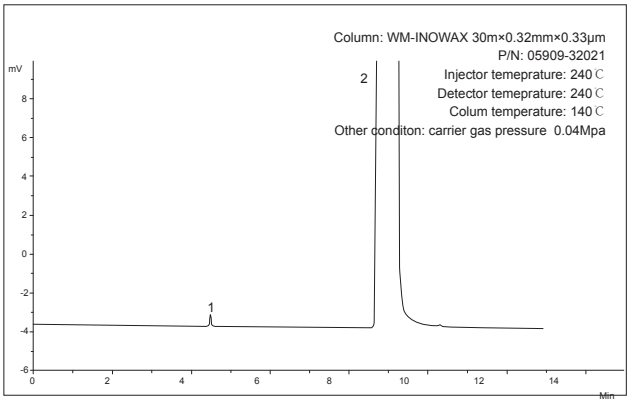


No.	Component	No.	Component
1	Ethanoic acid	4	Pentanoic acid
2	Propanoic acid	5	Caproic acid
3	Butyric acid		

Analysis of Formaldehyde, Methyl acetal, Methyl formate, Methanol and Methyl orthoformate



Analysis of n-Methylpyrazine Residue



No.	Component	No.	Component
1	Formaldehyde	4	Methanol
2	Methylal	5	Trimethyl orthoformate
3	Methyl formate		

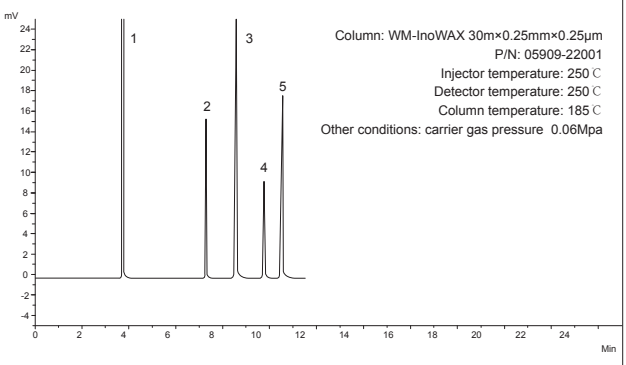
No.	Component	No.	Component
1	n-methylpyrazine	2	Dimethyl sulfoxide

2.5 Application of GC Column in Pharmacopoeia

According to the provisions of the 2020 edition of Chinese Pharmacopoeia and the actual needs of customers, Welch specially launched the pharmacopoeia GC detection chromatogram atlas. Welch GC column perfectly conforms to the pharmacopoeia's requirements for column effect, resolution and tailing factor, etc., with good quality stability and excellent inter-batch reproducibility, which provides a strong guarantee for pharmaceutical enterprises to monitor drug quality.

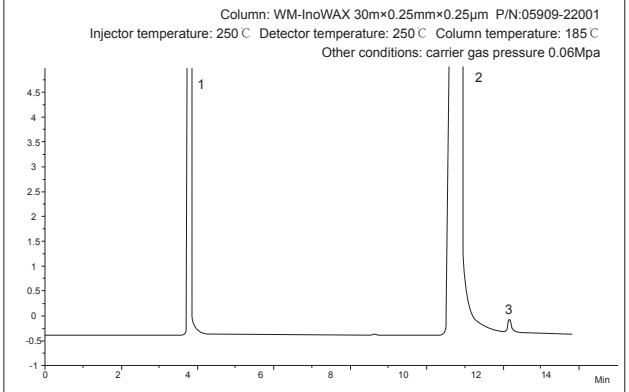
Analysis of Tropine Mixed Samples

Characteristics: analyze the reactants of tropine in medicine



No.	Component	No.	Component
1	Solvent methanol	4	β-tropine
2	Tropinone	5	Nortropine
3	α-tropine		

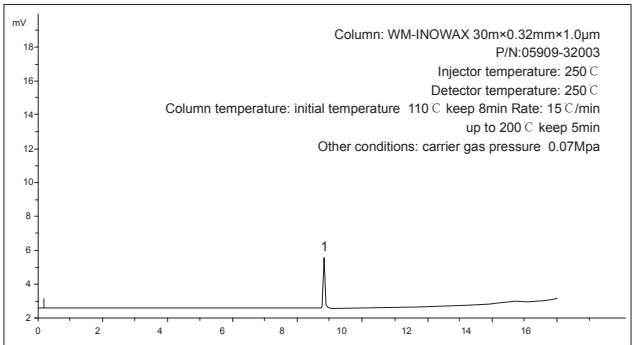
Analysis of the Purity of Noratropine



No.	Component	No.	Component	No.	Component
1	Solvent methanol	2	Nortropine	3	Impurity

Analysis of Chloroethanol in Water

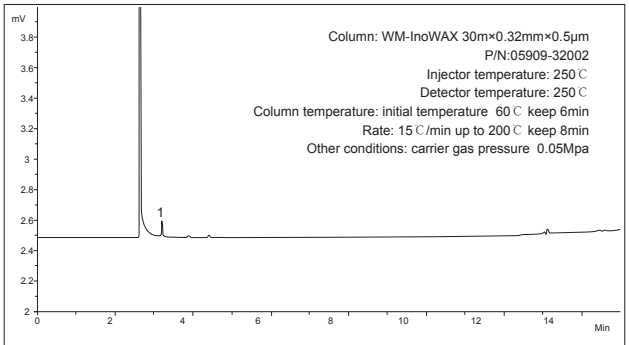
Characteristics: analyze the 2-chlorine ethanol residue in medical devices or hollow capsules in accordance with the pharmacopoeia, use water as solvent for direct injection analysis



No.	Component
1	Chloroethanol

Analysis of Ethylene Oxide

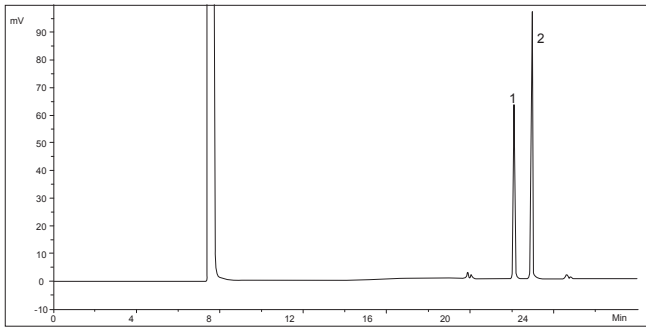
Characteristics: Use headspace injection to analyze ethylene oxide residue in medical devices or hollow capsules. The column can also be used for 2-chloroethanol analysis



No.	Component
1	Ethylene oxide

Analysis of Borneol Capillary Column 1

Characteristics: referring to the analysis requirements of natural borneol and synthetic borneol in the pharmacopoeia, select the capillary column specified in the pharmacopoeia to detect the content of isobornol and borneol in borneol, and the analysis effect was better than that of packed column

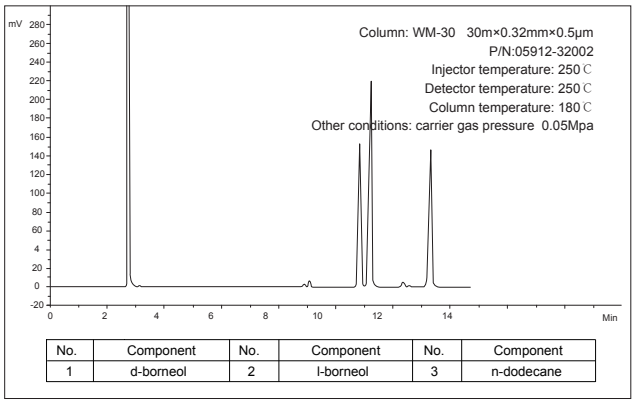


Column: WM-INOWAX 30m×0.32mm×0.5μm
P/N:05909-32002
Injector temperature: 250℃
Detector temperature: 250℃
Column temperature: initial temperature 40℃ keep 2min Rate: 10℃/min
Final temperature:180℃ keep 20min
Other conditions: carrier gas pressure 0.04Mpa

No.	Component	No.	Component
1	d-borneol	2	l-borneol

Analysis of Borneol by Capillary Column 1

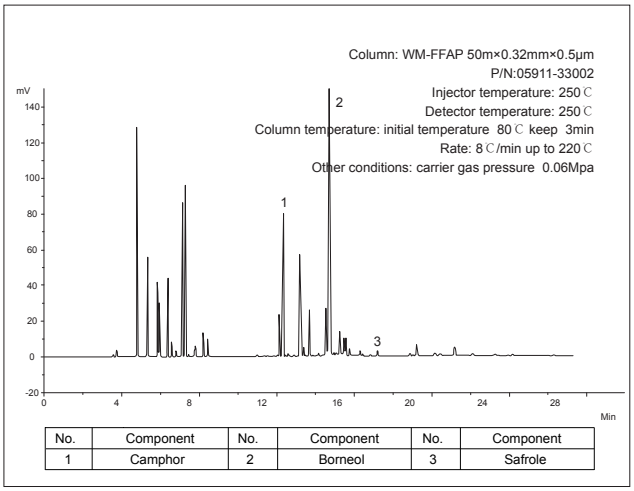
Characteristics: to determine the contents of isobornol and borneol in borneol by capillary column, because this column has better analysis effect of the than that of the packed column and faster analysis speed than that of borneol capillary column 1



Column: WM-30 30m×0.32mm×0.5μm
P/N:05912-32002
Injector temperature: 250℃
Detector temperature: 250℃
Column temperature: 180℃
Other conditions: carrier gas pressure 0.05Mpa

No.	Component	No.	Component	No.	Component
1	d-borneol	2	l-borneol	3	n-dodecane

Analysis of Camphor, Camphor and Safrol in Essential Oil

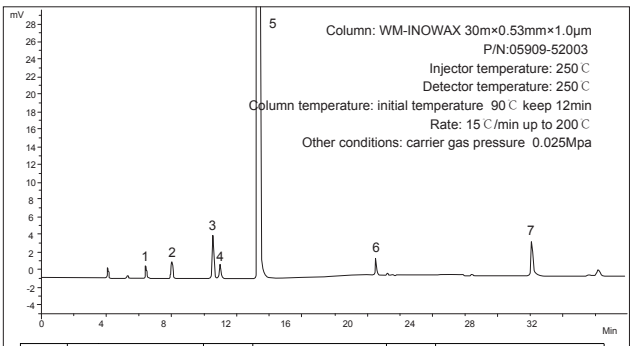


Column: WM-FFAP 50m×0.32mm×0.5μm
P/N:05911-33002
Injector temperature: 250℃
Detector temperature: 250℃
Column temperature: initial temperature 80℃ keep 3min
Rate: 8℃/min up to 220℃
Other conditions: carrier gas pressure 0.06Mpa

No.	Component	No.	Component	No.	Component
1	Camphor	2	Borneol	3	Safrole

Analysis of Coarse Morpholine

Characteristics: the capillary column is suitable for detecting the purity of morpholine raw material and the composition of morpholine treated with dehydrogenation

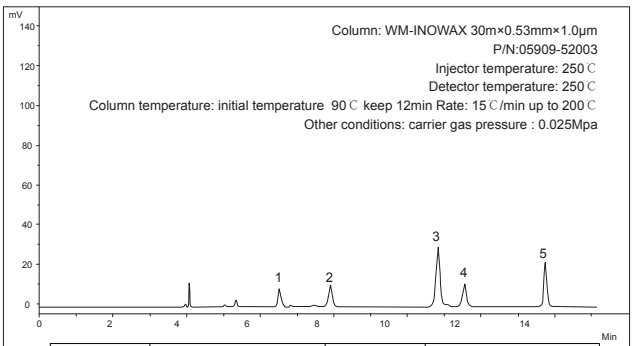


Column: WM-INOWAX 30m×0.53mm×1.0μm
P/N:05909-52003
Injector temperature: 250℃
Detector temperature: 250℃
Column temperature: initial temperature 90℃ keep 12min
Rate: 15℃/min up to 200℃
Other conditions: carrier gas pressure 0.025Mpa

No.	Component	No.	Component	No.	Component
1	Ethanol	4	Hqmme	7	2-(2-chloroethoxy) ethanol
2	n-methylmorpholine	5	Diethylene Glycol		
3	Ethyl morpholine	6			

Analysis of Morpholine

Characteristics: The column can be used for analysis of related components of morpholine with good reproducibility and high resolution

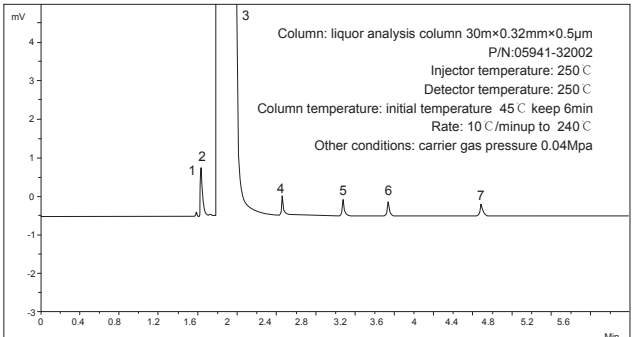


Column: WM-INOWAX 30m×0.53mm×1.0μm
P/N:05909-52003
Injector temperature: 250℃
Detector temperature: 250℃
Column temperature: initial temperature 90℃ keep 12min Rate: 15℃/min up to 200℃
Other conditions: carrier gas pressure : 0.025Mpa

No.	Component	No.	Component
1	Ethanol	4	Hqmme
2	n-methylmorpholine	5	Morpholine
3	n-ethylmorpholine		

Determination of Ethanol Volatile Substance

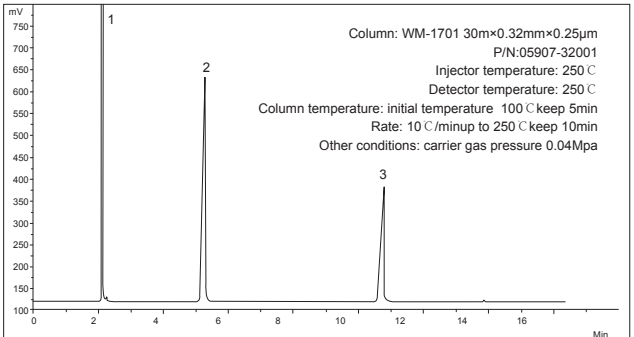
Characteristics: according to the determination method requirements of volatile substances in the pharmacopoeia, select capillary column to test the purity of ethanol



No.	Component	No.	Component	No.	Component
1	Acetaldehyde	4	n-propanol	7	Benzene
2	Methanol	5	n-butanol		
3	Ethanol	6	1-pentanol		

Analysis of Maleic Anhydride and Succinic Anhydride

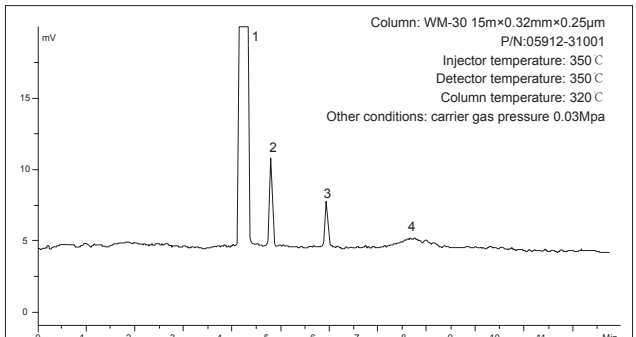
Characteristics: the capillary column is suitable for the detection of maleic anhydride and succinic anhydride with high analytical accuracy and symmetry peak



No.	Component	No.	Component	No.	Component
1	Acetonitrile	2	Maleic anhydride	3	Succinic anhydride

Analysis of Plasticizer

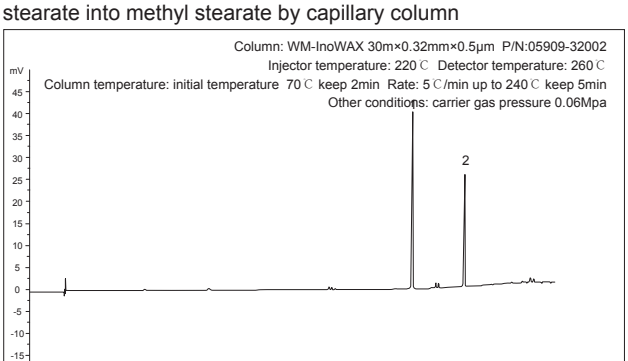
Characteristics: this capillary column is suitable for detecting the components of phthalate plasticizer in medical packaging



