

Analysis of Tetracycline Antibiotics in Foods by HPLC

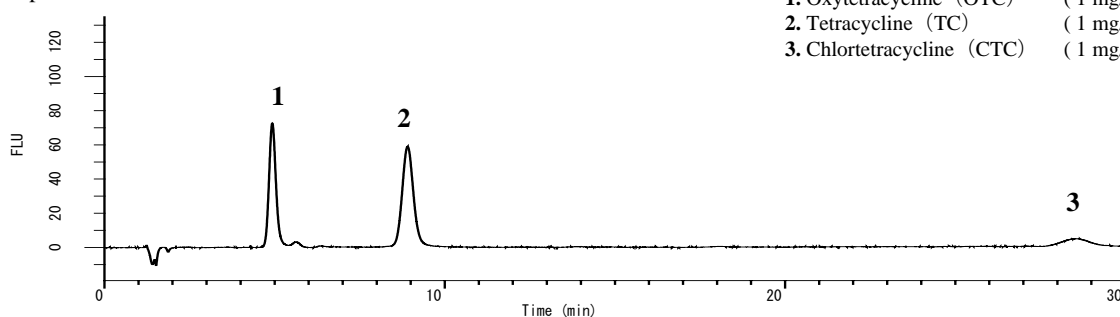
This note describes a determination method for tetracyclines using HPLC-fluorescence detection system. The method is based on the analytical procedures announced from Japanese Ministry of Health, Labour, and Welfare.

Three tetracycline antibiotics (oxytetracycline, tetracycline, and chlortetracycline) are regulated, and the guideline values were established at values ranging from 0.1 to 1.2 ppm (shown in the last page).

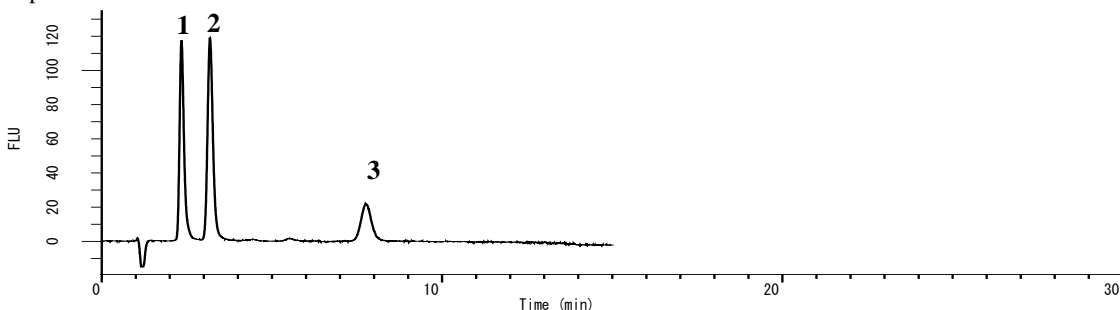
The procedures consist of depoteination, liquid-liquid extraction, solid-phase extraction (SPE), and HPLC analysis. Two mobile phase conditions for HPLC analysis are described: one is for simultaneous determination of oxytetracycline and tetracycline, the other is for analysis of chlortetracycline.

The separation was successfully achieved, and the obtained calibration curves were linear in the range of 0.1-2.0 mg/L.

