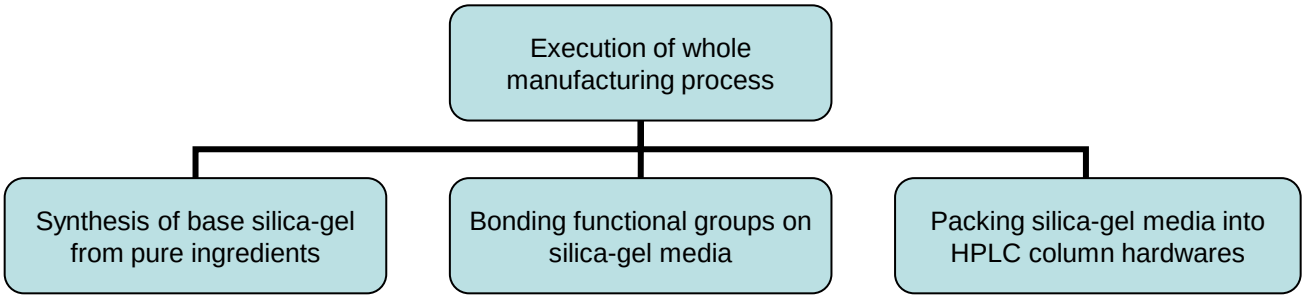
Comparison among Leading Companies

High Quality at Reasonable Prices

There are many companies which have a relation with supply of HPLC columns, for example base media manufacturers, chemical bonding companies, packers, companies which implement more than two of the above manufacturing process, OEM suppliers, dealers etc. GL Sciences Inc. synthesizes base silica-gel media from pure ingredients, bonds functional groups on the media and packs them into HPLC column hardware. We think the execution of whole manufacturing process with reliable and consistent high technologies is essential for the reproducibility of high column efficiency resulting in best customer satisfaction. We convince that this is the only way we can reduce the cost which enable to supply our customer with HPLC columns at a reasonable price



High Quality with Excellent Column Reproducibility

GL Science's Inertsil HPLC columns ushered in the high-purity silica revolution in early 1990 and set a new standard for excellence. The purity (99.999%) and physical properties of silica-gel and figures of chemical bonding are strictly controlled during the manufacturing process. Chromatographic inertness, selectivity and durability are also investigated for every batch.
All those Quality tests below guarantee "High Quality with Excellent Column Reproducibility".

Quality Control of Base Silica-Gel

The following instruments are used for the control of physical properties et al. and the figure shows very good batch-to-batch reproducibility.

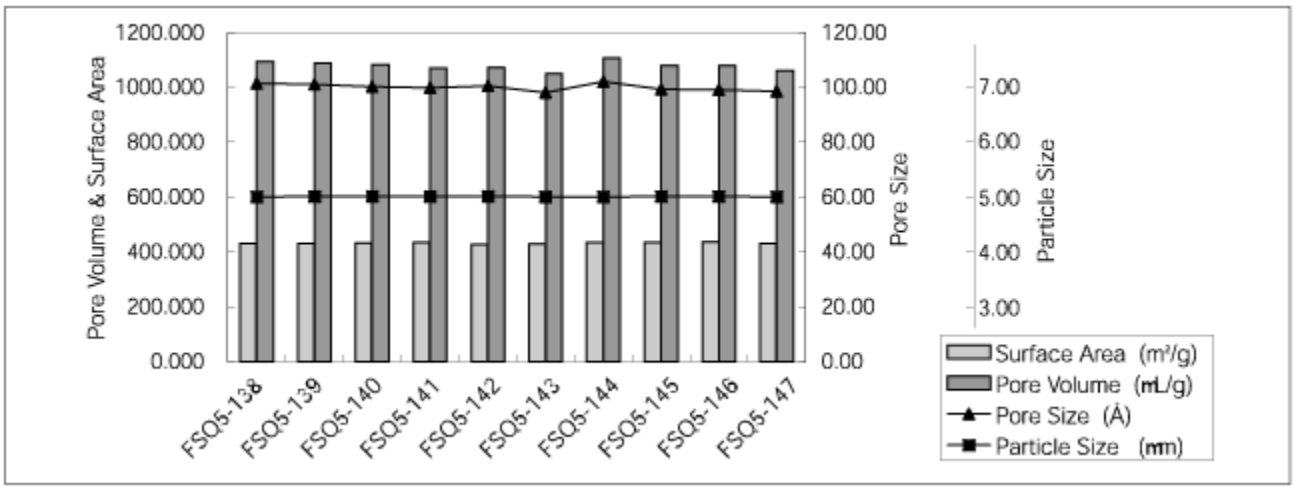
Scanning Electron Microscopy:
- Sphericity and surface smoothness of Silica-gel

Atomic Emission and ICP:
-Trace metals

Nitrogen Adsorption & Laser Ray Particle Analyzer:
- Particle size & its uniformity, Surface area, Pore diameter, Pore volume

Elementary Analysis:
- Carbon load

Si NMR:
- Residual silanol after bonding and endcaping



Quality Control by Chromatographic Tests

The following chromatographic tests are used for column quality and property control and the figures show very good batch-to-batch reproducibility.

