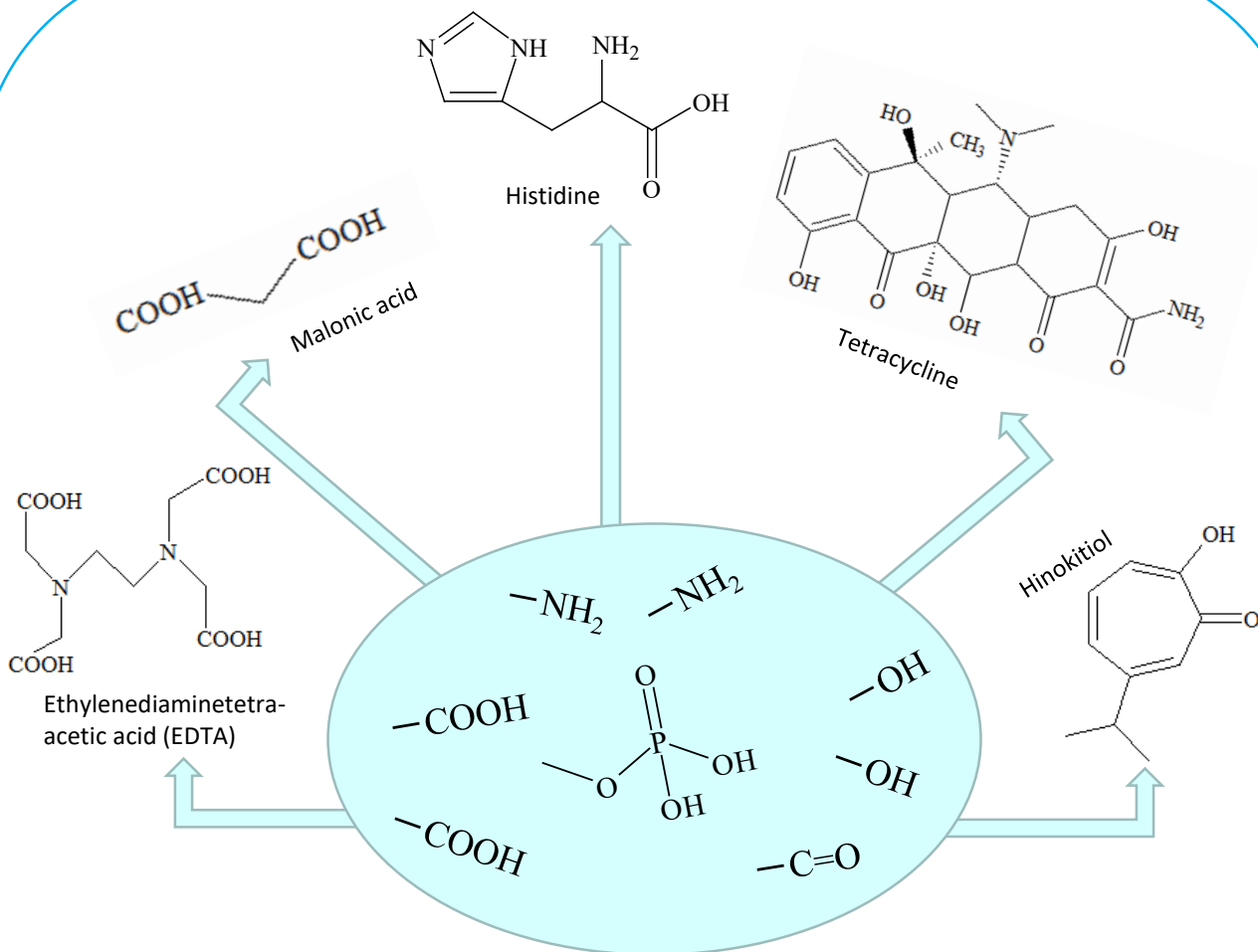


Some amino acids, organic acids, tetracyclines and organophosphates are metal chelators. Chelation during analysis of these compounds can distort the peak shapes and worsen the quantification accuracy. Residual metals on the packing surface were assumed to cause these problems. However, in the case of microanalysis, it has turned out that metals on the wetted parts such as tubing or frits also has a strong influence. Phosphate buffers are widely used in metal chelator analysis to improve the peak shapes, however, phosphate buffers cannot be used in LC/MS(/MS) because non-volatile salts precipitate from these buffers.