Mobile phase 1



Mobile phase 2



Chromatograms obtained from standard solution

Conditions

- Column Inertsil ODS-3 (5 μ m, 150 x 4.6 mm I.D.)
Cat.No. 5020-01731

- Col. Temp. 40°C

- Detection FL Ex 380 nm, Em 520 nm

- Inj. Vol. 20 μ L

< Mobile phase 1 for analysis of OTC and TC >

- Eluent : A) CH₃OH B) Imidazol Buffer*
A/B = 15/85, v/v

- Flow rate : 1.2 mL/min

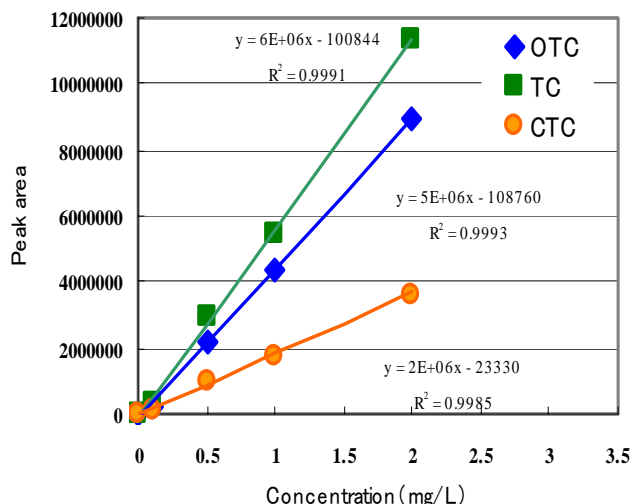
< Mobile Phase 2 for analysis of CTC >

- Eluent : A) CH₃OH B) Imidazol Buffer*
A/B = 25/75, v/v

- Flow rate : 1.4 mL/min

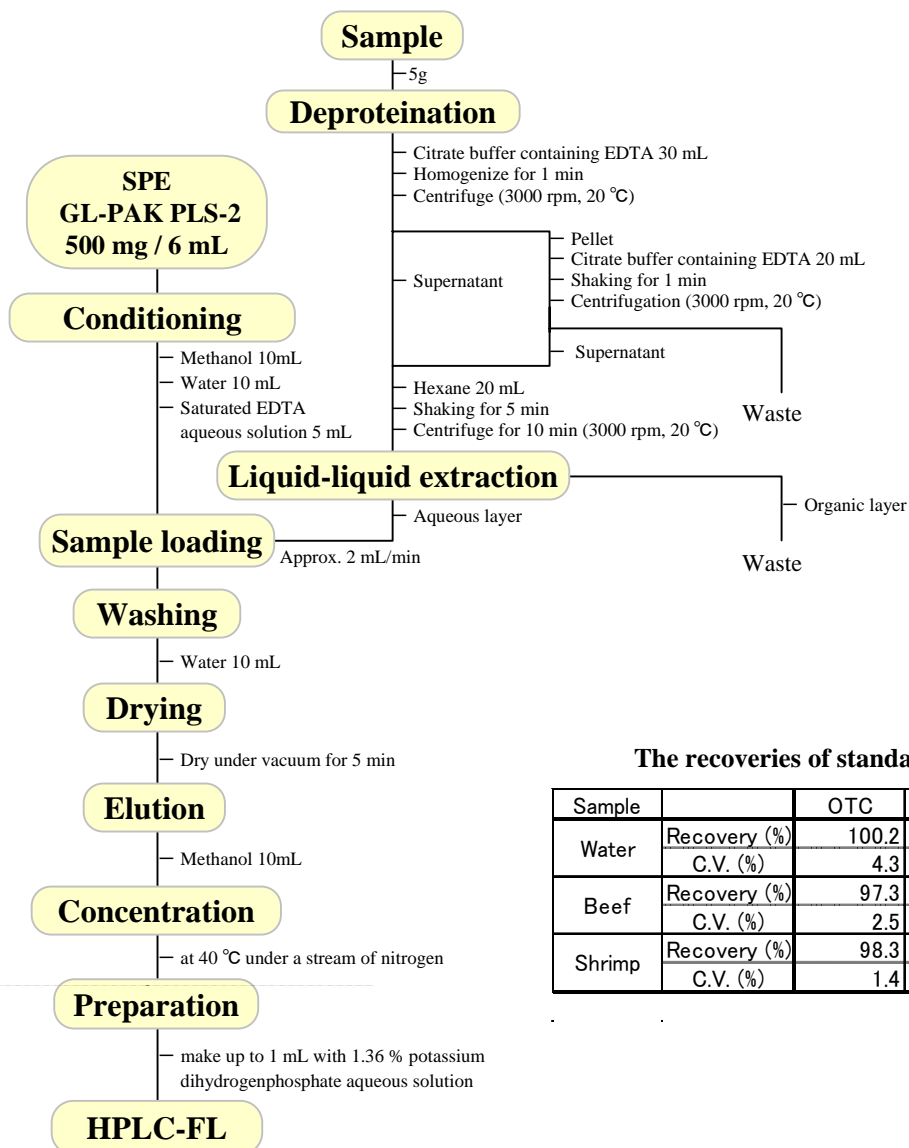
*Imidazol Buffer:

To 68.08 g of imidazol, 0.37g of EDTA and 10.72 g of magnesium acetate were added. After dissolved in water, the aqueous solution was made up to 800 mL with water. The pH was adjusted to 7.2 with acetic acid, and the solution was made up to 1000 mL with water.



The calibration curves for tetracyclines

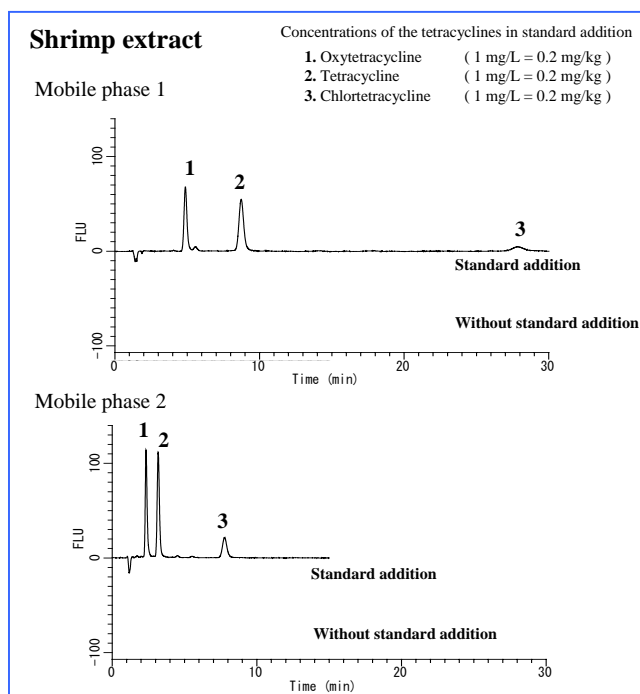
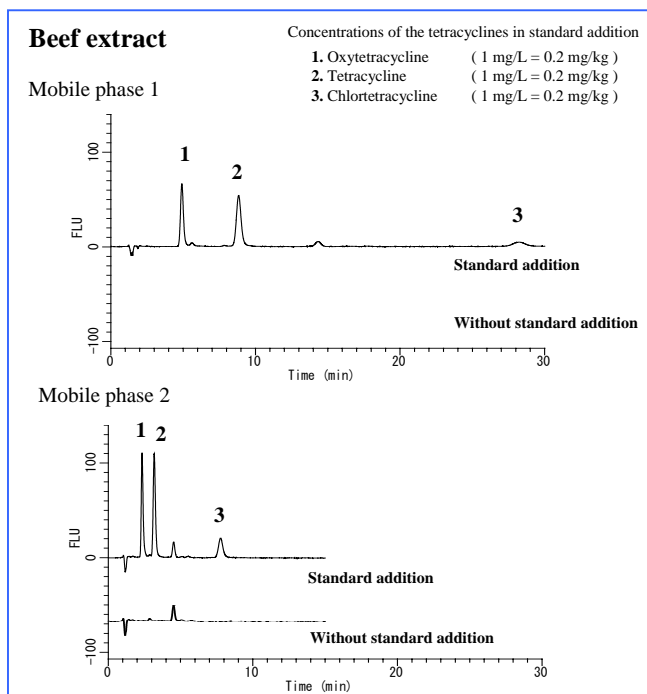
An example of sample pretreatment



The recoveries of standard addition

Sample		OTC	TC	CTC
Water	Recovery (%)	100.2	93.1	93.9
	C.V. (%)	4.3	4.0	9.2
Beef	Recovery (%)	97.3	83.5	83.0
	C.V. (%)	2.5	7.7	6.2
Shrimp	Recovery (%)	98.3	86.1	86.2
	C.V. (%)	1.4	1.6	4.7

(N=5)



Advantages of 3 μm particle-packed 100 mm x 3 mm I.D. columns

Since the columns with various specifications are available, Inertsil series are helpful also for downsizing, which decreases running cost of HPLC analyses.