Tanaka Test Mixture for Selectivity:
- Hydrophobicity, Stereoselectivity, Hydrogen-bonding capability

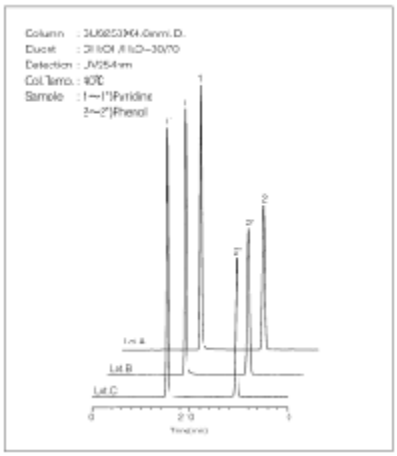
Inertness of Packing to Basic compounds:
- Pyridine Ethylaniline, Benzylamine, Aminopyridine

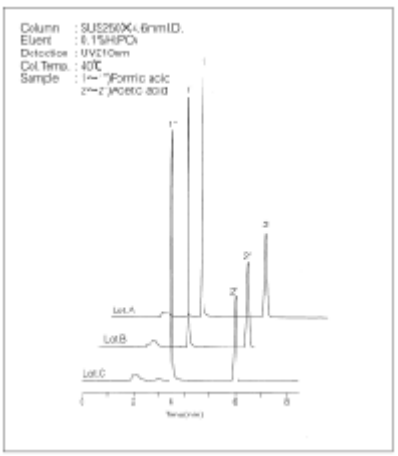
Inertness of Packing to Acidic compounds:
- Formic Acid, Acetic Acid

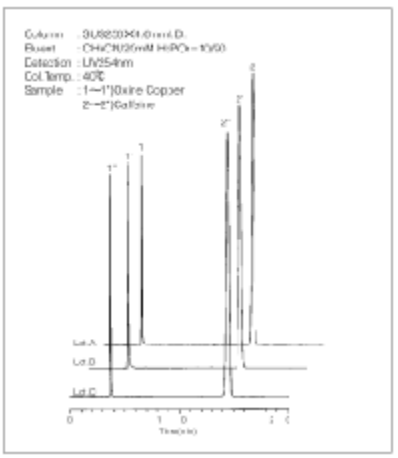
Inertness of Packing to Chelating compounds:
-Oxine-Copper

Durability of Packing at High pH & Low pH:
- At pH 2.0 & pH 9.0

Column Performance Test:
- Theoretical number plates, Peak symmetry, Retention Column back pressure