No.	Component	No.	Component
1	Butanone	3	Dioctyl phthalate
2	Dibutyl phthalate	4	Diisodecyl ortho-phthalate

Analysis of Magnesium Stearate

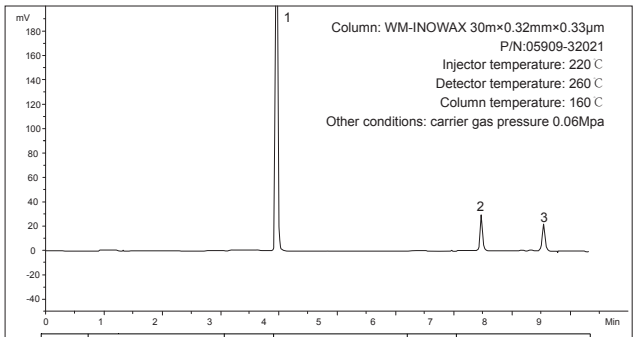
Characteristics: according to the requirement of magnesium stearate analysis in the pharmacopoeia, convert the magnesium stearate into methyl stearate by capillary column



No.	Component	No.	Component
1	Palmitate methyl ester	2	Methyl stearate

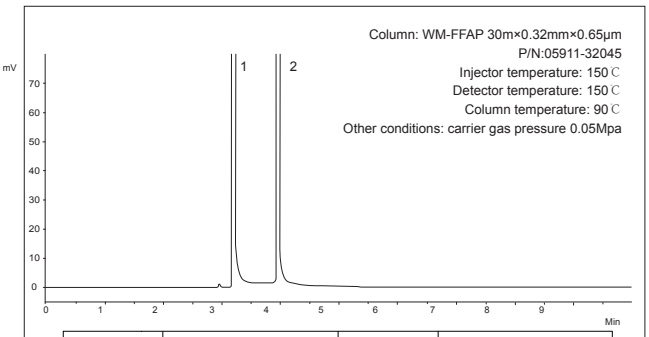
Analysis of Menthol Camphor

Characteristics: according to the pharmacopoeia, use the capillary column to detect menthol camphor content



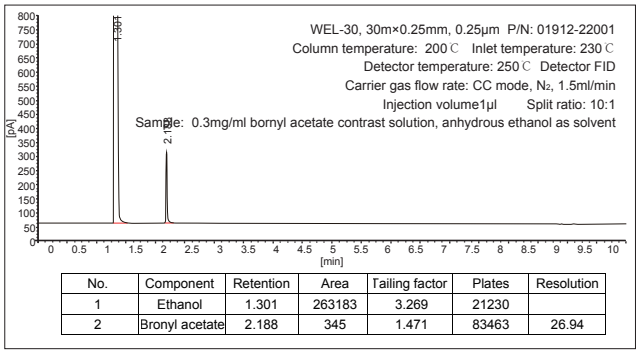
No.	Component	No.	Component	No.	Component
1	Solvent	2	Camphor	3	Menthol

Separation of Acetic Acid and Acetic Anhydride by Capillary Column



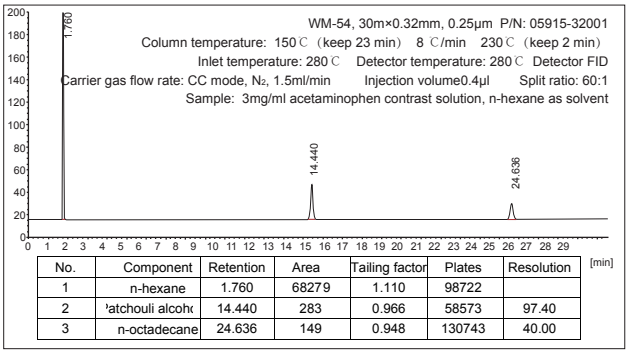
No.	Component	No.	Component
1	Ethanoic acid	2	Acetic anhydride

Amomum



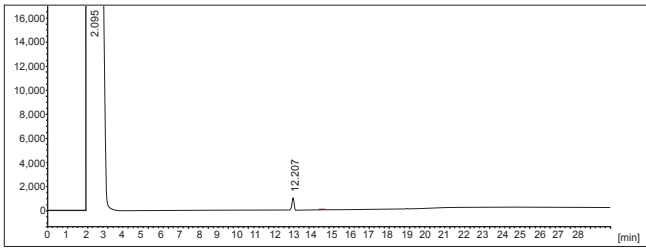
No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.301	263183	3.269	21230	
2	Bronyl acetate	2.188	345	1.471	83463	26.94

Pogostemon Cablin



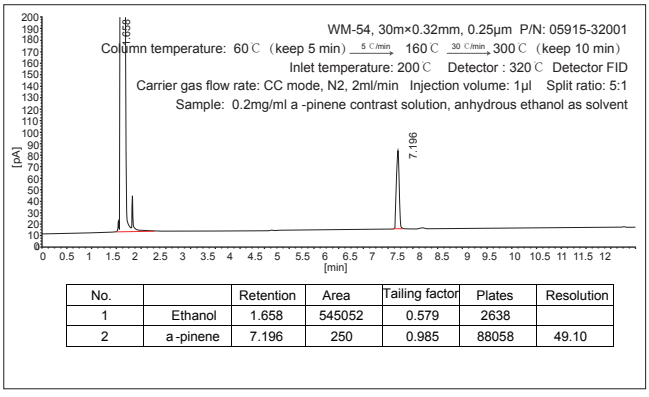
No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	1.760	68279	1.110	98722	
2	Patchouli alcoh	14.440	283	0.966	58573	97.40
3	n-octadecane	24.636	149	0.948	130743	40.00

Fructus Anisi Stellati

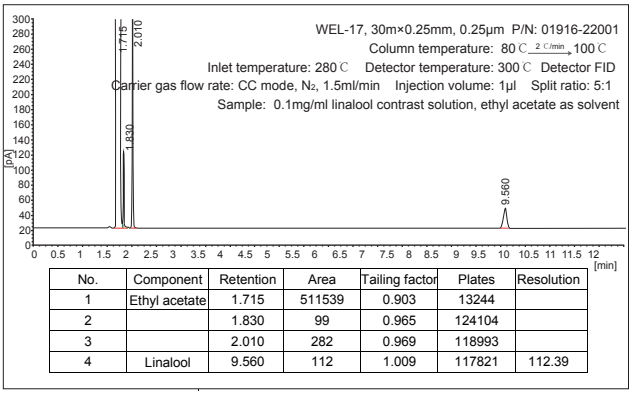


No.	Component	Retention	Area	Tailing fact	Plates	Resolutior
1	Ethanol	2.095	6312721	2.337	87	
2	Trans-anethole	12.207	6128	0.791	84261	18.97

Pine Nodular Branch

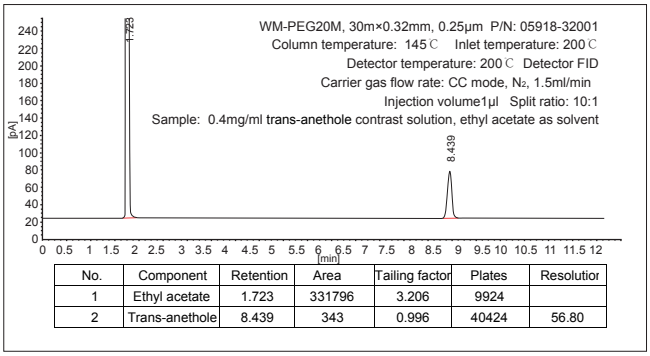


No.		Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.658	545052	0.579	2638	
2	a -pinene	7.196	250	0.985	88058	49.10



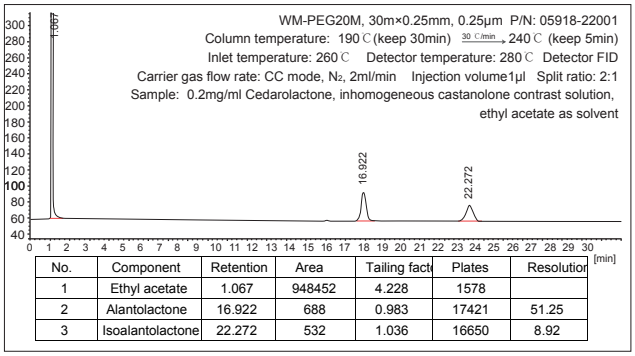
No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethyl acetate	1.715	511539	0.903	13244	
2		1.830	99	0.965	124104	
3		2.010	282	0.969	118993	
4	Linalool	9.560	112	1.009	117821	112.39

Fennel



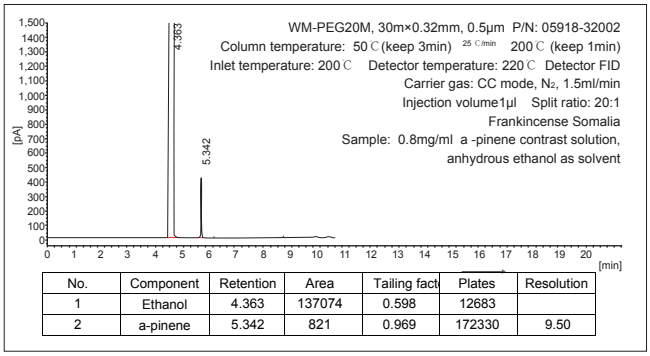
No.	Component	Retention	Area	Tailing factor	Plates	Resolutior
1	Ethyl acetate	1.723	331796	3.206	9924	
2	Trans-anethole	8.439	343	0.996	40424	56.80

Elecampane



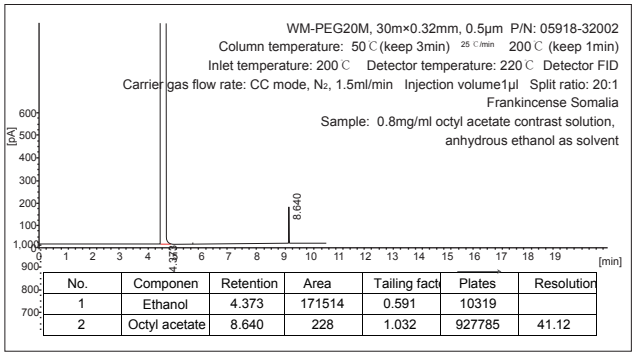
No.	Component	Retention	Area	Tailing fact	Plates	Resolutior
1	Ethyl acetate	1.067	948452	4.228	1578	
2	Alantolactone	16.922	688	0.983	17421	51.25
3	Isoalantolactone	22.272	532	1.036	16650	8.92

Frankincense Somalia



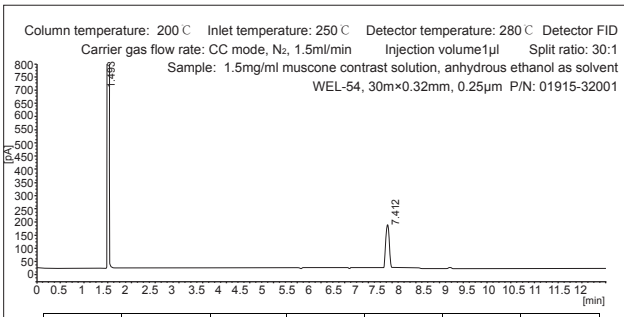
No.	Component	Retention	Area	Tailing fact	Plates	Resolution
1	Ethanol	4.363	137074	0.598	12683	
2	a-pinene	5.342	821	0.969	172330	9.50

Ethiopian Frankincense

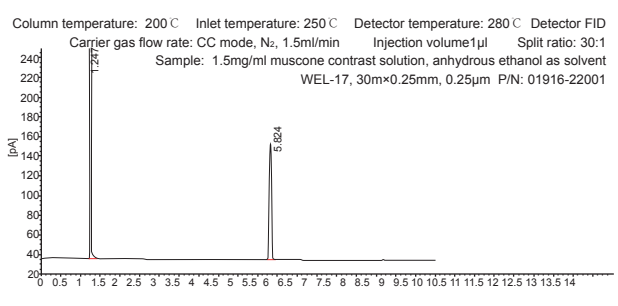


No.	Componen	Retention	Area	Tailing fact	Plates	Resolution
1	Ethanol	4.373	171514	0.591	10319	
2	Octyl acetate	8.640	228	1.032	927785	41.12

Moschus

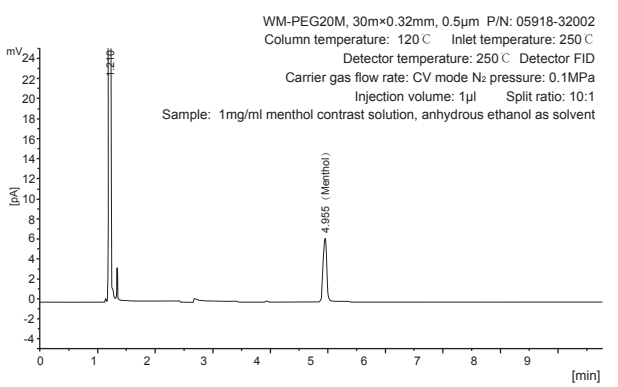


No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.493	23616	2.403	27792	
2	Muscone	7.412	783	0.922	59574	75.45



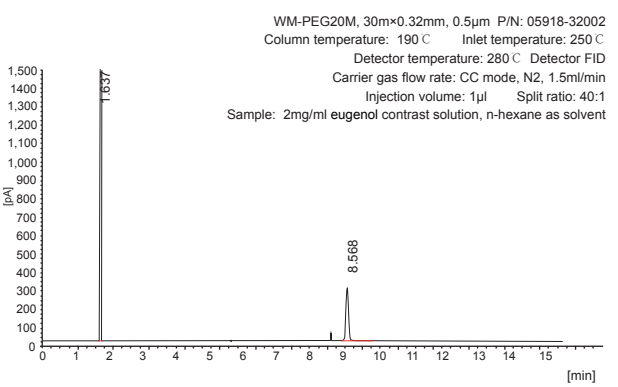
No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.247	97561	1.696	45899	
2	Muscone	5.824	425	0.931	63850	79.49

Menthol



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.210	2355206	1.0	8089	
2	Menthol	4.955	26378	1.0	32194	45.7

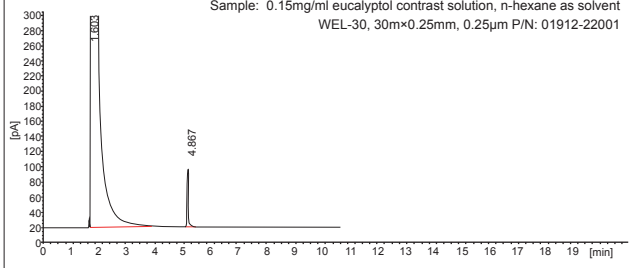
Cloves



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	1.637	327[illegible]80	1.728	72668	
2	Eugenol	8.568	173 4	1.110	48854	77.50

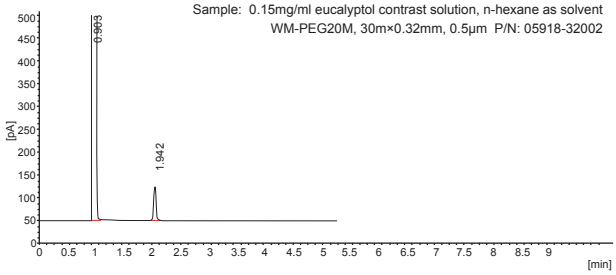
Folium Artemisiae Argyi

Column temperature: 110℃ Inlet temperature: 200℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 10:1
Sample: 0.15mg/ml eucalyptol contrast solution, n-hexane as solvent
WEL-30, 30m×0.25mm, 0.25μm P/N: 01912-22001



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	1.603	706081	3.835	9921	
2	Eucalyptol	4.867	212	1.074	72224	47.84

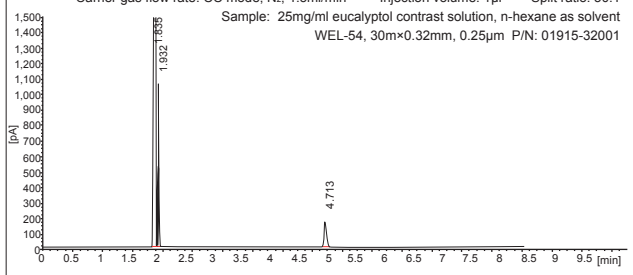
Column temperature: 110℃ Inlet temperature: 200℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 10:1
Sample: 0.15mg/ml eucalyptol contrast solution, n-hexane as solvent
WM-PEG20M, 30m×0.32mm, 0.5μm P/N: 05918-32002