Metal-free columns have wetted parts made of PEEK instead of metal. In this technical note, some applications using metal-free columns are shown and the advantages of metal-free columns are described.

(K.Kanno)



In HPLC, analytes containing the functional groups above are easily affected by metals.

Metal Effects \dashrightarrow

- Peak tailing
- No elution
- Low sensitivity

etc.

*Special inertization was carried out for the metal wetted parts of the HPLC systems used for this technical note. Please contact for details.

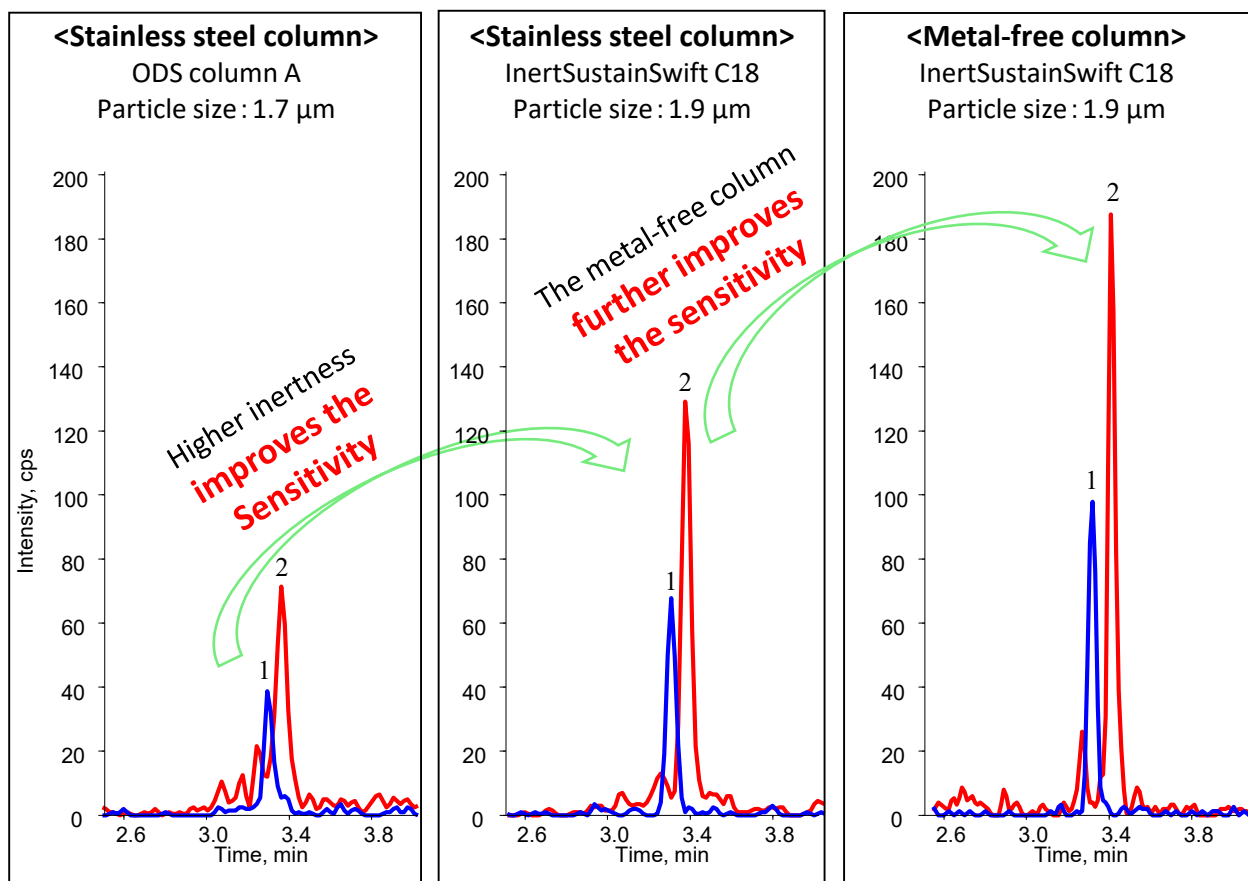
RP Example 1. Tetracyclines

Tetracyclines are metal chelators, and their adsorption onto residual metals on the packing surface and metal parts of the column results in poor performance.