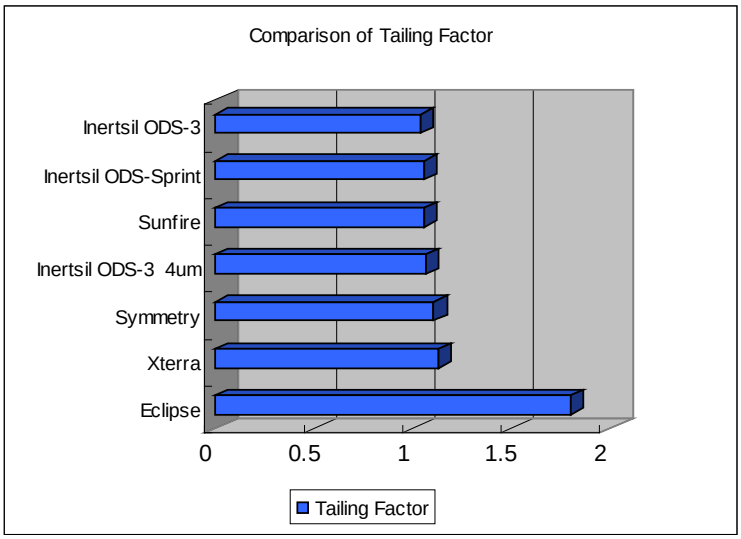






Industry Leader's Test Method for Peak Shape of Basic Compounds

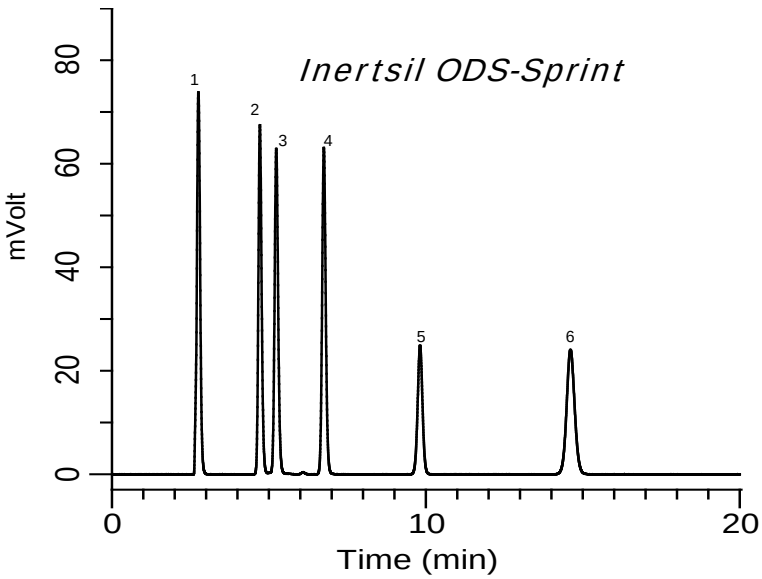
This method is employed by one of industry leaders to investigate peak shape of basic compounds. Amitriptyline, basic prove was analyzed under the most demanding mobile phase condition at pH 7.0 and USP tailing factor was measured. **Inertsil** columns show very good peak shapes for such significant basic compound.

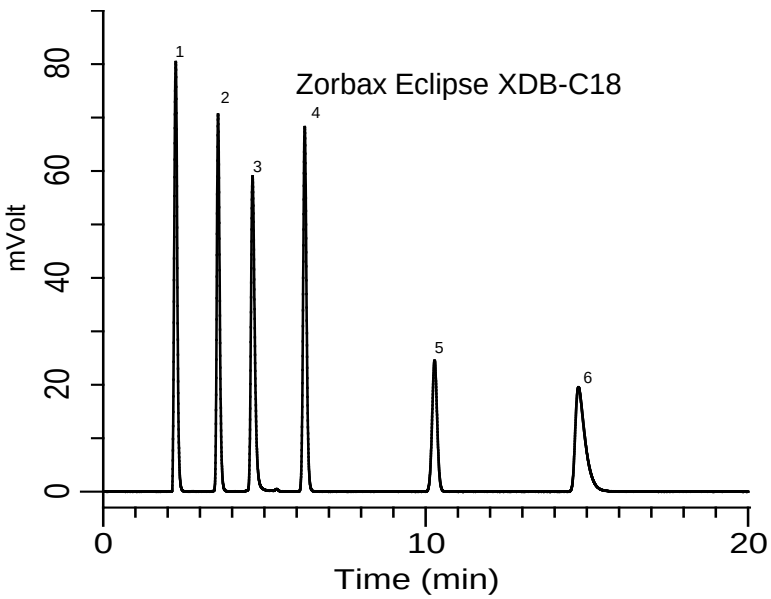


Column	Tailing Factor
Inertsil ODS-3	1.04
Inertsil ODS-Sprint	1.06
Sunfire	1.06
Inertsil ODS-3 4um	1.07
Symmetry	1.11
Xterra	1.13
Eclipse	1.8

Analytical Condition
Eluent: 20mM Phosphoric Acid Buffer (pH7.0) / MeOH = 20/80 (v/v)
Flow: 1.0mL/min
Detect: UV254nm
Oven: 40C
Sample: 10uL-inject

1.Uracil	12ug/mL
2.Propranolol	199ug/mL
3.n-Butyl parabene	11ug/mL
4.Naphthalene	37ug/mL
5.Acenaphthene	50ug/mL
6.Amitryptyline	30ug/mL





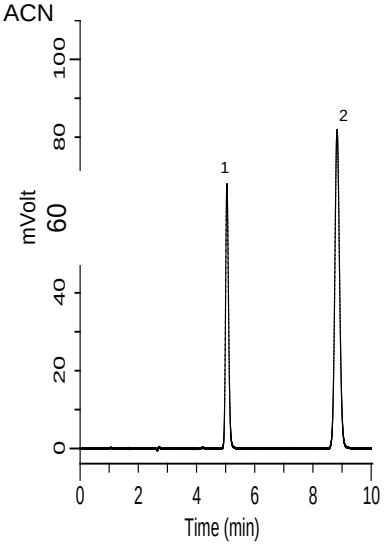
Another Industry Leader's Test Method for Peak Shape of Basic Compounds

This method is employed by another industry leader to investigate peak shape of basic compounds. Procainamide and N-acetylprocainamide are difficult basic compounds to analyze with symmetry peak. **Inertsil** columns show very good peak shapes for such significant basic compound.