• Solvent usage and sensitivity

Optimum flow rate for HPLC separation decreases proportionally to the square of column inner diameter (I.D.). To use smaller I.D. columns reduces solvent consumption.

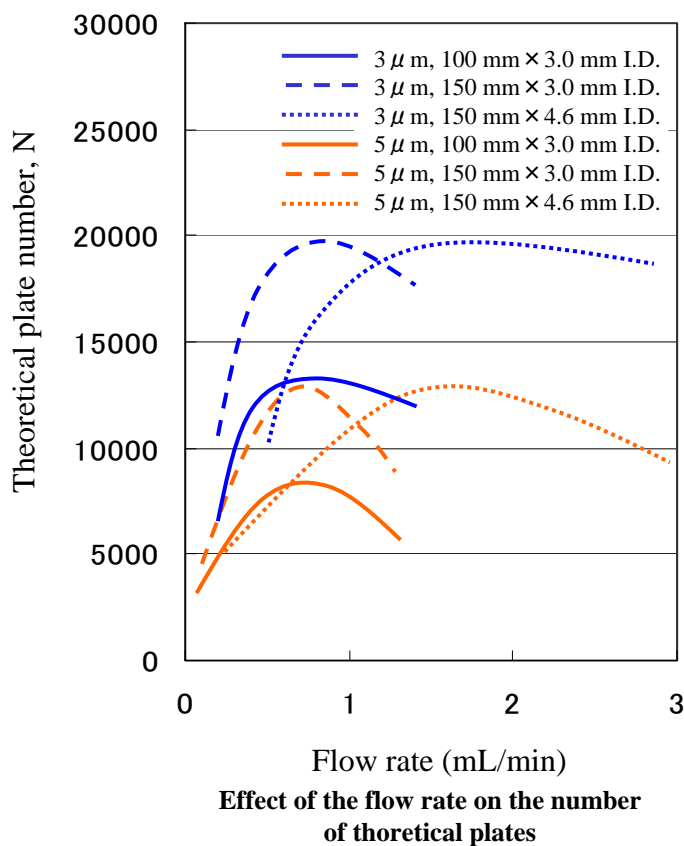
Moreover, when concentrate-dependent detectors (e.g. UV-Vis detector and Fluorescence detector) were used, the sensitivity is improved with decrease in flow rate. Enhancement in sensitivity can also be expected.

• Number of theoretical plates

Smaller particle columns provide higher separation efficiency. Therefore, comparable number of theoretical plates can be obtained even with 100 mm length column.

• Price

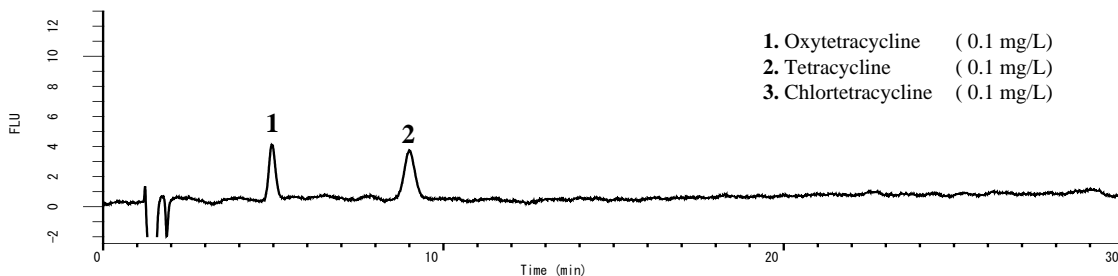
The shorter columns are generally available for lower prices.