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	0.903	1733619	2.246	5342	
2	Eucalyptol	1.942	196	1.040	13510	17.91

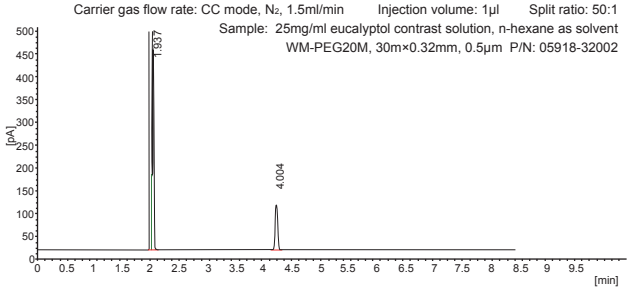
Nutmeg

Column temperature: 110℃ Inlet temperature: 140℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 50:1
Sample: 25mg/ml eucalyptol contrast solution, n-hexane as solvent
WEL-54, 30m×0.32mm, 0.25μm P/N: 01915-32001



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	1.853	169869	2.005	47971	
2		1.932	5 90	1.020	117519	2.79
3	Eucalyptol	4.713	1 40	1.033	78871	62.20

Column temperature: 110℃ Inlet temperature: 140℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 50:1
Sample: 25mg/ml eucalyptol contrast solution, n-hexane as solvent
WM-PEG20M, 30m×0.32mm, 0.5μm P/N: 05918-32002

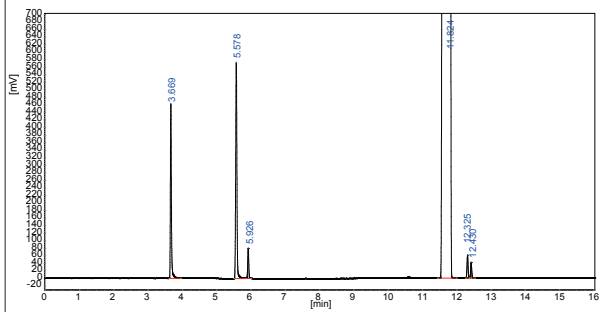


No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	n-hexane	1.883	112432	1.799	52231	
2		1.937	623	1.103	56959	1.66
3	Eucalyptol	4.004	284	1.031	46674	38.90

2.6 Other Applications of GC Columns

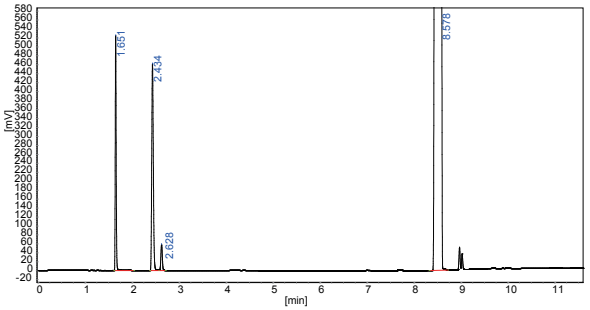
Amoxicillin Residual Solvent

Column temperature: 40℃（keep 4 min） 30 ℃/min 200℃
Inlet temperature: 240℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: H_2, 14psi Injection volume: 1μl
Sample: 225 mg isopropanol + 77 mg dichloromethane + 220 mg methanol, dissolve in 5ml DAMC
WM-624, 60m×0.32mm, 1.8μm P/N: 03908-34004



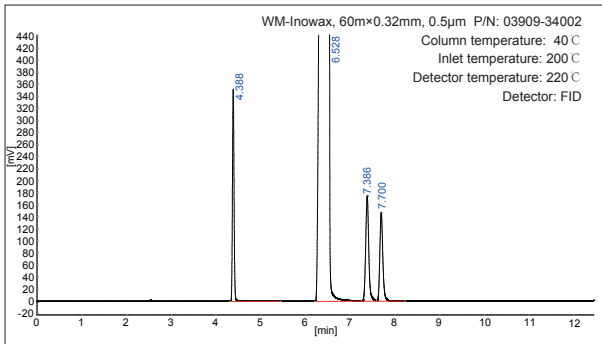
No.	Component	Retention	Width	Tailing factor	Resolution
1	Methanol	3.669	0.028	1.32	0
2	Isopropanol	5.578	0.036	1.075	35.122
3	Methylene chloride	5.926	0.03	1.031	6.211
4	DAMC	11.824	0.26	0.556	23.942

Column temperature: 40℃（keep 4 min） 30 ℃/min 200℃
Inlet temperature: 240℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: H_2, 14psi Injection volume1μl
Sample: 225 mg isopropanol + 77 mg dichloromethane + 220 mgMethanol, dissolve in 5ml DAMC
WM-624, 30m×0.53mm, 2.0μm P/N: 03908-52005

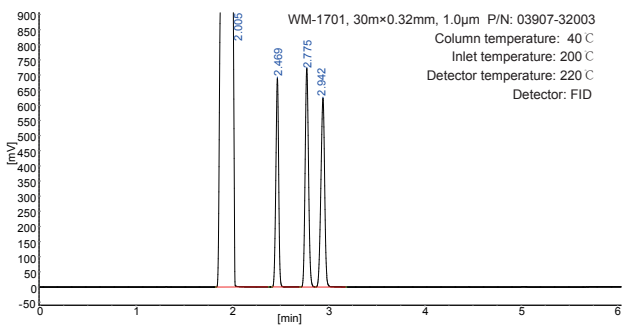


No.	Component	Retention	Width	Tailing factor	Resolution
1	Methanol	1.651	0.02	1.156	0
2	Isopropanol	2.434	0.034	1.159	16.964
3	Methylene chloride	2.628	0.031	1.03	3.479
4	DAMC	8.578	0.161	0.582	36.471

Solvent Separation



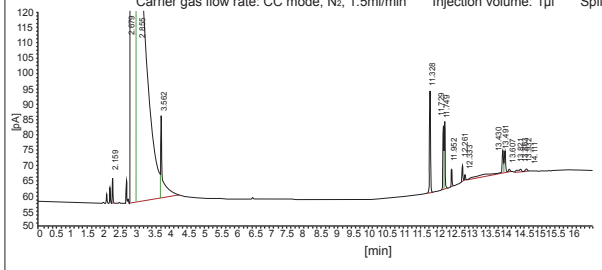
No.	Component	Retention	Half width	Tailing factor	Resolution
1	Acetone	4.388	0.036	1.1	0
2	Methanol	6.528	0.226	0.564	9.611
3	Isopropanol	7.386	0.067	1.14	3.445
4	Ethanol	7.7	0.066	1.185	2.787



No.	Component	Retention	Half width	Tailing factor	Resolution
1	Methanol	2.005	0.145	0.559	0
2	Ethanol	2.469	0.029	0.929	3.135
3	Acetone	2.775	0.035	1.069	5.55
4	Isopropanol	2.942	0.039	0.943	2.625

Related Substance of Propanediol

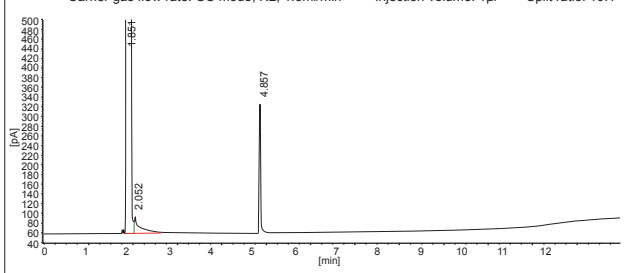
Sample: 12mg/ml Diethylene glycol+242.2mg/ml Dipropylene glycol +68.8mg/ml Tripropylene glycol+8.4mg/m
Epoxy propane contrast solution, anhydrous ethanol as solvent
WM-PEG20M, 30m×0.32mm, 0.5μm P/N: 05918-32002
Column temperature: 80℃(keep 3min) 15℃/min 220℃ (keep 4min)
Inlet temperature: 230℃ Detector temperature: 250℃ Detector: FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 10:1



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Propylene oxide	2.159	8.7	1.148	98077	2.63
2	Anhydrous ethanol	2.679	613153.3	4.373	11402	1.09
3	Anhydrous ethanol	2.855	2025.5	7.041	1086	0.79
4	Impurity	3.562	124.8	3.782	57734	3.49
5	Dipropylene glycol	11.328	62.5	1.016	833078	103.00
6	Dipropylene glycol	11.712	37.6	1.056	992838	7.97
7	Dipropylene glycol	11.749	40.9	0.999	891837	0.78
8	Dipropylene glycol	11.952	10.5	1.027	938722	4.10
9	Dipropylene glycol	12.261	9.9	1.065	1020006	6.33
10	Diethylene glycol	12.333	3.5	0.945	1045708	1.50
11	Tripropylene glycol	13.430	44.9	0.528	506934	17.78
12	Tripropylene glycol	13.491	19.8	1.052	512213	0.81
13	Tripropylene glycol	13.607	3.8	1.027	279177	1.30
14	Tripropylene glycol	13.821	1.2	0.941	651177	2.50
15	Tripropylene glycol	13.863	1.1	1.046	778881	0.64
16	Tripropylene glycol	13.932	2.6	0.832	402300	0.93
17	Tripropylene glycol	14.110	2.3	0.988	577699	2.20

Content of propanediol

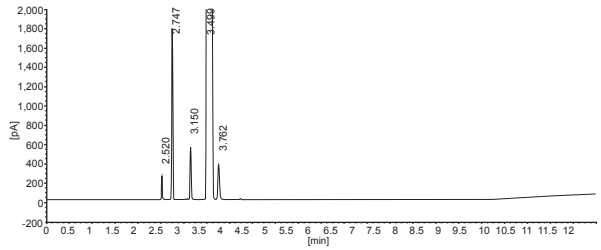
Sample: 1000ppm 1,2-Propanediol contrast solution, anhydrous ethanol as solvent
WM-PEG20M, 30m×0.32mm, 0.5μm P/N: 05918-32002
Column temperature: 130℃(keep 1min) 10 ℃/min 240℃ (keep 1min)
Inlet temperature: 230℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N2, 1.5ml/min Injection volume: 1μl Split ratio: 10:1



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethanol	1.851	477568	4.413	5583	0
2	Impurity 1	2.052	302	6.579	4496	1.82
3	Propanediol	4.857	539	1.195	153604	32.71

Methoxy, ethoxy

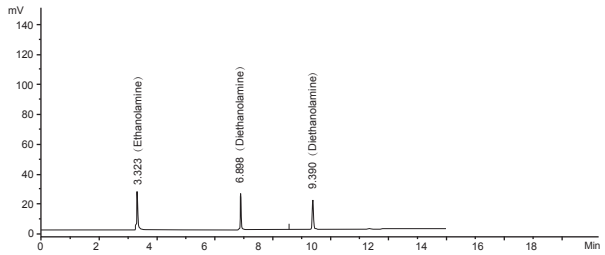
Sample: 5000ppm n-hexane, 5000ppm Methyl iodide,
5000ppm Iodoethane, 5000ppm 2-Iodopropane, benzene as solvent
WM-1301, 30m×0.32mm, 1.8μm P/N: 05905-32004
Column temperature: 100℃ (keep 8 min) 50 ℃/min 230℃(keep 2 min)
Inlet temperature: 200℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 20:1



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Methyl iodide	2.520	297	1.039	95973	0
2	n-hexane	2.747	2674	1.043	75243	6.28
3	Iodoethene	3.150	911	1.039	80111	9.54
4	Benzene	3.499	582569	4.557	15313	4.44
5	2-Iodopropane	3.762	973	0.970	45821	2.87

Triethanolamine

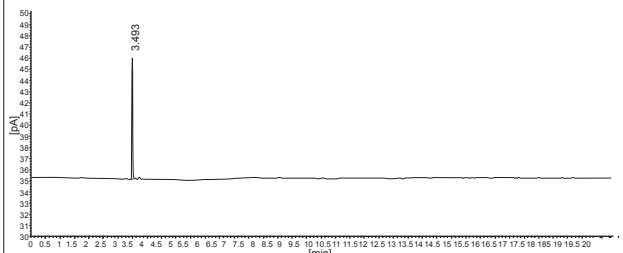
Sample: 2ul/ml ethanolamine. diethanolamine triethanolamine contrast solution, water as solvent
WM-54, 30m×0.53mm, 3.0μm P/N: 05915-52006
Column temperature: 60℃(keep 2min) 30 ℃/min 230℃ (keep 10min)
Inlet temperature: 250℃ Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CV mode N2, 0.04MPa Injection volume: 1μl Split ratio: 50:1



No.	Component	Area	Area	Tailing factor	Plates	Resolution
1	Ethanolamine	3.323	81480	1.2	38242	0
2	Diethanolamine	6.898	54495	1.2	237269	57.5
3	Triethanolamine	9.390	61107	1.1	209097	36.0

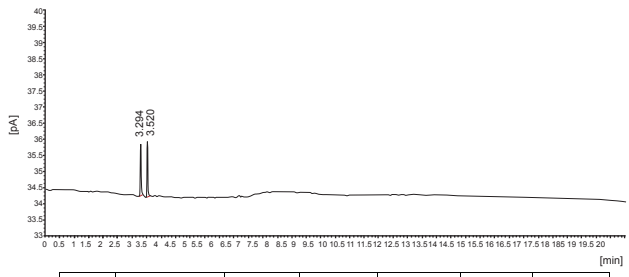
Epoxyethane and Dioxane in Polysorbate 80

Ethylene oxide as contrast substance 50ug/ml, water as solvent
WM-1, 30m×0.53mm, 1.0μm P/N: 05901-52003
Column temperature: 190℃ Inlet temperature: 250℃ Detector temperature: 280℃ Detector FID
Carrier gas flow rate: CC mode, N_2, 1.5ml/min Injection volume: 1μl Split ratio: 40:1



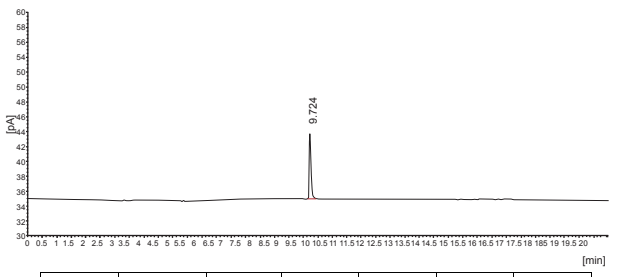
No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Ethylene oxide	3.493	18.6	1.025	99784	

System Suitability



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Acetaldehyde	3.294	2.8	1.395	97748	
2	Ethylene oxide	3.520	3.2	1.297	97930	5.197

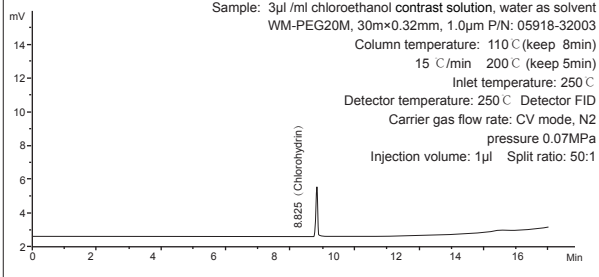
Dioxane 100ug/ml, water as solvent



No.	Component	Retention	Area	Tailing factor	Plates	Resolution
1	Dioxane	9.724	38.4	1.400	121054	

Gelatin Hollow Capsules Containing Chloroethanol

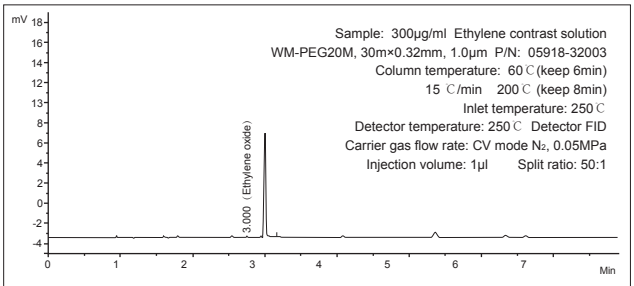
Sample: 3μl /ml chloroethanol contrast solution, water as solvent
WM-PEG20M, 30m×0.32mm, 1.0μm P/N: 05918-32003
Column temperature: 110℃(keep 8min)
15 ℃/min 200℃ (keep 5min)
Inlet temperature: 250℃
Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CV mode, N2
pressure 0.07MPa
Injection volume: 1μl Split ratio: 50:1