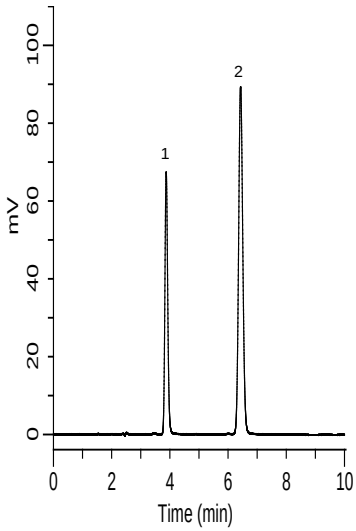
Analytical Condition

Eluent: 20mM Phosphoric Acid Buffer (pH7.0) / ACN = 90/10(v/v)
Flow: 1.5mL/min
Detect: UV254nm
Oven: 40C
Sample 10uL-inject

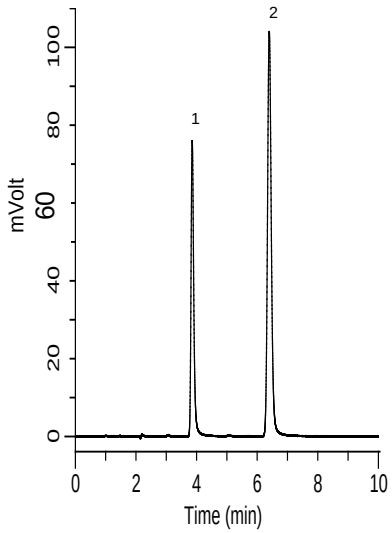
1. Procaine amide 50ug/mL
2. n-Acetylprocaine amide 50ug/mL