By using a highly inert column with minimized residual metals, high sensitivity becomes possible with formate buffers, which are often used in LC/MS(/MS). Further sensitivity improvement is possible with a metal-free column.

1. Oxytetracycline
2. Tetracycline

2 mg/L each



Different packing inertness

Different column material
Stainless steel or PEEK

Conditions

Column : InertSustainSwift C18 (1.9 μm, 50 x 2.1 mm I.D.)
 ODS column A (1.7 μm, 50 x 2.1 mm I.D.)

Mobile phase : A) 0.1 % HCOOH in CH₃CN
 B) 0.1 % HCOOH in H₂O
 A/B = 10/90 – 1.5 min – 10/90 – 2.5 min – 90/10, v/v

Flow rate : 0.4 mL/min

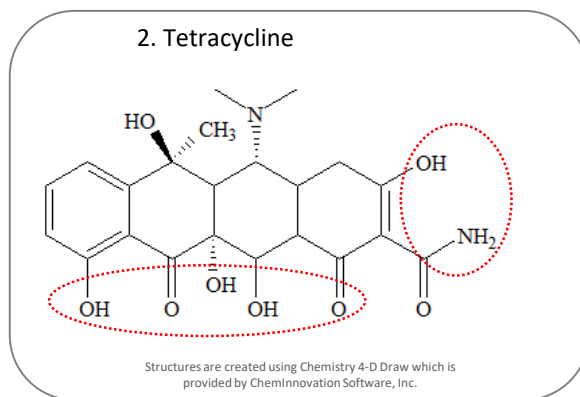
Temperature : 40 °C

Detection : LC/MS/MS (ESI, Positive, MRM)