No.	Component	Rt	Area	Tailing factor	Plates	Resolution
1	Chlorohydrin	8.825	10674	1.0	134364	

Gelatin Hollow capsules containing Ethylene oxide

Sample: 300μg/ml Ethylene contrast solution
WM-PEG20M, 30m×0.32mm, 1.0μm P/N: 05918-32003
Column temperature: 60℃(keep 6min)
15 ℃/min 200℃ (keep 8min)
Inlet temperature: 250℃
Detector temperature: 250℃ Detector FID
Carrier gas flow rate: CV mode N_2, 0.05MPa
Injection volume: 1μl Split ratio: 50:1

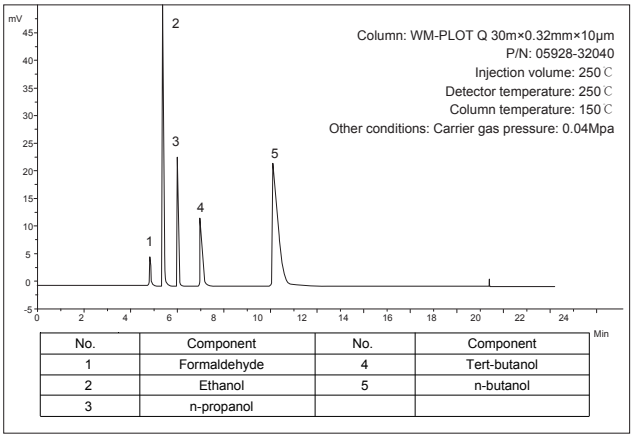


No.	Component	Rt	Area	Tailing factor	Plates	Resolution
1	Ethylene oxide	3.000	15185	1.0	91580	

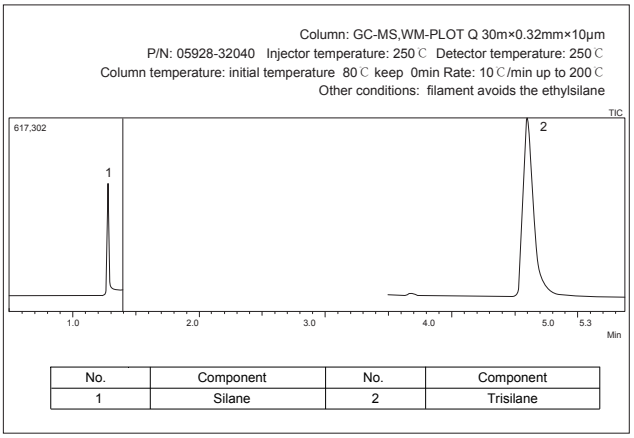
Analysis of Blood Alcohol by Capillary Column

Characteristics: according to the GA/T 842 blood alcohol test method, the capillary column detection of blood alcohol content can also be suitable for the analysis of large amounts of water trace alcohol components.

Analysis of Methylsilane and Propylsilane in Ethylsilane

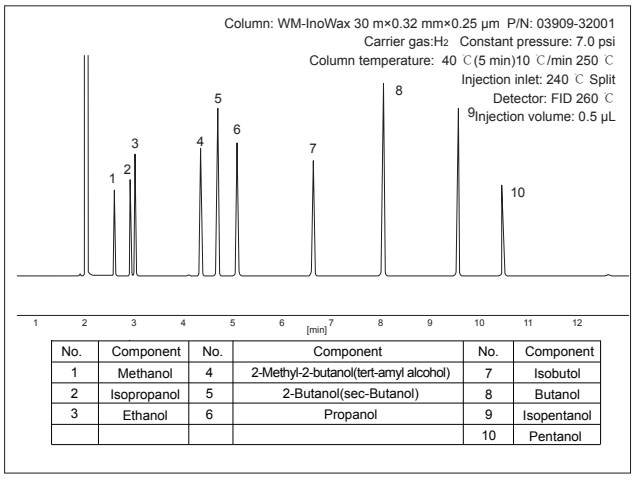


No.	Component	No.	Component
1	Formaldehyde	4	Tert-butanol
2	Ethanol	5	n-butanol
3	n-propanol		



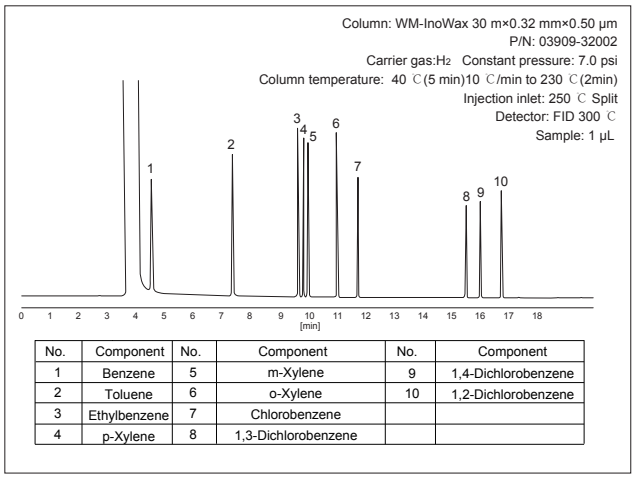
No.	Component	No.	Component
1	Silane	2	Trisilane

Analysis of Alcohol Compounds



No.	Component	No.	Component	No.	Component
1	Methanol	4	2-Methyl-2-butanol(tert-amyl alcohol)	7	Isobutol
2	Isopropanol	5	2-Butanol(sec-Butanol)	8	Butanol
3	Ethanol	6	Propanol	9	Isopentanol
				10	Pentanol

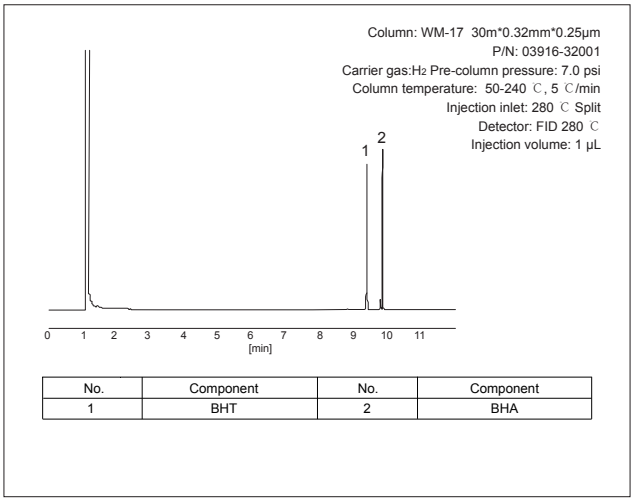
Aromatic Volatile Organic Compounds (EPA Method 507)



No.	Component	No.	Component	No.	Component
1	Benzene	5	m-Xylene	9	1,4-Dichlorobenzene
2	Toluene	6	o-Xylene	10	1,2-Dichlorobenzene
3	Ethylbenzene	7	Chlorobenzene		
4	p-Xylene	8	1,3-Dichlorobenzene		

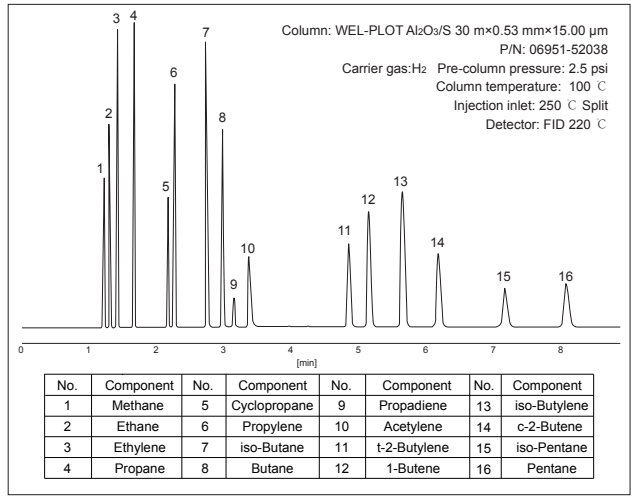
BHA (carcinogen, butylhydroxyanisole) and BHA Determination of BHT (dibutyl hydroxytoluene)

Characteristics: these two compounds have strong antioxidant ability and are often used as preservatives in food



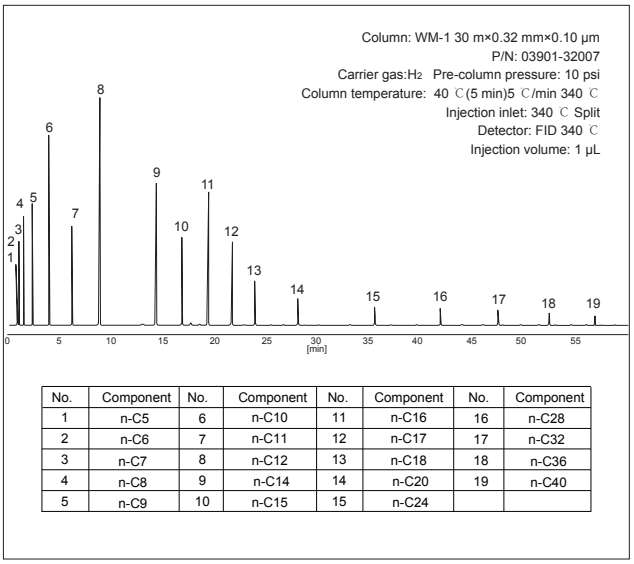
No.	Component	No.	Component
1	BHT	2	BHA

C1-C5 hydrocarbons (analysis of hydrocarbons)



No.	Component	No.	Component	No.	Component	No.	Component
1	Methane	5	Cyclopropane	9	Propadiene	13	iso-Butylene
2	Ethane	6	Propylene	10	Acetylene	14	c-2-Butene
3	Ethylene	7	iso-Butane	11	t-2-Butylene	15	iso-Pentane
4	Propane	8	Butane	12	1-Butene	16	Pentane

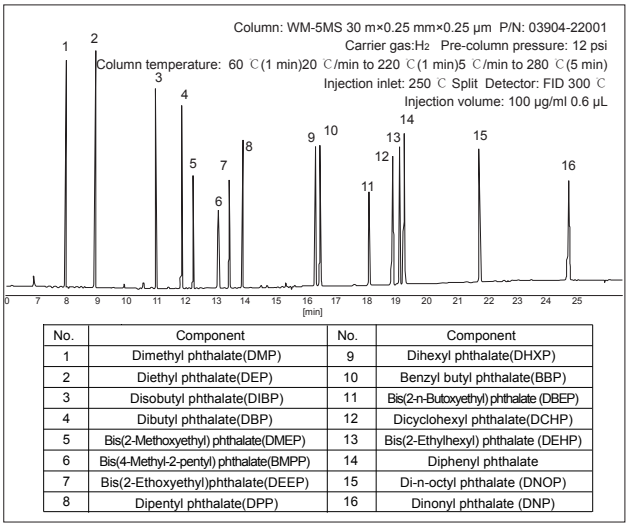
C5-C40 Hydrocarbons (Analysis of Hydrocarbons)



No.	Component	No.	Component	No.	Component	No.	Component
1	n-C5	6	n-C10	11	n-C16	16	n-C28
2	n-C6	7	n-C11	12	n-C17	17	n-C32
3	n-C7	8	n-C12	13	n-C18	18	n-C36
4	n-C8	9	n-C14	14	n-C20	19	n-C40
5	n-C9	10	n-C15	15	n-C24		

Analysis of Ester Compounds

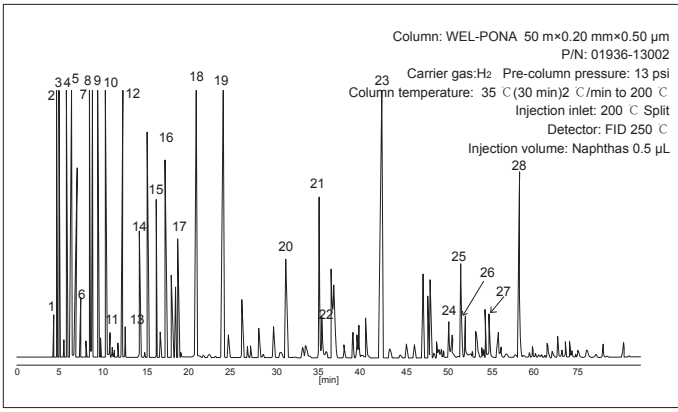
(Dimethyl phthalate, diethyl phthalate, phthalate esters)



No.	Component	No.	Component
1	Dimethyl phthalate(DMP)	9	Dihexyl phthalate(DHXP)
2	Diethyl phthalate(DEP)	10	Benzyl butyl phthalate(BBP)
3	Disobutyl phthalate(DIBP)	11	Bis(2-n-Butoxyethyl) phthalate (DBEP)
4	Dibutyl phthalate(DBP)	12	Dicyclohexyl phthalate(DCHP)
5	Bis(2-Methoxyethyl) phthalate(DMEP)	13	Bis(2-Ethylhexyl) phthalate (DEHP)
6	Bis(4-Methyl-2-pentyl) phthalate(BMPP)	14	Diphenyl phthalate
7	Bis(2-Ethoxyethyl)phthalate(DEEP)	15	Di-n-octyl phthalate (DNOP)
8	Dipentyl phthalate(DPP)	16	Dinonyl phthalate (DNP)

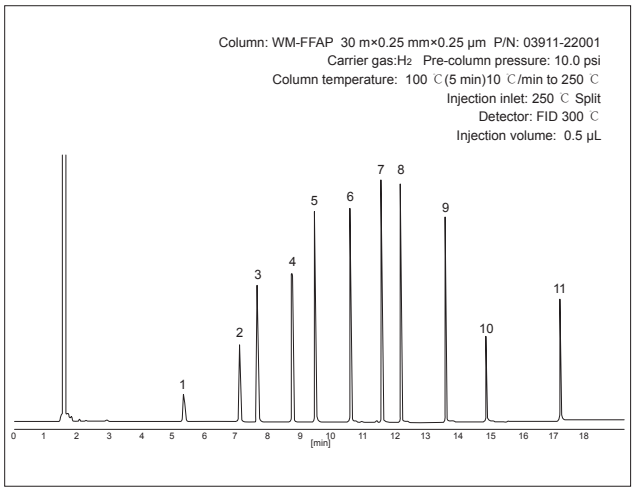
Naphthas Analysis

(Petroleum products, chemical light oil hydrocarbon compounds)

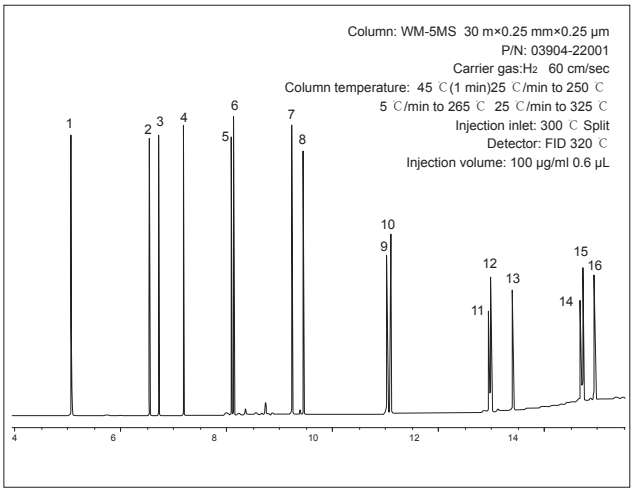


No.	Component	No.	Component
1	Propane	15	2-Methylhexane
2	Isobutane	16	2, 3-Dimethylpentane
3	Butane	17	3-Methylhexane
4	Isopentane	18	Heptane
5	Pentane	19	Methylcyclohexane
6	2, 2-Dimethyl butane	20	Toluene
7	Cyclopentane	21	2-Methylheptane
8	2-Methyl pentane	22	4-Methylheptane
9	3-Methyl pentane	23	Octane
10	Hexane	24	Ethylbenzene
11	2, 2-Dimethyl pentane	25	m-Xylene
12	Methylcyclopentane	26	p-Xylene
13	2, 4-Dimethylpentane	27	o-Xylene
14	Benzene	28	Nonane