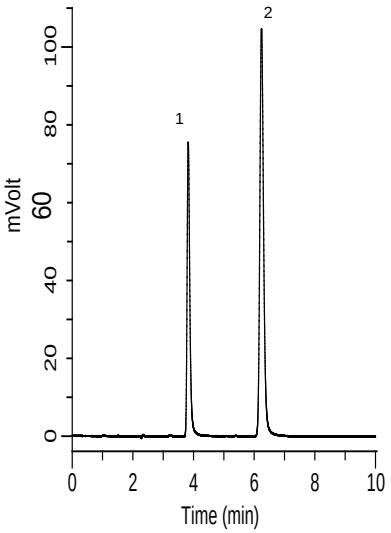
Inertsil ODS-Sprint



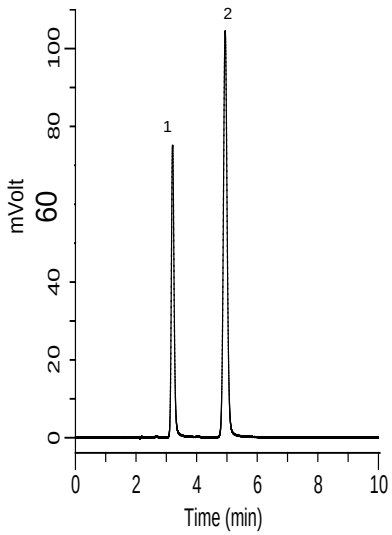
Inertsil ODS-3



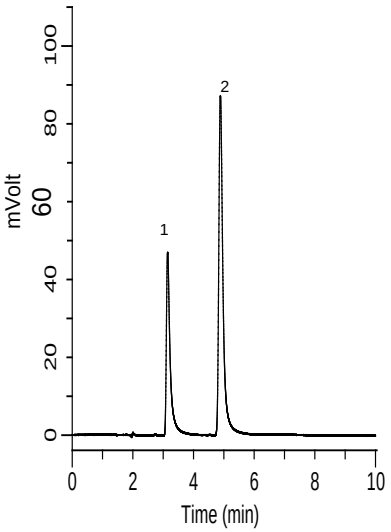
Symmetry



SunFire



XTterra



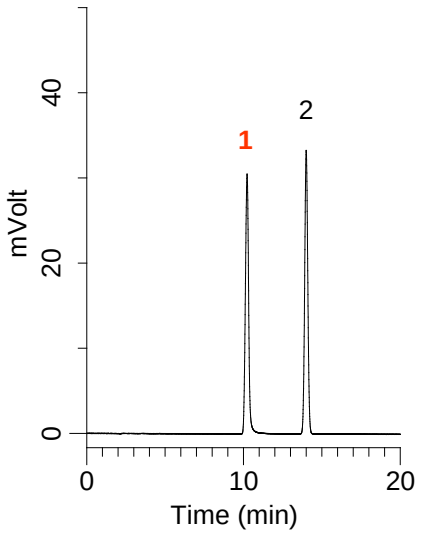
Zorbax Eclipse XDB-C18

Inertness to Basic Compounds

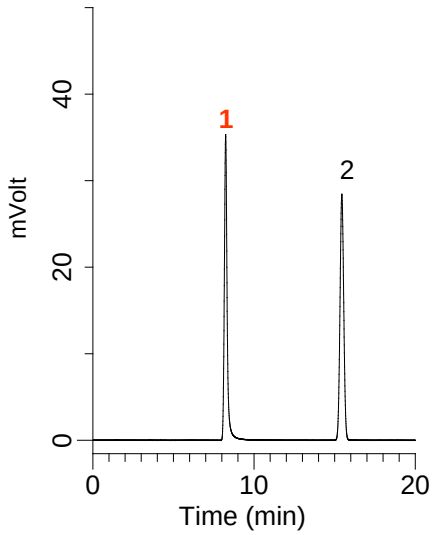
The Pyridine-Phenol Test is widely known as a simple but informative method to evaluate the residual silanol Groups on the surface of reversed-phase packing materials. The residual silanol groups are acidic and Strongly retain basic compounds. The retained basic compounds elute late or elute as tailing peaks.
GL Sciences inspects and controls the retention time and the tailing factor of the pyridine peak using an Eluent of pH 7.6, conditions under which the residual silanols are completely dissociated and most likely to cause tailing of bases.
Besides the Pyridine-Phenol Test, if necessary, Ehtylaniline Test developed by Prof. Engelhardt, Benzylamine Test developed by Prof. Tanaka and Aminopyridine Test developed by Prof. Barret are also Adopted as part of the quality control to understand the total profile of each packing material produced.

Pyridine Test for Base Deactivation

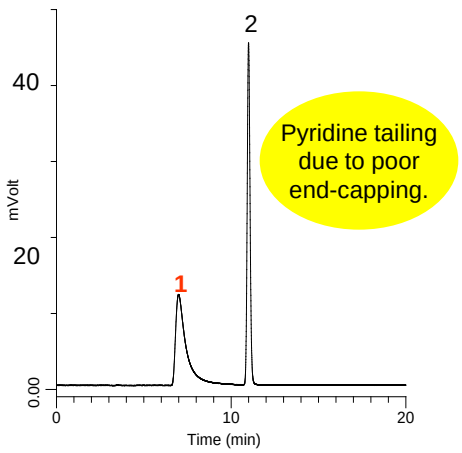
Column Length:	4.6X250mm 5um	
Eluent	CH3OH / H2O = 30 / 70	
Flow Rate:	1.0 mL/min	
Col.Temp.:	40C	
Detector::	UV254nm	
Sample Volume:	4uL	
Samples:	**1) Pyridine**	**0.09 mg/mL**
	2) Phenol	0.41 mg/mL