Injection volume : 10 μL

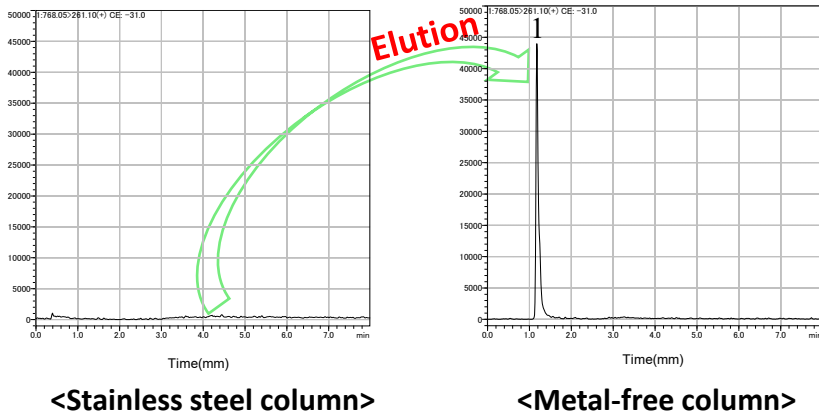
Concentration : 2.0 mg/L

	Q1	Q3
1. Oxytetracycline(OTC)	460.9	426.2
2. Tetracycline(TC)	445.0	154.0

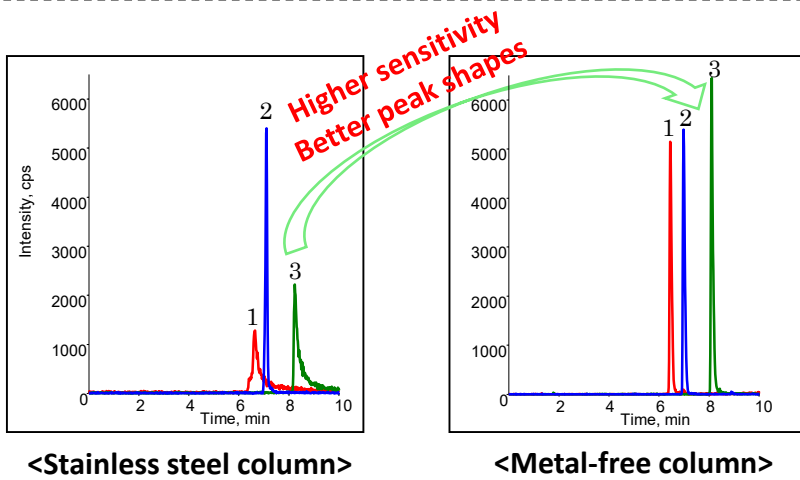
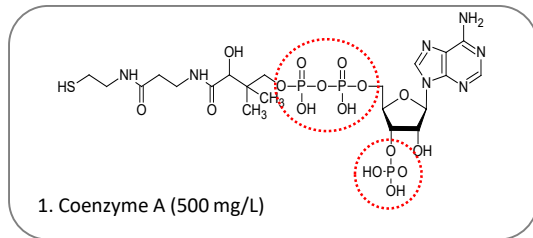


RP Example 2. Phosphate group-containing compounds

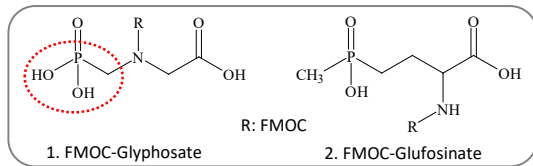
Phosphate group-containing compounds such as organophosphate pesticides and nucleotides easily form metal chelates. With a stainless steel column, analytes may not be able to elute from the column or distorted peaks may be obtained. In this case, a metal-free column can be an effective tool.



Conditions
 Column : InertSustainSwift C18 (1.9 μm, 50 × 2.1 mm I.D.)
 Mobile phase : A) 5 mM HCOONH₄ in H₂O
 B) 5 mM HCOONH₄ in CH₃CN
 A/B=98/2-2 min-80/20
 Flow rate : 0.4 mL/min
 Temperature : 40 °C
 Detection : LC/MS/MS (ESI, Positive, MRM)
 Injection volume : 10 μL
 Analyte : Coenzyme A (Q1/Q3 = 768/261)