A chromatogram shown below was obtained with a 3 μm particle-packed 150 mm x 3.0 mm I.D. column. The flow rate was adjusted to maintain the same linear velocity^{※1}. Good separation and reduction in solvent consumption were achieved. The run time may also be saved because sufficient theoretical plate number should be obtained even with 100 mm length column.

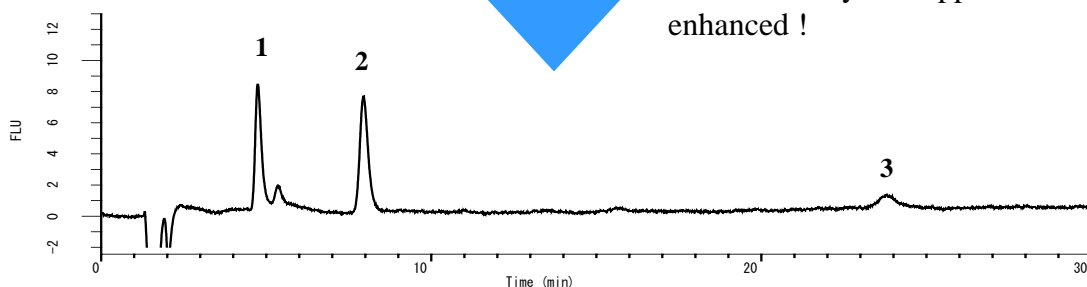
• 4.6 mm I.D. column

(150 x 4.6 mm I.D., particle size: 5 μm, flow rate: 1.2 mL/min)



• 3.0 mm I.D. column

(150 x 3.0 mm I.D., particle size: 3 μm, flow rate: 0.5 mL/min^{※2})



Solvent usage was reduced to **40%** !

The sensitivity was approximately **2-fold** enhanced !

※1 Linear Velocity (L.V.)

= (Flow rate) ÷ (Cross-sectional area of the column)

※2 Composition of the mobile phase is the same.

Table of maximum residue levels (MRLs) for tetracyclines

MRLs for oxytetracycline, chlortetracycline, and tetracycline are established for the sum of the three antibiotics by Japan Food Chemical Research Foundation.

<u>Muscle</u>	MRLs (ppm)	<u>Kidney</u>	MRLs (ppm)
Cattle, pig, and sheep	0.2	Cattle, pig, and sheep	1.2
Other terrestrial mammals*	0.1	Other terrestrial mammals*	0.6
Chicken, duck, and turkey	0.2	Chicken, duck, and turkey	1.2
Other poultry**	0.2	Other poultry**	1.2
<u>Fat</u>	MRLs (ppm)	<u>Edible offal</u>	MRLs (ppm)
Cattle, pig, and sheep	0.2	Cattle, pig, and sheep	0.6
Other terrestrial mammals*	0.3	Other terrestrial mammals*	0.3
Chicken	0.2	Chicken	0.6
Other poultry**	0.2	Other poultry	0.6
<u>Liver</u>	MRLs (ppm)	<u>Others</u>	MRLs (ppm)
Cattle, pig, and sheep	0.6	Chicken eggs	0.4
Other terrestrial mammals*	0.3	Other poultry eggs	0.4
Chicken	0.6	Milk	0.1
Other poultry**	0.6	Honey (including royal-jelly)	0.3

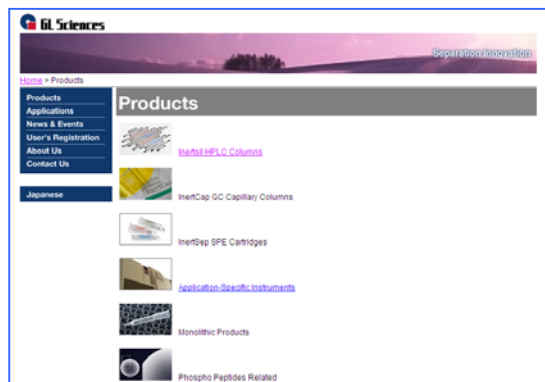
* except sheep and horse ** except duck and turkey

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