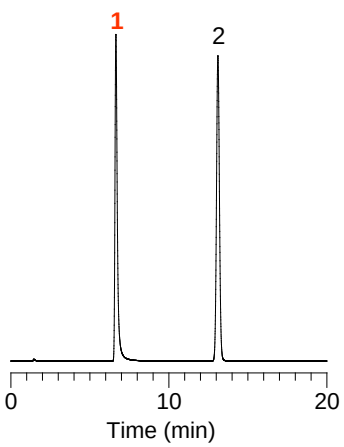
Inertsil ODS-SP



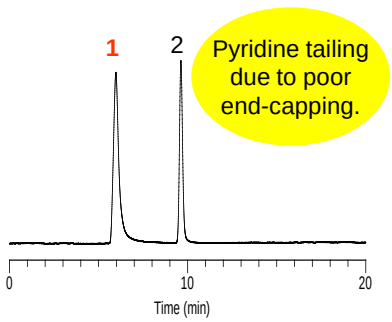
Inertsil ODS-3



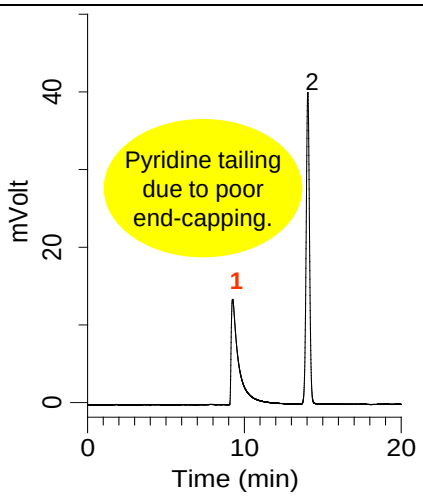
Symmetry C18



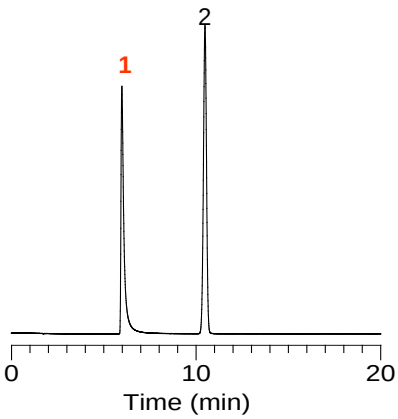
SunFire C18



XTerra MS C18



Atlantis dC18

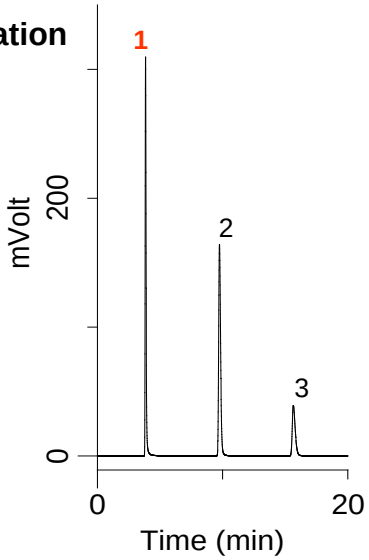


Zorbax Eclipse XDB-C18

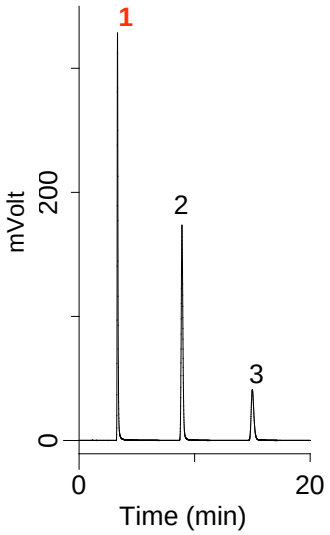
This method was published by D.A. Barret, etal., J. Chromatogr. Sci. 34 (1996) 146.
Determination of Aminopyridines is a very demanding analysis.
Only Inertsil columns show very good peak shapes.

Aminopyridine Test for Base Deactivation

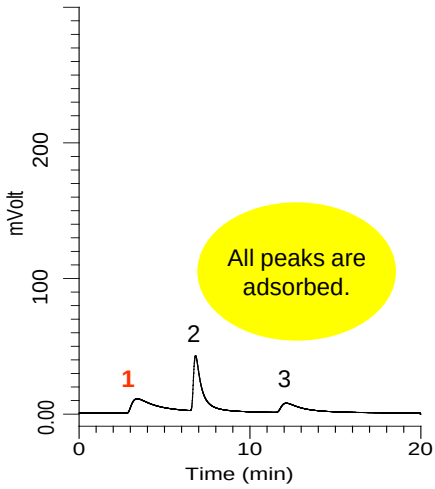
Column gth:	4.6X250mm 5um
Eluent	CH3OH / 20mM Phosphate Buffer (pH7.6) 10:90
Flow Ra	1.0 mL/min
Col.Temp.:	40C
Detector::	UV254nm
Sample Volume:	4uL
Samples:	**1) 4-Aminopyridine 0.1mg/mL**
	2) 3-Aminopyridine 1.0mg/mL
	3) 2-Aminopyridine 1.0mg/mL