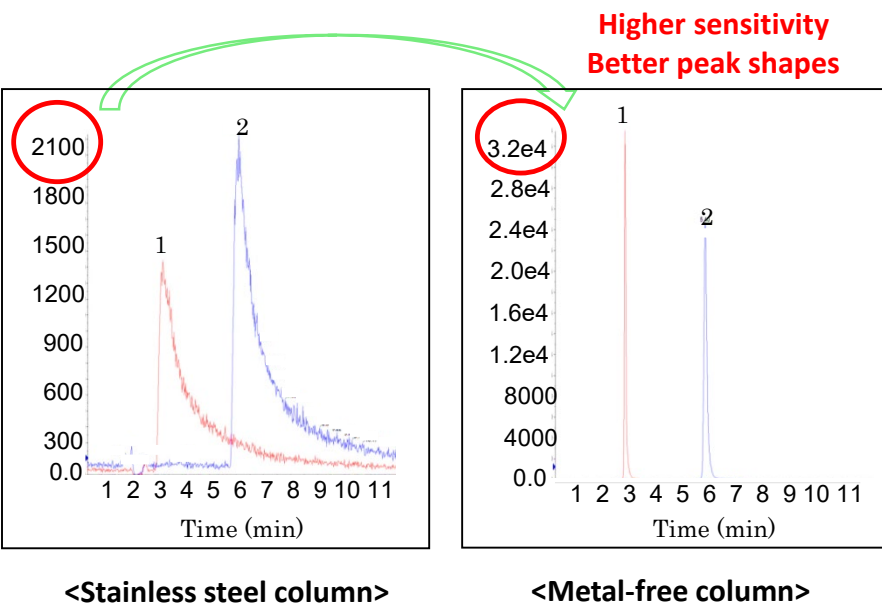


Conditions
 Column : InertSustain C18 (3 μm, 150 × 2.1 mm I.D.)
 Mobile phase : A) 5 mM HCOONH₄ in H₂O
 B) CH₃CN
 A/B=95/5 -9.3 min - 37/63
 Flow rate : 0.25 mL/min
 Temperature : 40 °C
 Detection : LC/MS/MS (ESI, Negative, MRM)
 Injection volume : 10 μL
 Analyte : 1. FMOC-Glyphosate (Q1/Q3 = 390/168)
 2. FMOC-Glufosinate (Q1/Q3 = 402/190)
 3. FMOC-AMPA (Q1/Q3 = 332/110) 2 μg/L each

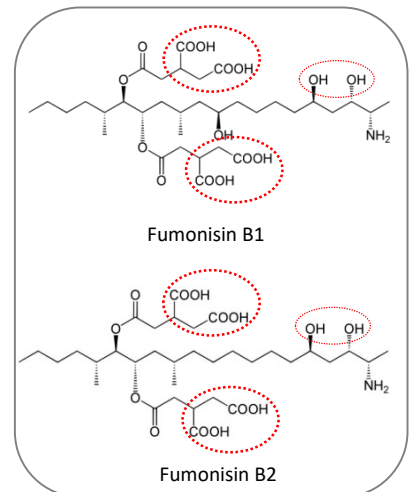


RP Example 3. Fumonisin

Fumonisin, kinds of mycotoxins, are strong metal chelators because of their adjacent carboxyl and hydroxyl groups. Adsorption of fumonisins onto the column inner wall and the filters of stainless steel columns distorts the peak shapes.

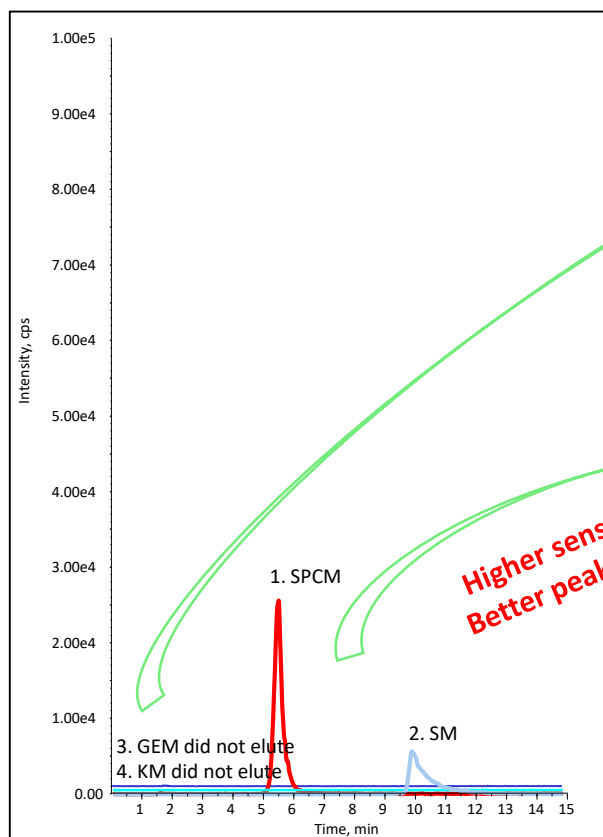


Conditions
 Column : InertSustain C18 (3 μm, 100 × 2.1 mm I.D.)
 Mobile phase : A) 0.1 % HCOOH, 10 mM HCOONH₄
 B) CH₃CN
 A/B = 60/40,v/v
 Flow rate : 0.2 mL/min
 Temperature : 40 °C
 Detection : LC/MS/MS (ESI, Positive, MRM)
 Analyte : 1. Fumonisin B1 (Q1/Q3 = 722/334)
 2. Fumonisin B2 (Q1/Q3 = 706/336)