Organics Acids Determination of Small Molecular Organic Acids



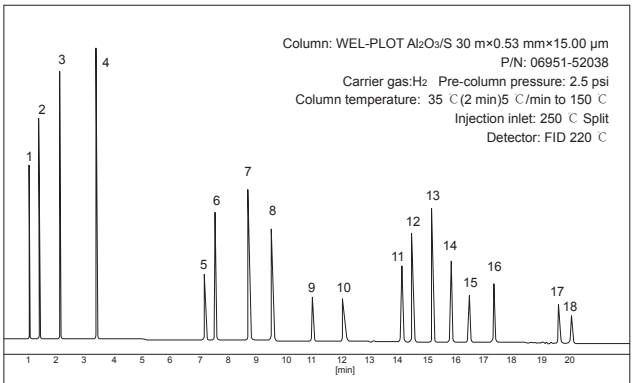
PAHS Determination of Polycyclic Aromatic Hydrocarbons



No.	Component	No.	Component	No.	Component	No.	Component
1	Acetic acid	4	Butyric acid	7	Isocaproic acid	10	Octanoic acid
2	Propionic acid	5	Isovaleric acid	8	Caproic acid	11	Decanoic acid
3	Isobutyric acid	6	Valeric acid	9	Heptanoic acid		

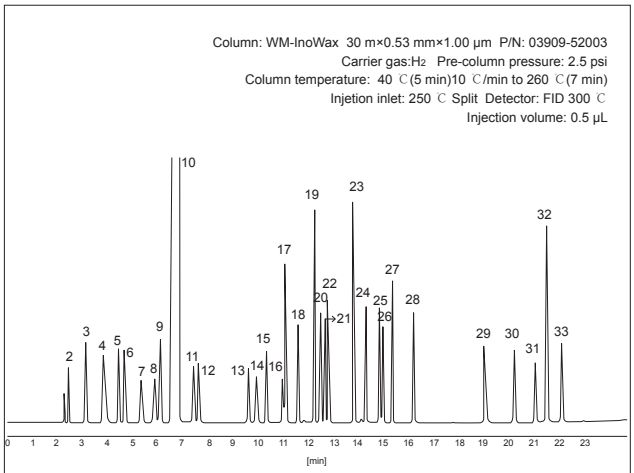
No.	Component	No.	Component
1	Naphthalene	9	Benz(a)anthracene
2	Acenaphthylene	10	Chrysene
3	Acenaphthene	11	Benzo(b)fluoranthene
4	Fluorene	12	Benzo(k)fluoranthene
5	Phenanthrene	13	Benzo(a)pyrene
6	Anthracene	14	Indeno(1, 2, 3-cd)pyrene
7	Fluoranthene	15	Dibenz(a, h)anthracene
8	Pyrene	16	Benzo(g, h, i)perylene

Determination of Refinery Gas



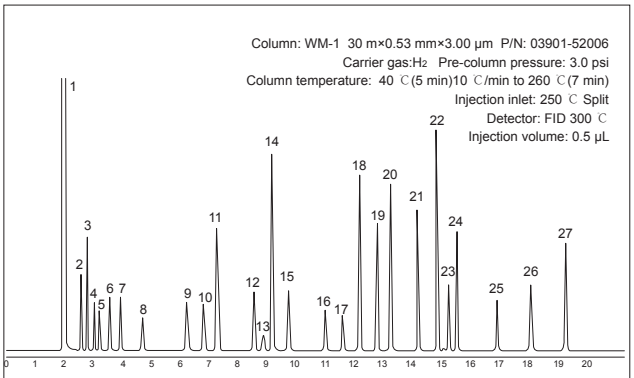
No.	Component	No.	Component	No.	Component	No.	Component
1	Methane	6	Propylene	11	t-2-Butylene	16	Pentane
2	Ethane	7	iso-Butane	12	1-Butene	17	1,3-Butadiene
3	Ethylene	8	Butane	13	iso-Butylene	18	Propyne
4	Propane	9	Propadiene	14	c-2-Butene		
5	Cyclopropane	10	Acetylene	15	iso-Pentane		

Solvent I Determination of Residual Solvent



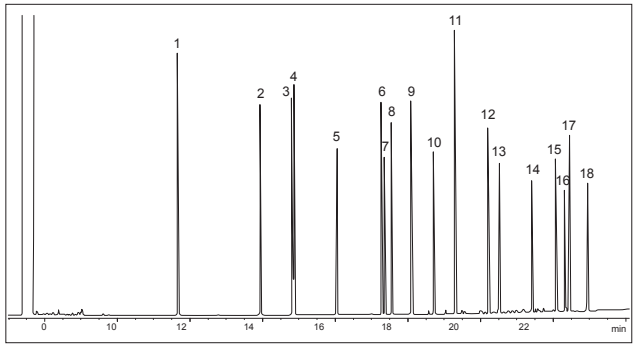
No.	Component	No.	Component
1	Pentane	18	iso-Butanol
2	Hexane	19	iso-Amyl acetate
3	Cyclohexane	20	Ethylbenzene
4	Triethylamine	21	p-Xylene
5	Acetone	22	m-Xylene
6	Methyl acetate	23	o-Xylene
7	Tetrahydrofuran(THF)	24	Propylbenzene
8	Tetrachloromethane	25	tert-Butylbenzene
9	Ethyl acetate	26	Pentanol
10	Methanol	27	Phenylethylene
11	Methylene chloride	28	Cyclohexanone
12	Ethanol	29	Acetic acid
13	Acetonitrile	30	Benzaldehyde
14	Chloroform	31	DMSO(methyl sulfoxide)
15	Toluene	32	Ethylene glycol
16	1,4-Dioxane	33	Acetophenone
17	Butyl acetate		

Solvent II Analysis and Determination of Residual Solvent



No.	Component	No.	Component
1	Methanol	15	Triethylamine
2	Ethanol	16	Pyridine
3	Acetonitrile	17	N,N-dimethylformamide
4	Acetone	18	Toluene
5	Isopropanol	19	Dimethyl sulfoxide (DMSO)
6	Pentane	20	Butyl acetate
7	Methylene chloride	21	N, N-dimethylacetamide (DMAC)
8	Propanol	22	Ethylbenzene
9	sec-Butanol	23	Cyclohexanone
10	Chloroform	24	Phenylethylene
11	Tetrahydrofuran(THF)	25	Benzaldehyde
12	Butanol	26	tert-Butylbenzene
13	Tetrachloromethane	27	Acetophenone
14	Ethylene glycol		

Determination of Substituted Aniline Compounds



No.	Component	No.	Component	No.	Component
1	Aniline	7	2,4,6-Trichloroaniline	13	2,6-Dichloro-4-nitroaniline
2	2-Chloroaniline	8	3,4-Dichloroaniline	14	2-Bromo-6-chloro- 4-nitroaniline
3	3-Chloroaniline	9	3-Nitroaniline	15	2-Chloro-4,6-dinitroaniline
4	4-Chloroaniline	10	2,4,5-Trichloroaniline	16	2,6-Dibromo-4-nitroaniline
5	4-Bromoaniline	11	4-Nitroaniline	17	2,4-Dinitroaniline
6	2-Nitroaniline	12	2-Chloro-4-nitroaniline	18	2-Bromo-4,6-dinitroaniline

Column:WM-5ms 30 m×0.25 mm×0.50 μm
P/N: 03904-22002
Carrier gas: H2 33 cm/sec Measured at 150 ℃
Column temperature: 40 ℃(5 min)12 ℃/min to 300 ℃(10 min)
Injetion inlet: 250 ℃ split
Detector: FID 325 ℃
Injection volume:0.5 μL

Gas Phase Accessories

3.1 Gas Generator

Product description: gas generator is safe, reliable and easy to operate, if turn on the power, it can produce high purity carrier gas with stable pressure, which is suitable for various GC manufacturers as an ideal substitute for gas cylinder.

Product	Type	Figure
High-purity hydrogen generator	GH-300	
High-purity hydrogen generator	GH-500	
High-purity hydrogen generator	GH-400	
High-purity hydrogen generator	GH-600	
High-purity hydrogen generator	GN-300	
High-purity hydrogen generator	GN-500	
Low noise air pump	GA-2000A	
Low noise air pump	GA-5000A	
Low noise air pump	GA-3000	

Product	Type	Figure
Nitrogen hydrogen air generator	NA-300A	
Nitrogen hydrogen air generator	NA-500A	
Nitrogen hydrogen air generator	HA-300A	
Nitrogen hydrogen air generator	HA-500A	
Nitrogen hydrogen air generator	GX-300A	
Nitrogen hydrogen air generator	GX-500A	

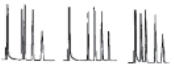
3.2 Gas Phase Accessories

Product description: with reliable quality, can match all kinds of gas chromatographs (Agilent, Shimazu, Platinum Elmer, Syme Technology, Brook, etc.) perfectly.

3.2.1 Injection Septa

Septum pollution or loss under high temperature, will lead to ghost peaks; Septa leakage, will lead to increased retention time and detector signal noise, decreased head pressure. It is recommended that the injection septa need to be changed frequently during daily use of the gas chromatograph.

Tab 3.1 Common fault of injection septa and solutions

Phenomenon	Possible Reasons	Solutions
Extra peak/ round peak 	Septa loss	If the extra peak disappears after closing the injector heater, it is suggested to change to high temperature septa or reduce the inlet temperature for analysis.
Post-peak baseline variation 	Severe leakage at the septa during the short time after injection, which is usually caused by a larger diameter injection needle	Change septa and use a smaller diameter injection needle
Post-peak baseline variation 	Carrier gas leakage occurs at the injector septa or column junction	Check for leaks, if any, replace the septa, or tighten the column junction

Suggestions for the Maintenance of Injection Septa:

- The use temperature of the spacer shall not exceed the recommended temperature
- Check and replace regularly
- Use an autosampler and the septa sweeping function if possibile

Tab 3.2 Classification of injector septa

Type	Leachability	Lifetime	Temperature Limit
BTO® （Drain and temperature optimized septa）	√√√	√	up to 400 °C
Advanced Green 3™ （Premium green septa）	√√	√√	up to 350 °C
Marathon™ （Long lifetime septa）	√	√√√	up to 350 °C

（√√√ = best　√√ = better　√ = good）

Drain and temperature optimized septa （BTO®）

- Extended temperature range, lowest loss
- Max. temp. is 400℃
- Each batch of septa is tested for loss by GC-FID
- Plasma treatment can eliminate adhesion and contamination at the injector
- Pre-aging, ready to use
- Packed in a clean glass bottle, clean and convenient

Premium green septa （AG3™）

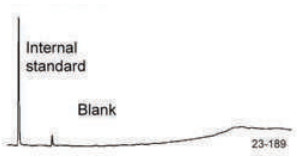
- Real long lifetime, high temperature resistant green septa
- High service temperature 350℃
- Each septa is subjected to more injections
- As high-performance alternativeof green septa
- Best for low-loss, MS capillary column

Long lifetime septa （Marathon™）

- The best septa for automatic injector with great operation
- Max. temp. 350℃
- Preperforation can avoid clastic formation and prolong life
- Each septa can tolerate up to 400 injections
- Plasma treatment can eliminate the adhesion at the injector inlet
- Packed in a clean glass bottle, clean and convenient

Comparison septa leachability

A）BTO septa
B）AG3 septa
C）Competing manufacturer's high temperature red spacer
D）Competitor's low loss green septa



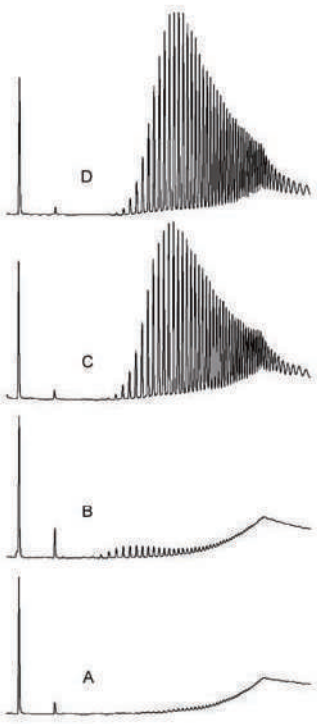


Fig 3.1 Comparison septa leachability

3.2.2 Graphite Ferrule

Improper use of sealing ferrule results in inconsistent chromatographic peaks and unreliable analytical results. Specifically, improper sealing ferrule can cause air and other contaminants and into the instrument system, seriously affecting column efficiency and detector performance. For optimal performance, replace the sealing ferrule every time the column is replaced or maintained.

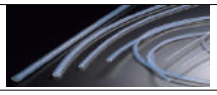
- To minimize problems, install the sealing ferrule with the following precautions:
- Don't screw too tight-tighten the column nut with your fingers and then tighten it with a wrench
- Prevent pollution and keep clean
- Before reusing, check the seal gasket for cracks, debris, or other damage with a magnifying glass. Replace the seal gasket when installing a new column or injector/detector component

Guide to sealing ferrule selection

Type	Temperature limit	Usage	Advantage	Limitaion
Carbon（100%） 	450℃	• Capillary column general • Suitable for FID and NPD • Recommended for high temperature and cold columns	• Easy to use, stable seal • Higher temperature upper limit • Easy to remove	• It is not recommended for MS and oxygen sensitive detectors • Soft, easy to deformation or damage
Vespel/Carbon 	400℃	• Capillary column • It is recommended for MS and oxygen sensitive detectors • The most reliable leak-free connection	• Mechanical stability • Long life	• Cannot be reused • It flows at high temperatures • It must be retightened
100% Vespel 	350℃	• Constant temp operation • Reusable and easy to remove • It is an excellent sealing material for connecting metal or glass	• Stable mechanical properties • Long lifetime • Reusable and easy to remove	• The program may leak after heating up several times • It's going to run off at high temperatures • It must be retightened frequently

3.2.3 Ordering Information of GC Accessories

P/N	Product	Specification	Pack	Picture
00832-00001	Silanized glass wool	Welchrom® max temp. 400℃, 0.5g/pcs, 1bag	1 bag	
00832-00004	Two-way valve	Welchrom® no variable diameter, 3mm outer diameter（Stainless steel）: Suitable for 2mm inner diameter column tube, 1	1pk	
00832-00005	Three-way valve	Welchrom® no variable diameter, 3mm outer diameter（Stainless steel）: Suitable for 2mm inner diameter column tube, 1	1pk	
00832-00006	Nut	Welchrom® 3mm outer diameter（Stainless steel）suitable for 2mm inner diameter column tube, 1	1pk	
00832-00007	Gas path on/off valve	Welchrom® 3mm outer diameter	1	
00832-00008	Graphite ferrule	Max 400℃, Welchrom® Suitable for column inner diameter: 3mm, 1	1	
00832-00013	Graphite ferrule	Max 400℃, Welchrom® Suitable for column inner diameter: 2mm, 1	1	

P/N	Product	Specification	Package	Picture
00832-00014	Graphite ferrule	Max temp. 400℃, Welchrom® suitable column inner diameter 0.53mm	1	
00832-00015	Graphite ferrule	Max temp. 400℃, Welchrom® column inner diameter 0.32mm	1	
00832-00009	Soap bubble flowmeter	Welchrom® contains a glass flowmeter, a 50cm hose, a rubber head, 100ml (glass)	1 pcs	
00832-00010	Gas pipeline	Welchrom® outer diameter 3mm, inner diameter 2mm, materials: teflon tube	1 meter	
00832-00011	Deoxidation tube	Welchrom® color changing type, organic glass material	1 pcs	
00832-0001	Gas path purifier	Welchrom® packing materials: allochroic silicagel activated carbon, molecular sieve	1	

Method A: Determination of organochlorine pesticide residues - Chromatography

Determination of 9 organochlorine pesticide residues

1. Method introduction

The homogenized samples will be separated by adding sodium chloride and dichloromethane after extraction with water and acetone. Concentrate organic phase, then redissolve with petroleum ether and sulfonate with concentrated sulfuric acid. Through decompression and concentration and redissolve with petroleum ether for GC-ECD analysis and determination.