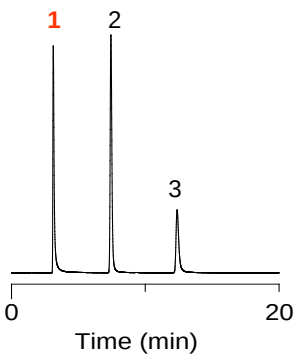
Inertsil ODS-SP



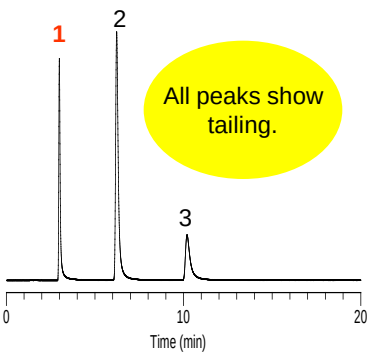
Inertsil ODS-3



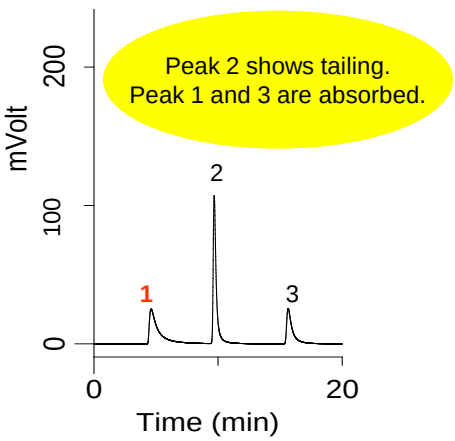
Symmetry C18



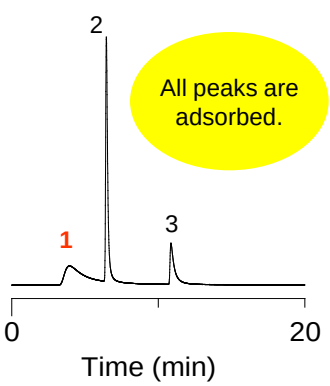
SunFire C18



XTerra MS C18



Atlantis dC18



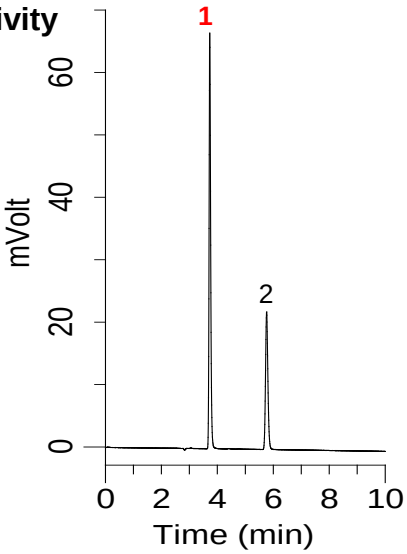
Zorbax Eclipse XDB-C18

Inertness to Acidic Compounds

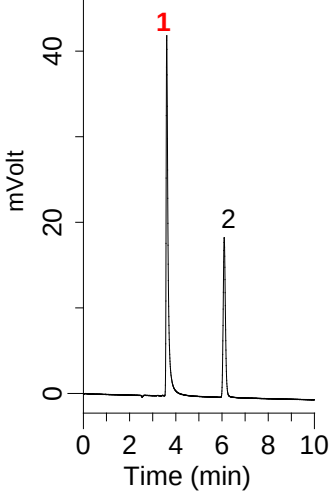
Acidic compounds of low molecular weight like acetic acid or formic acid may be absorbed into the Reversed-phase packing materials. We have sometimes experienced the phenomena that a packing material showing a good performance and a good peak shape for pyridine gives tailing peaks for low molecular weight carboxylic acids. This might be caused by the procedure and the reagents used in the process of the chemical modification of the reversed-phase packing materials. Inertness for acidic compounds as well as basic compounds is important for reliable and reproducible reversed-phase selectivity.

Carboxylic Acid Test for Silanol Activity

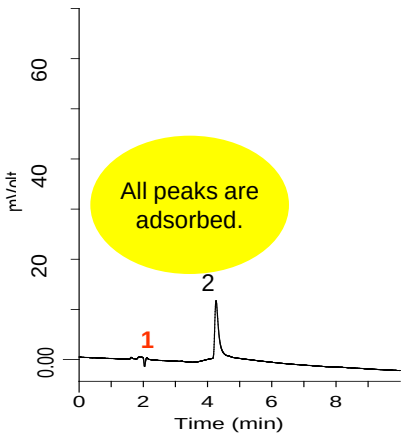
Column Length:	4.6X250mm 5um
Mobile Phase:	0.1% H3PO4(v/v)
Flow Rate:	1.0 mL/min
Col.Temp.:	40C
Detector:	UV210nm
Sample Volume:	4uL
Samples:	**1) Formic Acid 0.1 %(v/v)**
	2) Acetic Acid 0.1 %(v/v)