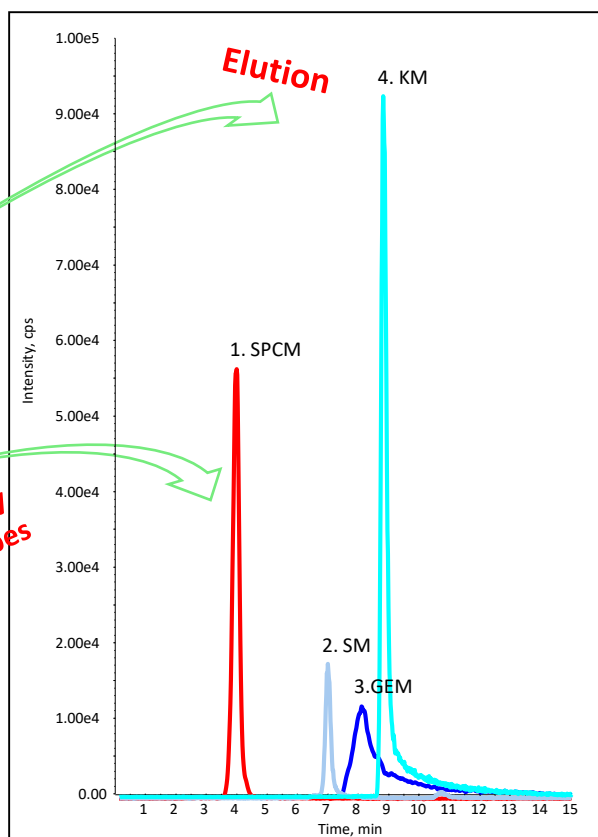


HILIC Example 1. Aminoglycosides

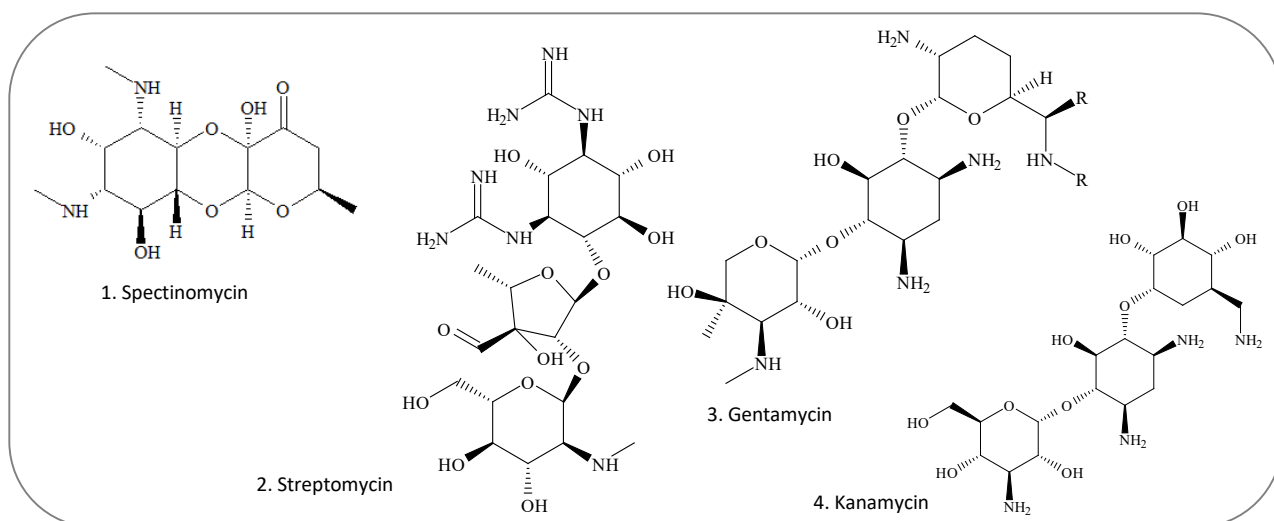
Aminoglycoside antibiotics such as streptomycin possess amino sugar substructures and their adjacent hydroxyl and amino groups contribute to metal chelation. The effects of stainless steel depends on the analyte; kanamycin does not elute from the column, whereas spectinomycin elutes as a broad peak.



<Stainless steel column>



<Metal-free column>



Conditions

Column : Inertsil Amide
(5 μm, 150 x 2.1 mm I.D.)