2. Sample preparation

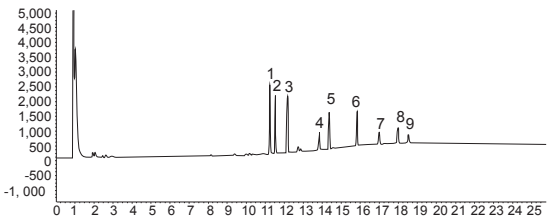
1. After precise weighing and homogenizing, put 2g samples into 100ml conical flask and soaked in 20ml water overnight.
2. Add acetone 40ml precisely, ultrasound for 30 mins (using acetone to make up the reduced weight);
3. Add 6g NaCl, 30ml dichloromethane, ultrasound for 15 mins(using acetone to make up the reduced weight);
4. Transfer organic phase to a 100ml conical flask containing an appropriate amount of anhydrous sodium sulfate and placed for 4 hours.
5. Weigh 35ml precisely and through decompression and concentration under 40℃ to nearly dry, then add a small amount of petroleum ether (60~90℃) to converse several times.
6. Dissolve the petroleum ether and transfer petroleum ether to 10ml centrifuge tube with plug. Dilute the petroleum ether (60~90℃) to 5ml.
7. Carefully add 1ml sulfuric acid, shake for 1 minute.
8. Centrifuge at 3000rpm for 10 minutes. Take 2ml of the supernatant for precision measurement and place it in a graduated concentrator.
9. Through decompression and concentration under 40℃ to nearly dry, add petroleum ether (60~90℃) to a constant volume of 1mL for GC-ECD analysis.

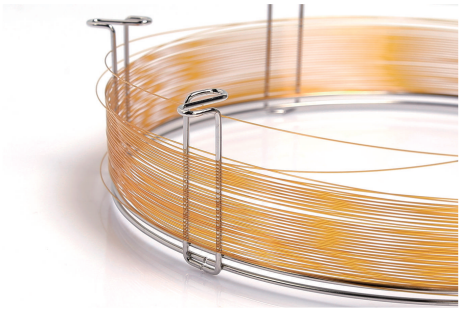
3. GC Chromatographic condition

GC Chromatographic condition
Column: WM-1701 (30m×0. 32mm× 0.25μm),
Column temperature: 100℃ (0min) 10℃/min→220℃ (0min) 8℃/min →250℃ (10min)
Carrier gas: N_2
Injector: 250℃, splitless injection
Detector: ECD 300℃

Peak: 1- α- benzene hexachloride, 2-quintozene, 3-γ- benzene hexachloride, 4-β- benzene hexachloride, 5-δ- benzene hexachloride, 6- p,p'-DDE, 7- o,p'-DDT, 8- p,p'-DDD, 9- p,p'-DDT

GC-ESD Chromatogram of 9 organochlorine standard solutions





4. Related Products

The homogenized samples will be separated by adding sodium chloride and dichloromethane after extraction with water and acetone. Concentrate organic phase, then redissolve with petroleum ether and sulfonate with concentrated sulfuric acid. Through decompression and concentration and redissolve with petroleum ether for GC-ECD analysis and determination.

P/N	Product	Specification
03907-32001	WM-1701	WM-1701 30m×0.32mm×0.25μm
03902-32001	WM-5 GC Ca	WM-5 30m×0.32mm×0.25μm
Variety of specifications, welcome to consult		

Determination of 22 Organochlorine Pesticide Residues

1. Method introduction

After the homogenized samples are extracted by water and acetonitrile, the two phases can be stratified by salting out pack. The acetonitrile phase was concentrated and then redissolve with cyclohexane-ethyl acetate (1:1) solution, purified by gel chromatography and floreli silica column. Through decompression and concentration and redissolve with petroleum ether for GC-ECD analysis and determination.analysis and determination.

2. Sample preparation

1. After precisely weigh and homogeneity, put 1.5g samples in a 50mL centrifuge tube and soak it in 10ml water for 2 hours.
2. Precisely add 15ml acetonitrile and extract by violent shock for 1 min.
3. Add QuEChERS salting out packs (4g anhydrous magnesium sulfate +1g sodium chloride) and shake violently for 1 min.
4. After centrifugation at 4000rpm for 1 min precisely transfer 10mL acetonitrile phase and through decompression and concentration at 40℃.
5. Transfer 10mL solution of ethyl acetate - cyclohexane (1:1) to a 10mL measuring flask by seversl times, and keep volume at 10ml.

6 Take 5 ml of supernatant to be be purified by GC. Column used is Welch Bio-Beads S-X3 400×25mm.

7 Collect purification liquid for 18-30min, concentrate at 40℃ under decompression to nearly dry, and then add 1ml n-hexane for resolution. Collect eluent according to the detector to check the peak of organochlorine.

8 Use Flori silica column for purification (Florisil PR 1000mg/6ml).

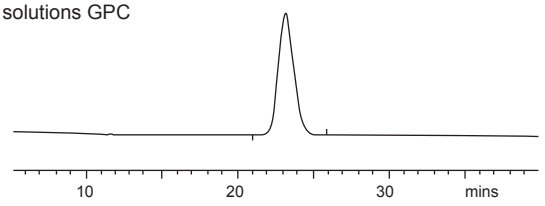
9 After purification, the samples can be concentrated to near dry with a nitrogen blower, and add 1ml isooctane vortex for GC-ECD analysis.

Note: The boiling range of petroleum ether used in this experiment is 60-90℃

3. Chromatographic analysis

Column: Welch Bio-Beads S-X3 400×25mm
Flow rate: 5ml/min
Mobile phase: cyclohexane/ethyl acetate=1:1
Column temperature: room temperatrue(about 24℃)

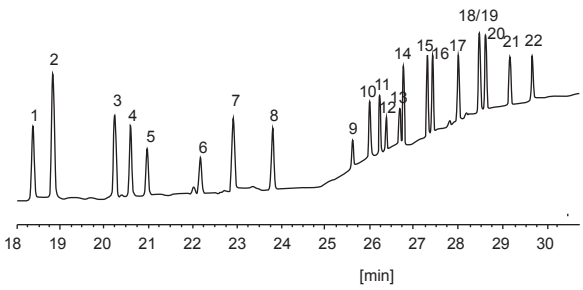
(1) Chromatogram of 22 kinds of organochlorine standard solutions GPC



GC chromatographic condition
Column: WM-17 (30m×0.25mm×0.25μm),
Column temperature: 70℃(1min)10℃/min→180℃(5 min)5℃/min →220℃(0 min)100℃/min→280℃(8 min)
Carrier gas: N_2, 1.3ml/min
Injector: 240℃, splitless injection
Detector: ECD 300℃

Chromatographic : 1-Hexachlorobenzene, 2-α-Benzene hexachloride, 3-Quintozene, 4-γ-benzene hexachloride, 5-β-benzene hexachloride, 6-Heptachlor, 7-δ--benzene hexachloride, 8-Aldrin, 9-Oxychlordane Isomer, 10-Ethylcarboxamido Adenosine, 11-Heptachlor-endo-epoxide, 12-Trans-chlordane, 13-Cis-chlordane, 14-α-endosulfan, 15- p, p'-DDE, 16-Dieldrin, 17-Endrin, 18-o, p'-DDT, 19- p, p'-DDD, 20-β-endosulfan, 21- p, p'-DDT, 22- Sulfate

(2) Chromatogram of 22 kinds of organochlorine standard solutions GC-ECD



4. Related products

P/N	Product	Specification
03916-32001	WM-17 GC Capillary Column(HPLC column)	WM-17 30m×0.25mm×0.25μm
01901-22001	WEL-1 GC (Verification column)	WEL-1 30m×0.25mm×0.25μm
00530-20000	QuEChERS Extraction Bag	QuEChERS extration bag, initial method (without buffer salt) 4g magnesium sulphate, 1g NaCl, use in10g samples, 50pcs/box
00516-20007	Welchrom® SPE Column	Welchrom® Florisil PR,1g/6ml, 30pk
00823-00002	GPC Column	Welch Bio-Beads S-X3, 200-400 mesh,
Variety of specifications, welcome to consult		

Method B: Determination of organochlorine pesticide residues - Chromatographic method

1. Method introduction

After the homogenized samples are extracted by water and acetonitrile, purified by gel chromatography and floreli silica column. Through decompression and concentration, redissolve with petroleum ether for GC- NPD/FPD analysis and determination.

2. Sample preparation

1. Weigh 5g homogenized to the concial flask with plug. Add 5g anhydrous sodium sulfate.
2. Add ethyl acetate for 50~100ml to through ultrasonic extraction in ice bath for 3min. Keep still.
3. Filtrate the upper layer, and extract the residue repeatedly, then combine the
4. Ethyl acetate detergent residues and filter paper, combine the filtrate, through decompression concentration under 40 ℃ to nearly dry;
5. Redissolve it with ethyl acetate and add to 5ml.
6. Take 1ml, graphicarbon column (250mg/3ml)
   Graphitized carbon column purification:
   Activation: activate the column with ethyl acetate 50mL, do not collect.
   Add samples: add 1ml ethyl acetate solution to the column without collection.
   Elution: elute with 5ml n-hexane-ethyl acetate (1:1) mixed solution, collect the effeunt. Take 1ml by graphicarbon column (250mg/3ml)
7. Concentrate the eluent to near dry with nitrogen blower.
8. Add ethyl acetate to 1ml, vortex to dissolve.

3. Related products

P/N	Product	Specification
03916-22001	WM-17 GC capillary column	WM-17 30m×0.25mm×0.25μm
03902-22001	WM-5 GC capillary column	WM-5 30m×0.25mm×0.25μm
00551-20000	QuEChERS extration bag	QuEChERS extraction bag, 5.0g anhydrous sodium sulfate, 50 pcs/box
00517-20012	Welchrom® SPE column	Welchrom® Carb, 250mg/3ml, 50pk
Variety of specifications, welcome to consult		

Method C: Determination of pyrethroid pesticide residues - Chromatographic method

1. Method introduction

After the homogenized samples were extracted by ultrasound with mixed solution of petroleum and ether-acetone, dehydrate with anhydrous sodium sulfate and purify by special column for pyrethroid. Concentrate and redissolve, and add petroleum ether to have a constant volume for GC-ECD analysis.

2. Sample preparation

1. Precisely weigh 1-2g homogenized samples (through sieve number 3) into 100ml conical flask with plug.
2. The petroleum ether-acetone (4:1) solution was added to 30ml and extracted by ultrasonic for 15min.
3. Transfer the extraction solution , and extract the crude drug samples twice and combine with the extraction solution.
4. After dehydration with anhydrous sodium sulfate, reduce the filtrate to nearly dry by decompression.

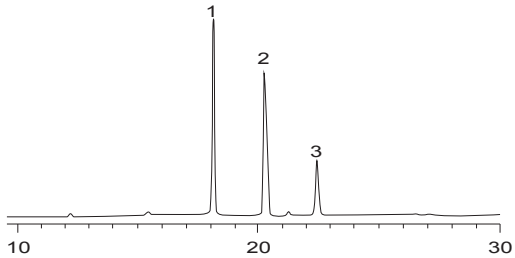
5

Used a small amount of petroleum ether repeatedly until acetone was removed and then dissolve with 5ml petroleum ether.
Purify with special column for pyrethroid:
Activation: Activate column by petroleum ether-ethyl ether (4:1) mixed solution of 20mL, without collection.
Sample loading: add 5ml petroleum ether solution to the column and collect the outflow.
Elution: elute with 90ml mixed solution of petroleum and ether-ethyl ether (4:1) and collect the elution.
Reduce pressure and concentrate the sample effluent and eluent under 40℃ to nearly dry.
Repeat the operation with 4ml of petroleum ether until the ethyl ether is removed, dissolve with a small amount of petroleum ether and transfer it to a 5ml measuring bottle, make a constant volume with petroleum ether, shake well.
Note: The boiling range of petroleum ether used in this experiment is 60-90℃

3. Analysis of Chromatogram

Column: WM-5 30m×0.32mm×0.25μm
Detector: ECD
Inlet temperature: 270℃, detector temperature 330℃, splitless injection
Temperature program: 160℃(1min)10℃/min→278℃(0.5min), 1℃/min →290℃(5min)

Chromatogram of substances of three kinds of permethrin



4. Related products

P/N	Products	Specification
03902-32001	WM-5 GC capillary column	WM-5 30m×0.32mm×0.25μm
Variety of specifications, welcome to consult		

Method D: Determination of pyrethroid pesticide residues-MS

1. Method introduction

Extract homogenized samples which were soaked in 1% aqueous acetic acid solution with acetonitrile. Then tratify by salting out bag. After centrifugation, take the supernatant to be purified with QuEChERS purification tube. Concentrate to have a constant volume for GC /MS or LC/MS analysis.

2. Sample preparation

1 Precisely weigh tested product 3g to 50mL polystyrene centrifuge tube with plug

2 Add 15ml 1% glacial acetic acid solution and soak in vortex for 30min.

3 Precisely add 15ml acetonitrile and 100 μl internal standard solution;

4 Extract with violent oscillation for 5 minutes.

5 Add QuEChERS salting out bag and shake violently for 3min, then cool in the ice bath for 10 min.

6 After centrifugation at 4000rpm for 5min, take 9ml supernatant and added the QuEChERS purification tube for 5min of violent oscillation.

7 After centrifugation at 4000rpm for 5min, take 5 ml supernatant and concentrate at 5ml 40 ℃ to about 0.4mL, and stabilize with acetonitrile to 1mL.

8 Mix the vortex with a 0.22μm nylon filter for instrumental analysis.

3. Related products

P/N	Products	Specification
03904-22001	WM-5MS GC Capillary Column (1.GC-MS/MS)	WM-5MS 30m×0.25mm×0.25μm
960-04023	Boltimate® C18 (Core-Shell) Column (2.LC-MS/MS)	Boltimate® C18, 2.7μm, 90Å, 3.0×150mm
00528-20000	QuEChERS extraction bag	QuEChERS extraction bag, AOAC method, 6g magnesium sulfate, 1.5g sodium acetate, 50 pcs/box
00581-20021	QuEChERS extraction tube	QuEChERS extraction tube-15ml, 900mg $MgSO_4$, 300mg PSA, 300mg C18E, 300mg Silica, 90mg GCB, 50 pcs/box

Method E: Determination of pesticide residue-MS method

Sample preparation

1. Extration steps

Weigh 5g samples and add 1g sodium chloride, then shake. Continue to add 50mL acetonitrile, homogenized, centrifuge for 5min (4000r/min), and remove supernatant. Add 50mL acetonitrile into the precipitation, homogenized, centrifuge for 5min (4000r/min), then transfer the supernatant and combine. Concentrate the supernatant in a water bath at 40℃ to 3-5mL, then dilute and redissolve with acetonitrile to 10mL, shake well, and set aside. Weigh 5g samples, and add 1g NaCl.

2.Celanup steps

Method 1:

Welchrom® QuEChERS specification: anhydrous magnesium sulfate 1200mg, N-propyl ethylenediamine (PSA) 300mg, and measure C18E 100mg and 3mL of the test product solution prepared by direct extraction method in a centrifuge tube, which was fully mixed by vortex, centrifuge for 5min (4000r/min), and transfer the supernatant.

Method 2:

SPE column: Welchrom®BRP, specificaiton: 200mg/6mL
Sample loading: The test sample solution is 3mL, purify with the column, collect all the purification liquid, mix.

Method 3:

SPE column: Welchrom® Carb/NH_2, specification: 250mg/250mg/6mL
Actviation: 10mL acetonitrile-toluene(3:1), discard.
Sample loading: collect 2mL of the test sample solution prepared by the direct extraction method and collect in a heart-shaped flask.
Elution: 20mL acetonitrile-toluene (3:1) elute, press and collect in a heart-shaped flask.
Redissolve: cycle the collected liquid to dry in a water bath at 40℃, then transfer with acetonitrile and dilute to 2mL.

Determination method: accurately absorb 1mL of each substrate mixed control solution and test sample solution, and accurately add 0.3ml of internal standard, mix, filter, and take the additional filtrate for detection, and calculate according to the standard curve method of internal standard.