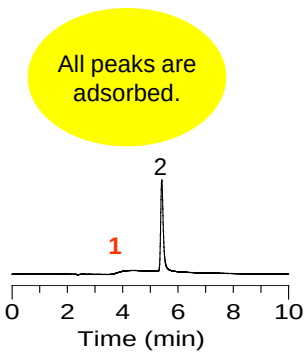
Inertsil ODS-SP



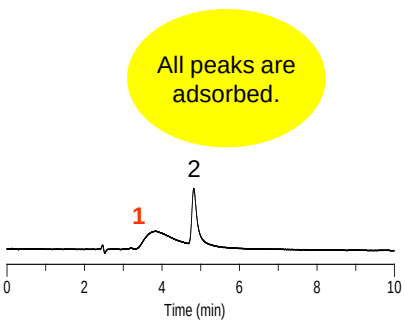
Inertsil ODS-3



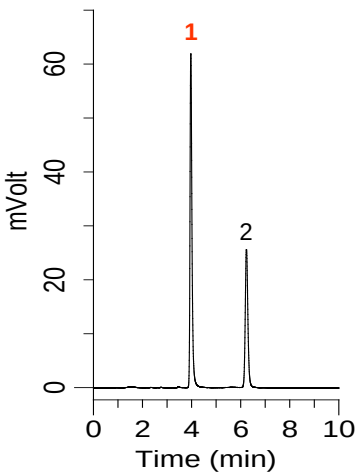
Symmetry C18



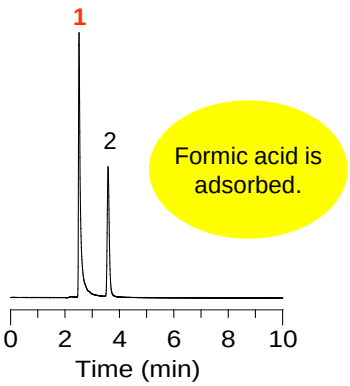
SunFire C18



XTerra MS C18



Atlantis dC18



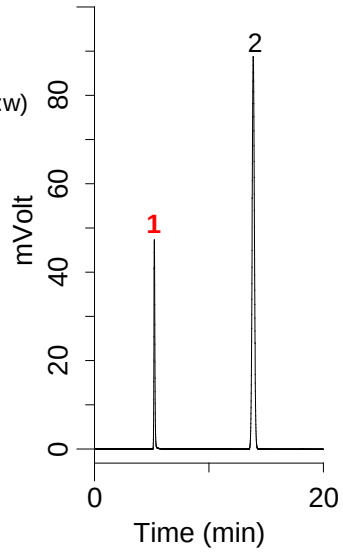
Zorbax Eclipse XDB-C18

Inertness to Chelating Compounds

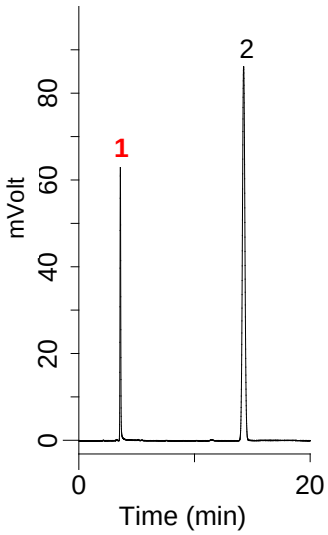
Chelating compounds have been widely used as pesticides, disinfectants, etc. Strong chelating compounds sometimes elutes from HPLC columns as tailing peaks or, in the worst case, they never elute from the column due to the strong chelation with metal impurities in the packing materials. The inertness for chelating compounds is inspected by chromatographing oxine-copper in addition to determining the level of metal impurities by ICP or AA spectrum analyses.

Oxine-copper Teest for Silica Purity

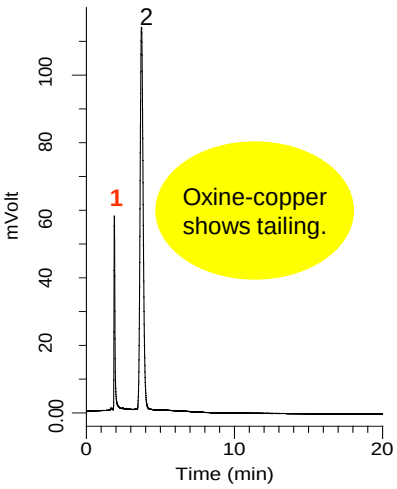
Column Length:	4.6X250mm 5um
Eluent	CH3OH / 20mM H3PO4 (10/90, w:w)
Flow Rate:	1.0 mL/min
Col.Temp.:	40C
Detector::	UV254nm
Sample Volume:	2.5uL
Samples:	**1) Oxine-copper 0.01 mg/mL**
	2) Caffeine 0.4 mg/mL



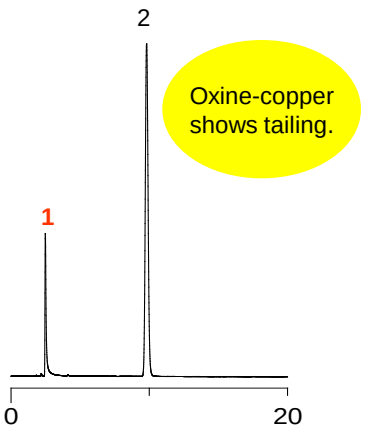
Inertsil ODS-SP



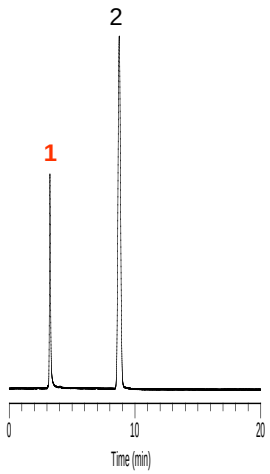
Inertsil ODS-3



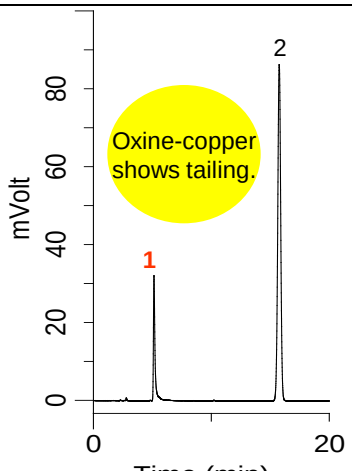
Symmetry C18



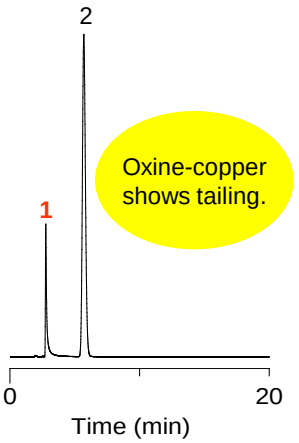
SunFire C18



XTerra MS C18



Atlantis dC18



Zorbax Eclipse XDB-C18