Mobile phase : A) 0.1 % HCOOH in CH₃CN
B) 0.1 % HCOOH in H₂O
A/B = 70/30 – 10 min – 50/50, v/v

Flow rate : 0.2 mL/min

Temperature : 40 °C

Injection volume : 10 mL

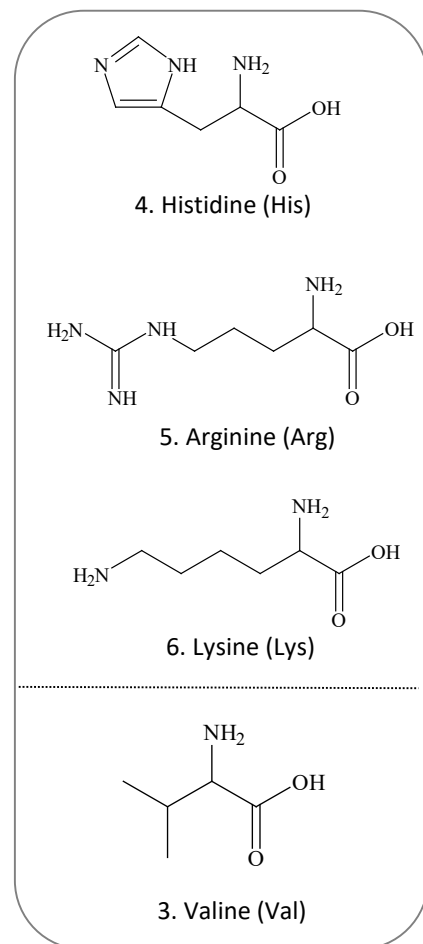
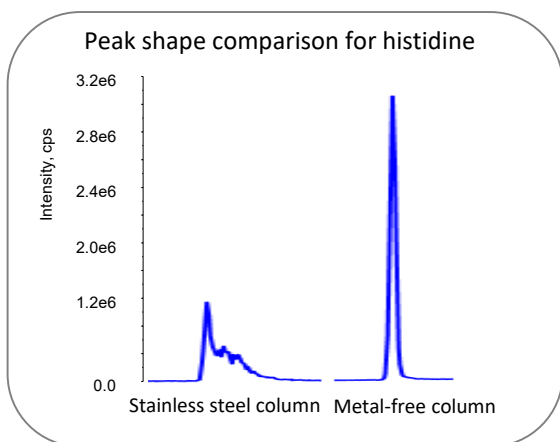
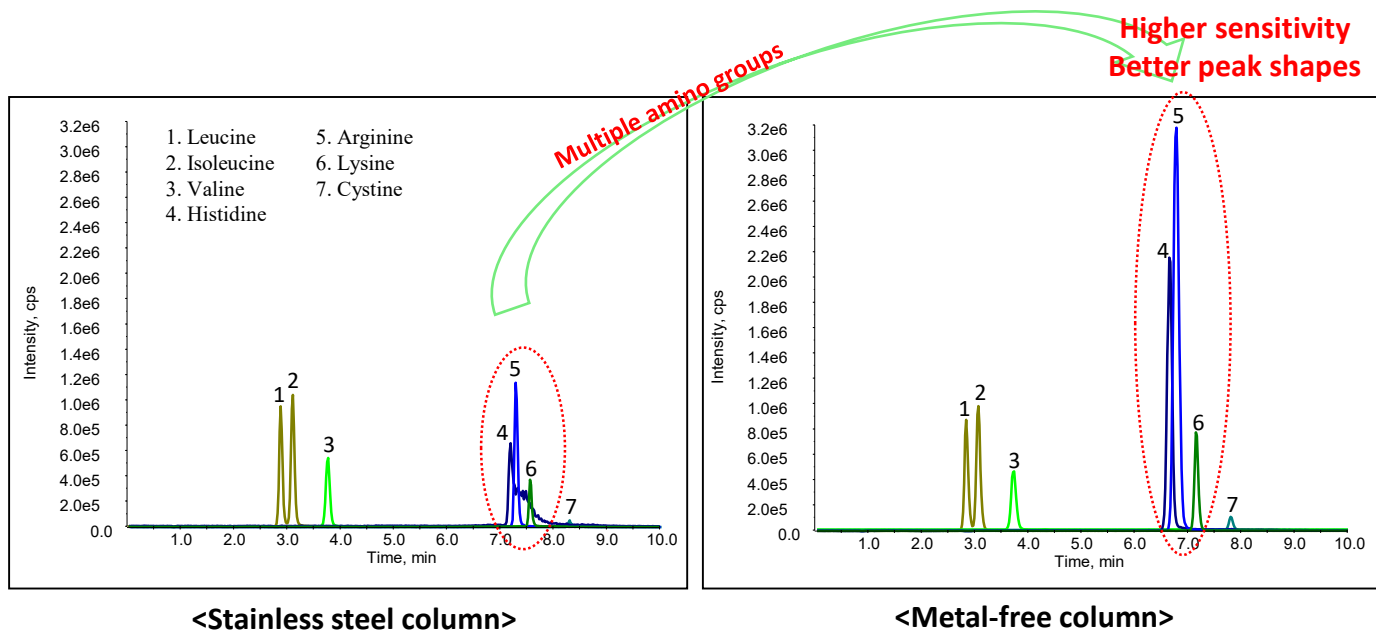
Detection : LC/MS/MS (ESI, Positive, MRM)