3. Related products

P/N	Procuct	Specification
00522-20014	SPE column	Welchrom® BRP,200mg/6mL,30pk
00527-20010	SPE column	Welchrom® Carb/NH_2,250mg/250mg/6mL,30pk
005PM-077-50	QuEChERS	QuEChERS extration-15ml, 1200mg $MgSO_4$, 300mg PSA, 100mg C18E, 50 pcs/box
00837-05006	Centrifuge tube	Welchrom® centrifuge tube, disposable centrifugal tube, flat cap, conial, RCF12000xg, bag, without sterilization, 50mL, 50/pcs
00837-05002	Centrifuge tube	Welchrom® centrifuge tube, centrifuge tube, flat cap, RCF12000xg, bag, without sterilization, 15mL, 50/pcs

00824-31001	SPE device	Welch SPE device, 12 port
00821-32291	Caps and septa	Pre-slit white PTFE/white silicone septa, 9mm blue short screw-thread cap, 100/pk.
00821-40927	Sample vial	Welchrom® 2mL wide opening short screw-thread vial, clear, 11.6×32mm, 100/pk
03916-22001	GC column	WM-17,30m×0.25mm×0.25μm

Technical Reference

5.1 Selection of GC Column

In actual work, if the separated component has enough thermal stabilty and volatility, GC separation mode should be considered first during analysis. Compared with LC, GC has advantages as follows: faster analysis speed, great repeatability, lower cost, and its column efficiency usually has a higher order of magnitude.

How to Select Correct Capillary Column

For separation problem of a kind of sample, selecting a suitable capillary column is a very important task, which concerns a series of principles.

In general, this selection principles are around three requirements as follows: sample component should have suitable retention value, the analysis speed shoud be fast and the analysis time should be short.

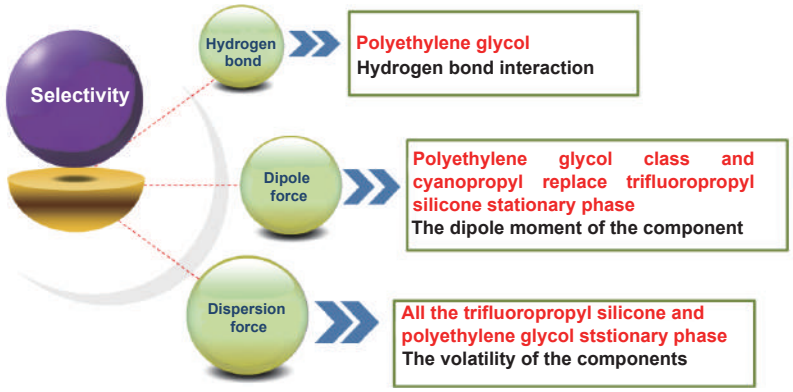
According to GC basic principles and actual requirements, we need to consider several main influencing factors, such as stationary phase, inner diameter of column, column length and film thickness.

5.1.1 Selection of Staionary Phase

Stationary phase of polydimethylsiloxane has high thermal stability and it keeps liquid state from -60℃ to 350℃, which has wide application range among GC. When other groups, such as - CN or phenyl, replace the alkyl of siloxane, the polarity of the stationary phase will change and columns with polarity and selectivity appear.

Polyethylene glycol (PEG) is another widely used stationary phase with polarity, among which PEG 20M (WM is about 20,000) is the most popular one. The hydroxyl groups of polyethylene glycol chain react with various functional groups, which can change the selectivity and improve the thermal stability of stationary phase. FFAP, for example, is to connect O-nitroterephthalic acid at the end of the PEG. The stationary phase has weak acidity, suitable for separating neutral and acidic compounds, and the thermal stability of the stationary phase can be increased to 250℃.

The selectivity and polarity of stationary phase should be considered, because selectivity is the ability of a stationary phase to distinguish between two component properties (chemical or physical), while polarity depends on the structure of the stationary phase. The selectivity is shown in the following Figure and Table 5.1, and the polarity is shown in Table 5.2.



Tab 5.1 Selectivity of stationary phase

Fuctional group	Dispersion force	Dipole force	Hydrogen bond
Methyl group	Strong	No	No
Phenyl group	Strong	No or weak	Weak
Cyanopropyl	Strong	Very strong	Medium
Propyl three fluorine	Strong	Medium	Weak
Polyethylene glycol	Strong	Strong	Medium

Tab 5.2 Polarity of stationary phase

Nonpolar				Moderate polarity			Strong polarity
WEL-1	WEL-5	WEL-35	WEL-17	WEL-1301	WEL-1701	WEL-225	WEL-WAX
WEL-101	WEL-52	WM-35	WEL-XE60	WEL-624	WM-1701	WM-225	WEL-PEG 20M
WEL-30	WEL-54		WM-17	WM-1301		WEL-930	WEL-INOWAX
WM-1	WM-5			WM-624			WEL-FFAP
WM-1MS	WM-5MS						WM-INOWAX
WEL-PONA							WM-FFAP

Summary of Stationary Phase Selection:

(1) Non-polar stationary phase has a longer lifetime than polar stationary phase. If the resolution and analysis time meet the requirements, choose the stationary phase with small polarity as far as possible.

(2) Usually a stationary phase whose polarity is similar to the component will be chosen, but polarity is only one of the factors affecting separation.

(3) If you do not know which stationary phase to choose and have no information to refer to, you can start testing from WEL-1 or WEL-5.

5.1.2 The inner diameter of the column

The inner diameter of column is an important factor affecting column efficiency, retention, column pressure and column capacity.

Column efficiency (N/m) is inversely proportional to the inner diameter of the column. The resolution is the square root function of the column effect. In theory, the resolution increases to 1.41 times, the column efficiency will be doubled. Therefore, to achieve high column efficiency and separation, we need to use the column with smaller diameter.

At constant temperature, the smaller the inner diameter of the column, the smaller the retention of the component.

The column head pressure is sensitive to the change of column inner diameter, which is about the negative quadratic function of column inner diameter. With the decrease of the inner diameter of the column, the column head pressure increases sharply.

In general, as the diameter of column increases, the capacity of column will increase. The typical column capacity of various columns is shown in Table 5.3.

Tab 5.3 Column capacity (ng)

Film thickness (μm)	Column inner diameter (mm)			
	0.18-0.20	0.25	0.32	0.53
0.10	20-35	25-50	35-75	50-100
0.25	35-75	50-100	75-125	100-250
0.50	75-150	100-200	125-250	250-500
1.00	150-250	200-300	250-500	500-1000
3.00		400-600	500-800	1000-2000
5.00		1000-1500	1200-2000	2000-3000

Summary of Column Inner Diameter Selection:

(1) Column with inner diameter of 0.18-0.25mm has high column efficiency. The column with smaller inner diameter has smaller column capacity and larger column head pressure.

(2) Column with inner diameter of 0.32 mm has large sample capacity. For large volume injection or earlier outflow of components of splitless injection, it has better degree of separation.

(3) A column of 0.45 mm inner diameter is especially suitable for high carrier gas flow rate, such as sweep traps, headspace injectors and valve injection applications.

(4) A column of 0.53 mm inner diameter, which is suitable for the situation where equipped with a large-caliber direct sampler. It integrates advantages of sample capacity, column efficiency and injection on the needle, and is increasingly replacing the packing column.

5.1.3 Selection of Column Length

Column efficiency (N/m) is proportional to column length. The resolution is the square root function of the column efficiency. Theoretically, if the column length is doubled, the resolution will increase to 1.41 times. However, with the increase of column length and the extension of analysis time, the loss of column will also increase. The cost of column is doubled with the doubling of column length, so increasing column length is the last consideration when increasing column efficiency.

(1) 25-30 m columns are more commonly used and generally available.

(2) 10-15m column, especially suitable for the separation of samples containing fewer or easily separated components.

(3) 50-60m column, suitable for the separation of complex samples containing multiple components.

5.1.4 Selection of Column Thickness

(1) For columns with inner diameter of 0.18-0.32mm and film thickness of 0.18-0.25μm, suitable for most analyses.

(2) For columns with inner diameter of 0.45-0.53mm and film thickness of 0.8-1.5μm, suitable for most analyses.

(3) Thick film column is suitable for separation of volatile components.

(4) Thin film column is suitable for the analysis of components with high molecular weight and high boiling point.

5.2 Installation of Capillary Column

The installation of column directly affects the analysis effect and the lifetime of column, so it is crucial to connect column with injection inlet and detector accurately. Installation steps of capillary column are as follows:

(1) Preparations before installing

Check the carrier gas and gas filter to ensure the use of auxiliary gas and detector gas; check whether the column is damaged or broken; check the inlet, clean or replace the injection pad and the injection port liner.

(2) Cutting columns

Install the nut and card sleeve at one end of the capillary column, and then cut the capillary column port flat.

Cut capillary column: first use your finger to support the cutting part of the capillary column, mark the outer wall of the capillary with the corresponding cutting tool. Then hold the column body at 1-2 cm with both hands, pull out and bend the column body. Finally, use a magnifying glass to ensure that the cut port and wall are at right angles without edges or residual debris.

(3) Connect the column to the inlet

Generally, the top of the column should be located in the middle and lower part of the inlet liner. Ideally, the distance between the tip of the needle and the top of column is 1-2 cm. When the injection needle passes through the spacer to insert the injection port.

Installation of connecting nut: after the column is embedded in the injection port, the connecting nut is screwed by hand, and when the hand is not twisted, the wrench 1/4-1/2 is used to ensure the sealing of the installation.

(4) Gas connection

After the column and the inlet are connected, the carrier gas should be connected, and then the suitable carrier gas flow rate can be obtained by adjusting the pre-pressure of the column. The relationship among column front pressure and column length and column inner diameter is shown in Table 5.4.

Tab 5.4 Similar column pre-pressure(Psig)

Column length (m)	Inner diameter (mm)		
	0.25	0.32	0.53
15	8-12	5-10	1-2
20/30	15-25	10-20	2-4

Column length (m)	Inner diameter (mm)		
	0.25	0.32	0.53
50/60	30-45	20-30	4-8
75			5-10
105			7-15

Insert the other end of the column into the sample vial containing hexane. After the carrier gas is connected, the stable and continuous foaming appears in the bottle, indicating that the connection is normal, otherwise, the carrier gas device and flow should be rechecked.

Quantity control device and air tightness. After the problem is solved, take the column from the sample vial, wipe inlet without solvent residue, prepare for the next installation.

Precaution: hydrogen as carrier gas, be sure to pay attention to safety. When the content of hydrogen in the air reaches 4%-10%, there is a risk of explosion, and diffusion of gas needs to speed up.

(5) Column connected to detector

The connection between column and detector is almost the same as step (3).

Precaution: when the detector is ECD or NPD, in order to enable the detector to achieve stability in a shorter time, do not connect it to the detector when aging column.

(6) Gas leak detection

The GC system must be detected before heating column. Electronic leak detector is one of the most convenient and fastest methods for carrier gas leak detection of inlet and detector.

Precaution: the inlet and detector for carrier gas leak detection, do not to use Snoop and other soap bubbles to avoid pollution or damage to the system.

(7) Determination of carrier gas flow and inspection of column installation

After installing the column, adjust the carrier gas flow rate or the sample chromatogram of the non-reserved compound is analyzed to verify the correct installation of the injection port and detector. Common non-reserved compounds are shown in Table 5.5.

Tab 5.5 Common non-retention compounds(Psig)

Detector	Compound
FID	Methane, butane
TCD	Methane, butane, argon, air
ECD	Methylene chloride, SF6, CF2Cl2
NPD	Acetonitrile
PID	acetylene, ethylene
MS	Methane, butane, argon, air

(8) Aging and test of columns

If the temperature of the column oven is set to the maximum operating temperature, or 20℃ above the maximum analytical temperature (whichever is lower), the column is aged for 2-3 hours under that temperature.

Under normal circumstances, in the initial stage, the baseline shows a continuous upward trend. After reaching the aging temperature for 5-10 min, the baseline begins to decline and last about 30-90 min, finally, baseline stabilizes.

Confirm the flow rate of carrier gas by testing the sample of non-retention substance again.

5.3 Troubleshooting of GC column

5.3.1 Reasons for Declination of GC Column Properties

(1) Fracture of column

For the GC capillary column, the polyimide coating can protect the elastic fused quartz tube, and the column rarely breaks naturally. Attention should be paid to avoid the label of column, metal edge in column oven and other articles with sharp edge scratching polyimide coating, resulting in the phenomenon of column fracture. Moreover, the 0.45-0.53 mm column tube is more prone to fracture than the inner diameter 0.18-0.32 mm column tube.

(2) Heat damage

When the analytical temperature is higher than the maximum operating temperature, the stationary phase and the inner surface of the column tube will be damaged, resulting in the loss of the column, the declination of the column efficiency and the deterioration of the peak type. Thermal damage is a slow process, only if column operates upper limit is temperature for a long time, will obvious damage occur. However, in the presence of high concentration of oxygen, the overheating of the column will cause rapid and permanent damage to the column.

It is suggested that the maximum temperature of the column oven should be set as the upper temperature limit of the column or slightly lower than the upper temperature limit to avoid accidental overheating of the column. If the column is hot damaged, the detector end can be cut off about 10 cm. Even aging or having column efficiency test, the column can not completely restore to the original performance, but it may still work. The column lifetime after thermal damage will be shortened.

(3) Oxygen damage

For most capillary columns, oxygen is a nuisance. Under the condition of oxygen, the stationary phase degrades rapidly with the increase of column temperature, resulting in column loss, column efficiency decrease and peak type variation. Compared with the thermal damage of the column, the column has been seriously damaged when oxygen damage is found. Especially for polar capillary column, the temperature and oxygen concentration which can cause serious damage to column are very low.

Continuous contact with oxygen will cause oxygen damage, short contact with oxygen, such as a single air injection will not be a problem.

The purity of carrier gas or the leakage of carrier gas flow path is the source of oxygen exposure, so keeping the system oxygen free and leakage free is the best choice to prevent the oxygen damage of column. It is recommended to have gas leak detection regularly, to use high purity carrier gas, and to replace oxygen capture hydrazine and gas cylinders timely.

(4) Chemical damage

The compounds that produce chemical damage to the column are mainly inorganic or mineral acids and mineral bases. Acids include hydrochloric acid (HCl), sulfuric acid (H2S04), nitric acid (HNO3), phosphoric acid (H3PO4) and chromic acid (CrO3). Bases include potassium hydroxide (KOH), sodium hydroxide (NaOH) and ammonium hydroxide (NH4OH). They are less volatile, easy to remain at the front of the column. If you don't clear them in time, they will damage the stationary phase, resulting in column loss, reduced column efficiency and poor peak type. Among them, hydrochloric acid and ammonium hydroxide do least damage to stationary phase. The damage of the two substances to the column is often accompanied by the existence of water. These two kinds of damage often occur with the water in the sample. The retention time of HCl and NH4OH in the column will be very short and the damage to the column will be weakened if the column has little or no retention of water under certain conditions.

Only compounds such as perfluorinated acids, including trifluoroacetic acid, pentafluoropropionic acid and heptafluorobutyric acid, have been reported to produce chemical damage to columns. A concentration of 1% or more of these substances can damage the stationary phase of the column. Most of the problems occur in direct injection of non-shunt or large diameter columns.

Chemical damage is often limited to the front end of the column, cut off the front end of the column of 0.5-1 m and eliminate chromatographic problems. In more serious cases, it may be necessary to intercept longer columns. Using pre-columns or retaining gap tubes can minimize chemical damage to columns, but regular replacement of pre-columns is required.

(5) Contaminated column

Column contamination is also a common problem in gas phase analysis. The pollutants in the column are divided into two categories: non-volatile and semi-volatile. The nonvolatile remains in the column and is distributed on the inner surface of the column, affecting the distribution of the components in the stationary phase. In addition, the nonvolatile also interacts with the active components (compounds containing hydroxyl, amino, mercapto or aldehyde groups), resulting in the-type tailing of the active components and the decrease of the responder. Then semi-volatile contaminants will accumulate in the chromatography, causing peak type, response intensity, and baseline

There are many sources of column pollution, and samples are the most common and direct source. such as biological fluids, soil, wastewater and groundwater, all contain large amounts of nonvolatile and semi-volatile components. The semi-volatile and non-volatile components in the sample are more easily accumulated in the column, resulting in column contamination.

Complete sample purification is the best way to prevent contamination, and the use of protective or protective clearance tubes can reduce the degree of contamination.

5.3.2 Troubleshooting

Problem 1: Tailing area and solutions

1. Injector liner pollution: clean liner, or remove 1~2 laps of the column inlet to use.
2. Temperature of column or injector temperature is too low: rise temperature (do not exceed maximum temperature).
3. Overload caused by the too large injection volume: adjust the tailing blowing flow and split ratio.
4. Co-elution of two compounds: reduce the rate of rising column temperature and increase the resolution. Improve the sensitivity and reduce the injection volume.
5. Column damage: replace column
6. Column pollution: remove 1~2 laps from the inlet end of the column and reinstall; if it does not work, aging columns is required; furthermore, the clean column with solvent, but this method is only suitable for bonded crosslinked stationary phase.
7. Mismatch of solvent phase and polarity : earlier outflow peaks or peaks near the solvent front are more likely to tail and change the sample solvent.

Problem 2: Leading area and solutions

1. Overload caused by injection volume: reduce sample injection volume.
2. Co-elution of two compounds: reduce the rate of rising column temperature and increase the resolution. Improve the sensitivity and reduce the injection volume.
3. Sample decomposition: reduce the inlet temperature and use deactivated liner.
4. Sample condensation: if necessary, increase the inlet temperature and column temperature.

Problem 3: No peak and solution

1. Injection needle leakage or blockage: clean or replace injection needle.
2. leakage of Injection pad: replace injection pad.
3. Inlet temperature is too low: increase the inlet temperature to ensure the complete gasification of the sample.
4. Column temperature is too low: rise column temperature, avoid sample condensation in column.
5. When injecting automatically, the sample quantity in the sample is insufficient, the sample needle can not absorb the sample: normally, the sample quantity should be 0.8-1.2ml.
6. Blockage or leakage at the connection between the column and the inlet, the column and the detector: leak detection and reinstall if necessary.
7. If FID detector was used the flame may be extinguished or the polarization voltage is not added: check and re-ignite.
8. Recorder line connection or damage: check the line or replace the recorder.
4. Detector leakage: check leakage
5. Injector pad degradation: change sample pad

Problem 4: Baseline instability and solutions

1. Carrier gas deficiency: check carrier gas pressure, if less than 500 psi, timely replace gas cylinders
2. Gas purity is not enough or gas path pollution: replace gas cylinders or use gas purification devices
3. The flow rate of carrier gas is not within the limit of the instrument: measure the flow rate and adjust it according to the instrument manual.
4. sampler or detector contamination: cleaning
5. Injection pad leakage: replace injection pad
6. liner pollution: cleaning liner, replace quartz cotton;
7. Column loss or contamination: replace liner; or cut off 1-2 laps at the inlet end of column; or aging treatment.

Problem 5: Excessive baseline noise and solutions

1. Injector or detector contamination: clean injector, replace liner and injection pad; clean detector;
2. Carrier gas purity is not enough or pollution: use high purity gas; check gas purifier for expiration or leakage;
3. Carrier gas flow rate is not suitable: adjust the gas flow rate to the recommended value;

4. Detector leakage: check leakage
5. Injector pad degradation: change sample pad.
6. liner pollution: cleaning liner, replace quartz cotton;
7. Column loss or contamination: replace liner or cut off 1-2 laps at the inlet end of column. Through aging treatment.

Problem 6: Peak broadening and solutions

1. Injection technology: rapid and stable injection technology
2. Carrier gas flow rate: adopt recommended carrier gas flow rate
3. Sample concentration: reduce sample concentration
4. Sample solvent effect: when using ECD detector, you can not use dichloromethane and other solvents.
5. Column contaminated: cut the front end of the column 1-2 laps.

Problem 7: Retention time fluctuations and solutions

1. Carrier gas flow rate change: check carrier gas flow rate;
2. Column temperature change: check column temperature;
3. Column specification change: check column specification model consistency;
4. Injector leakage: leak detection;
5. Injection spacer leakage: replace spacer;
6. Gas path blockage: cleaning or replacing gas pipeline.

Problem 8: Split peaks and solutions

1. Mixed sample solvent: change the sample solvent to a single solvent;
2. Column incorrect installation: reinstall column;
3. Injection needle contamination: clean injection needle;
4. Sample degradation in injector: reduce injector temperature, and ensure sample gasification but can not decompose.

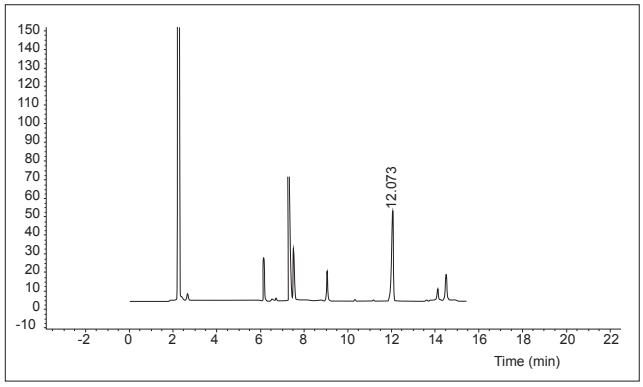
5.3.3 Troubleshooting Case Analysis

General troubleshooting requires several steps: identify problems, collect information, think about plans, test, repair, and record.

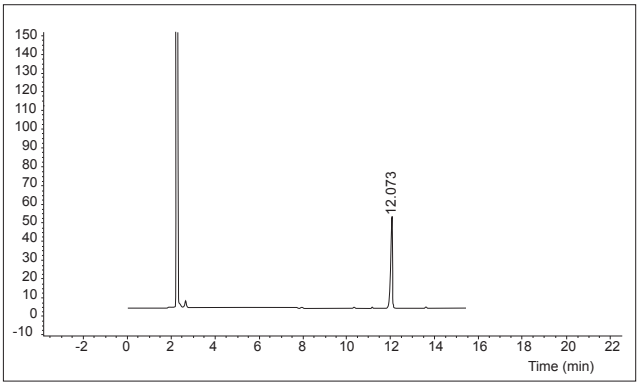
1. Ghost Peaks

(1) Confirm question:

Abnormal Chromatogram



Referring Chromatogram



- With ghost peaks
- The results of the second of injection are the same

(2) Collect information

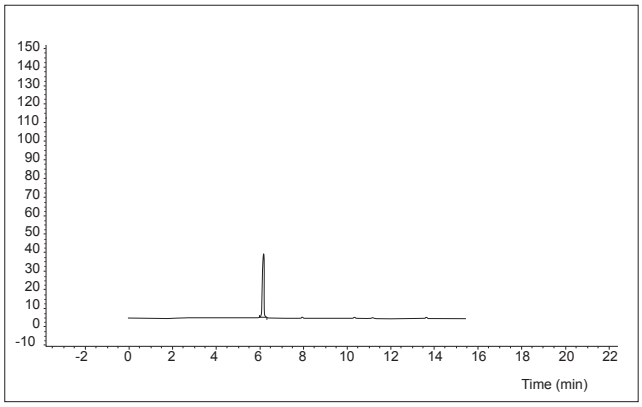
- EPC system, Manual injection, S/SLinlet, FID
- All the operational parameters are correct
- Without other phenomena
- Using the same gas source and column to do the same batch of samples with another GAS FID has no problem
- Device has not maintained recently

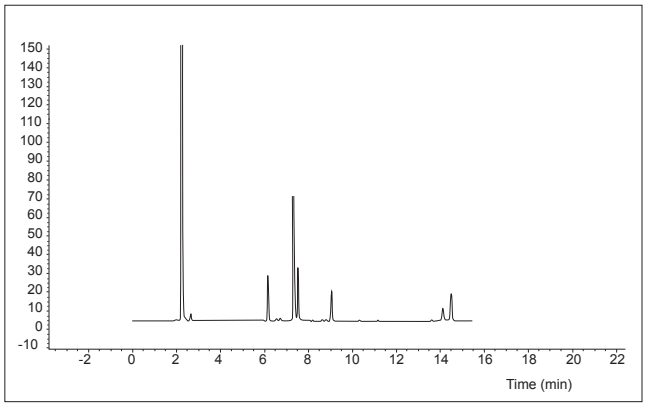
(3) Think plans

Possible sources of ghost peaks: sample, solvent, injection needle, gas cylinder, gas purification pipe, gas pipeline, inlet, column, detector.
Using another GC FID but the same column to do the same batch of samples has no problem, exclude the problems of solvent, samples, gas cylinders, gas purification pipe, gas pipeline, column problems.
Contamination of injection needle, injection port and detector should be further checked in the following experiments.

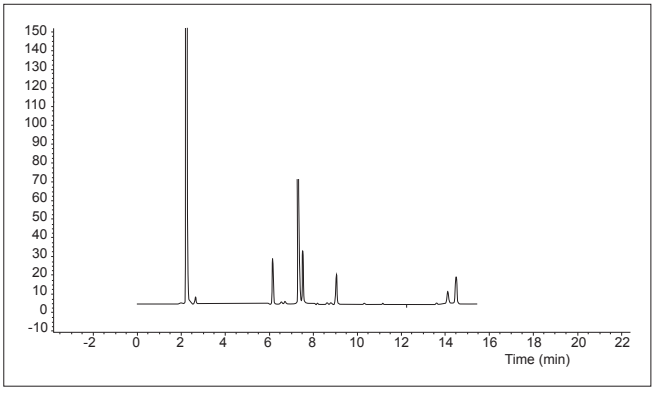
(4) Test results

- Empty injection (without injection): have ghost peaks, the pollution is most likely to be changed by temperature shadow solvent blank (only into the solvent) : there is ghost peak, which means that the pollution may be in the area where the solvent goes through the noise -- the injector, the detector.





- Replace injection needle and run with empty injection: ghost peak, indicating contamination may be in the area where the solvent passes or the solvent itself, but not from the injection needle - injection inlet, detector



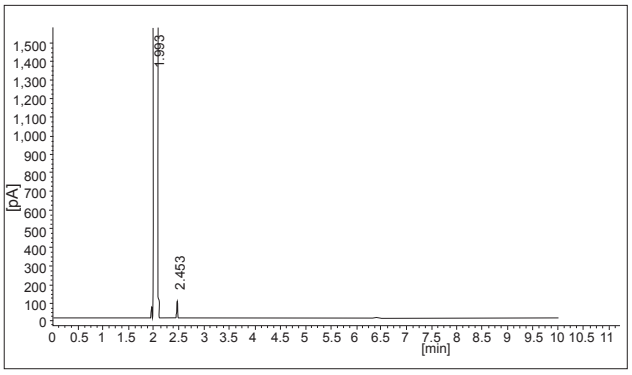
Conclusion: After screening, the remaining two areas are injection inlet and detector

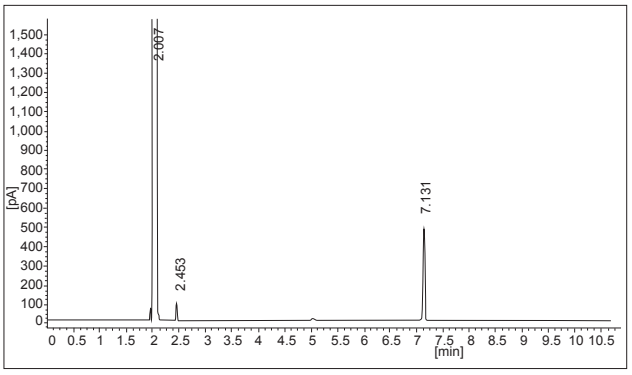
(5) Repair

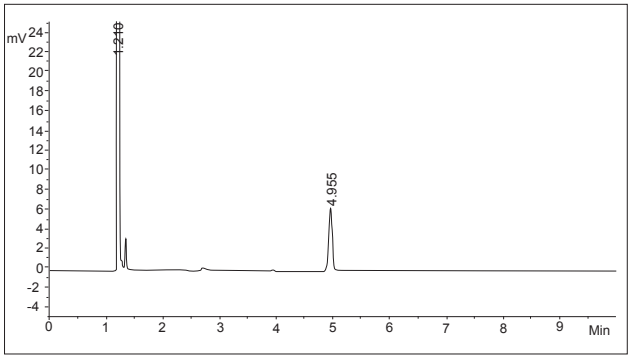
- Injection inlet maintenance: replace the injection pad, replace the liner and quartz cotton
- Detector maintenance: cleaning nozzle

(6) Record

- System performance can be restored to reference conditions

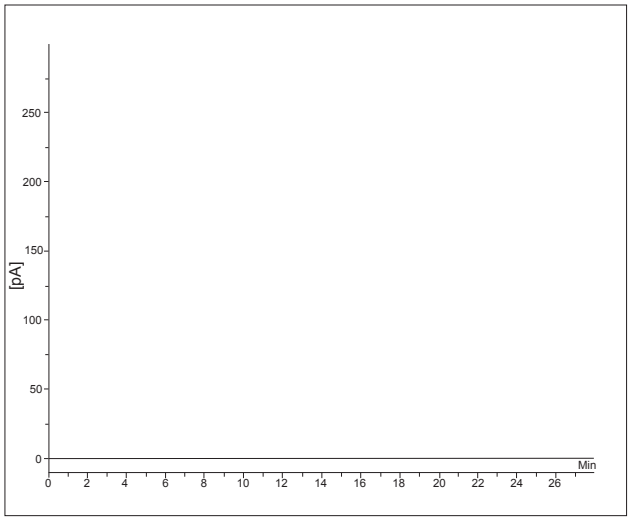




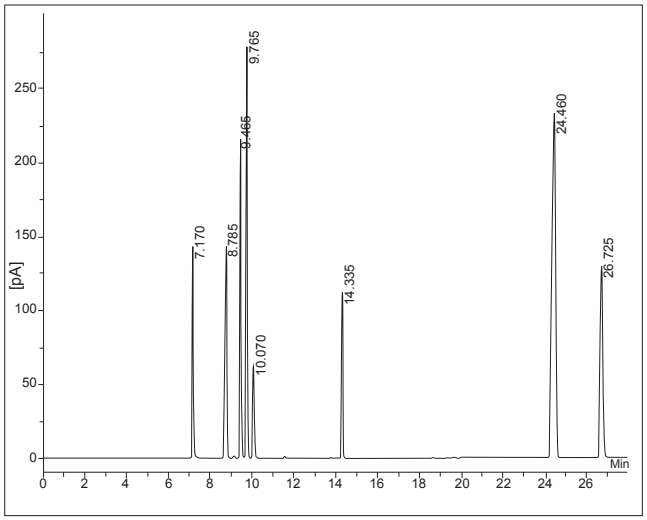


(2) Water as solvent (FID Detector)

Abnormal chromatogram



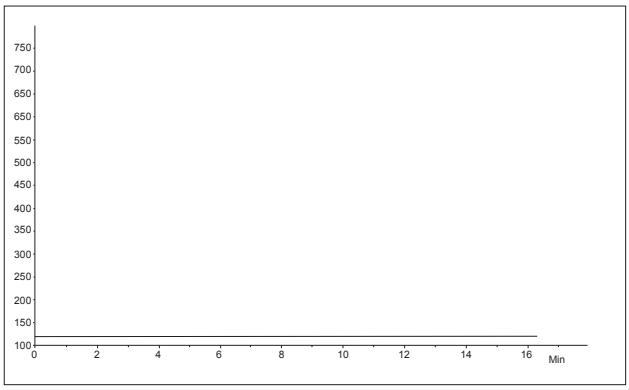
Referring chromatogram



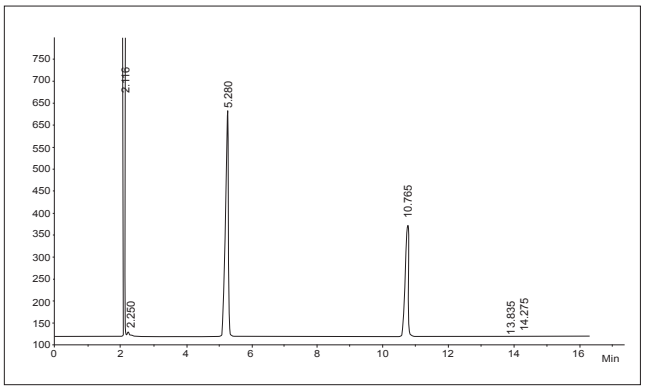
Conclusion: the reason for unappearance of peaks is the sensibility of GC device can’t achieve the test requirements

(3) There's no solvent peak

Abnormal chromatogram



Chromatogram for reinstalling the column



Conclusion: the reason for unappearance of peaks is thst the column is not installed accurately or there is air leakage at the connection between the column and the inlet of detector.

Welch

Bridging Separation Techniques

Welch Materials.Inc.
Email: info@welchmat.com
Web: www.welch-us.com