	Q1	Q3
1. Spectinomycin(SPCM)	351	333
2. Streptomycin(SM)		292 176
3. Gentamycin(GEM)		322 160
4. Kanamycin(KM)	243	162

Concentration : 500 mg/L

HILIC example 2. Amino acids

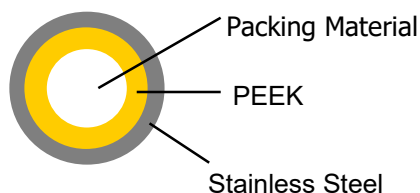
Amino acids containing multiple amino groups are easily affected by metals. There is no difference between stainless steel columns and metal-free columns in the sensitivity of amino acids possessing only one amino group, such as leucine and valine. On the other hand, the effects of column material are considerable on the sensitivity and the peak shapes of amino acids include several amino groups, such as histidine and arginine.



Conditions

- Column** : Inertsil Amide
(3 μm, 150 x 2.1 mm I.D.)
- Mobile phase** : A) 100 mM HCOONH₄, 0.1 % HCOOH in 75 % CH₃CN
B) 100 mM HCOONH₄, 0.1 % HCOOH in H₂O
A/B = 100/0 – 3 min – 100/0 – 5.5 min – 70/30, v/v
- Flow rate** : 0.3 mL/min
- Temperature** : 40 °C
- Detection** : LC/MS/MS (ESI, Positive, MRM)
- Injection Volume** : 5.0 μL
- Concentration** : 5 mM

	Q1	Q3
1. Leucine	132	86
2. Isoleucine	132	86
3. Valine	118	72
4. Histidine	155	110
5. Arginine	175	70
6. Lysine	147	84
7. Cystine	241	152



UHPLC-PEEK Columns



PEEK Columns

Analytical Columns List

InertSustain Series

- InertSustain C18
- InertSustain C8
- InertSustain Phenylhexyl
- InertSustainSwift C18
- InertSustain NH2
- InertSustain Phenyl
- InertSustain AQ-C18

Inertsil Series

- Inertsil ODS-4
- Inertsil ODS-3
- Inertsil ODS-SP
- Inertsil ODS-P
- Inertsil ODS-EP
- Inertsil C8-4
- Inertsil C8-3
- Inertsil Ph-3
- Inertsil WP300 C18
- Inertsil WP300 C8
- Inertsil WP300 C4
- Inertsil Peptides C18
- Inertsil HILIC
- Inertsil Amide
- Inertsil Diol
- Inertsil NH2
- Inertsil WP300 Diol
- Inertsil SIL-100A
- Inertsil WP300 SIL
- Inertsil CN-3

*Other packing materials are on request.

*Check https://www.glsciences.com/product/lc_columns/01853.html for details.

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