

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 1 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

Contents

PART I: DETERMINATIVE METHOD

A.	INTRODUCTION	2
B.	EQUIPMENT	2
C.	REAGENTS AND SOLUTIONS	3
D.	STANDARD(S)	5
E.	SAMPLE RECEIPT AND PREPARATION	6
F.	ANALYTICAL PROCEDURE	6
G.	DECISION CRITERIA / CALCULATIONS	10
H.	SAFETY INFORMATION AND PRECAUTIONS	11
I.	QUALITY ASSURANCE PLAN	11
J.	APPENDIX.....	12

PART II: CONFIRMATORY METHOD

A.	INTRODUCTION	15
B.	EQUIPMENT	15
C.	REAGENTS AND SOLUTIONS	15
D.	STANDARD(S)	16
E.	SAMPLE RECEIPT AND PREPARATION	16
F.	ANALYTICAL PROCEDURE	16
G.	DECISION CRITERIA / CALCULATIONS	18
H.	SAFETY INFORMATION AND PRECAUTIONS	19
I.	QUALITY ASSURANCE PLAN	19
J.	APPENDIX.....	20
K.	APPROVALS AND AUTHORITIES.....	22

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 2 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

PART I: Determinative Method

A. INTRODUCTION

1. Background / Summary of Procedure

Florfenicol and related metabolites in bovine and poultry liver and muscle and Siluriformes (catfish) muscle homogenate are converted to florfenicol amine (FA) salts by acid-catalyzed hydrolysis. The hydrolysate is partitioned with ethyl acetate to remove lipids and other neutral interferences, and then made strongly basic to convert the salts to free FA. This solution is then applied to a diatomaceous earth column and the FA is extracted from the absorbed liquid with ethyl acetate. The organic extract is evaporated to dryness and the residue dissolved in an aqueous buffer and analyzed using reverse phase high performance liquid chromatography (HPLC) with UV detection.

2. Applicability

This method is suitable for the determination of florfenicol (as florfenicol amine) in bovine liver at levels ≥ 0.3 ppm, bovine muscle at levels ≥ 0.2 ppm, poultry liver at levels ≥ 1.5 ppm, poultry muscle at levels ≥ 0.6 ppm, and fish of the order Siluriformes (catfish) muscle at levels ≥ 0.5 ppm.

Note: Refer to 21CFR for tolerance values set by FDA and 40CFR for tolerance values set by EPA.

Note: This method may be performed using standards/solutions that contain fewer analytes than the method is applicable for, if the excluded analytes will not be included in the reported results.

B. EQUIPMENT

Note: Equivalent equipment may be substituted.

1. Apparatus

- a. Balance - 0.1 mg sensitivity, Mettler AE163 Electrobalance.
- b. Centrifuge - Sorval RT-6000 Tabletop, Dupont, Inc.
- c. Shaking water bath - with cover, capable of maintaining at least 95 °C, Precision Scientific.
- d. Round-bottom tubes - 50 mL Corex/Pyrex or Teflon®, with Teflon® lined screw caps.
- e. Vortex mixer - Thermolyne Corporation.
- f. Liquid/liquid extraction cartridge, 20 mL capacity - Chem Elut™ CE1020 Sorbent

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 3 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

Column with #16 Stopcocks, Varian/Analytichem International.

- g. 125 mL round-bottom flasks - Chem Glass.
 - h. Rotary evaporator - Buchi.
 - i. Ultrasonic bath - Branson.
 - j. Micropipettes - Rainin EDP variable volume micropipettes with Rainin pipette tips, Rainin Instruments, Inc.
 - k. Transfer pipettes - glass, disposable.
 - l. Volumetric flasks - Class A, various sizes, Corning, Inc.
 - m. Volumetric pipettes - Class A, various sizes, Corning, Inc.
 - n. Pyrex Glass beakers - Corning, Inc.
 - o. Silanized glass wool - Supelco Inc.
 - p. pH meter - Sentron 2001, Sentron Inc.
 - q. pH Strips - ColorpHast® Chem Strips pH 7.0 to 14.0, EM Science, Inc.
 - r. Filters - Acrodisc LC25 PVDF 0.2 µm filters, Gelman Sciences.
 - s. Syringes - 3 cc Plastic, B-D.
 - t. Mobile phase degas and filtration unit with 0.45-µm aqueous and organic filters.
2. Instrumentation
- a. Agilent HPLC 1200 series, Agilent Technologies
 - b. Column - MAC MOD Zorbax RX-C8 (4.6 mm i.d. x 250 mm, 5 µm particle size) column preceded by a Waters C8 Novapak cartridge precolumn.
- Note: Equivalent columns must meet the system suitability criteria stated in section J.2.*

C. REAGENTS AND SOLUTIONS

Note: Equivalent reagents / solutions may be substituted.

1. Reagents

Unless otherwise stated, only reagents of recognized analytical grade are used.

- a. Water, HPLC - deionized, distilled, or of equal purity.
- b. Ethyl acetate (EtOAc) - HPLC grade.
- c. Acetonitrile (ACN) - HPLC grade.
- d. Methanol (MeOH) - HPLC grade.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 4 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- e. Triethylamine (TEA) - HPLC grade.
- f. Hydrochloric acid (HCl) - concentrated (12N).
- g. Sodium hydroxide (NaOH) - 50% (w/w) solution.
- h. Potassium phosphate monobasic (KH₂PO₄) - reagent grade.
- i. Phosphoric acid (H₃PO₄) - 85% (v/v), HPLC grade.
- j. Methylene Chloride (CH₂Cl₂) - HPLC grade.

2. Solutions

a. 6N HCl:

Slowly add 500 mL of concentrated hydrochloric acid to 500 mL of deionized water and carefully mix. Store at room temperature. Solution is stable for one year.

b. 30% (w/w) NaOH:

Slowly add 600 mL of 50% (w/w) NaOH to 400 mL of deionized water and carefully mix. Store at room temperature in an inert plastic container. Solution is stable for one year.

c. Sample Buffer: 10 mM KH₂PO₄ (pH 4.0), 1% Acetonitrile:

Add 2.72 ± 0.2 g of KH₂PO₄ and 20 mL of acetonitrile to a 2 L volumetric flask containing approximately 1900 mL deionized water. Adjust pH of the solution, using a pH meter, to 4.0 ± 0.2 by the addition of approximately 60 µL of 85% H₃PO₄. Dilute to volume with deionized water, stopper, and mix. Solution is stable for 1 month when refrigerated.

d. HPLC Mobile Phases:

Note: If matrix interference is seen, variation in the % TEA of Mobile Phase A may be tried.

i. Mobile Phase A: 10 mM KH₂PO₄ (pH 4.0), 1% Acetonitrile, 0.01% TEA:

Add 2.72 ± 0.2 g of KH₂PO₄, 20 mL of ACN and 200 µL of TEA to a 2 L volumetric flask containing approximately 1900 mL of deionized water. Adjust the pH to 4.0 ± 0.2 by the addition (approximately 135 µL) of 85% H₃PO₄. Dilute to volume with deionized water, stopper, and mix. Filter the solution through a 0.45 µm HPLC aqueous filter and degas with vacuum or helium sparge. Solution is stable for five days at room temperature.

ii. Mobile Phase B, 100% Acetonitrile:

Filter acetonitrile through a 0.45 µm HPLC organic filter and degas with vacuum or helium sparge.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 5 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

D. STANDARD(S)

Note: Equivalent standards / solutions may be substituted. Purity and counterions are to be taken into account when calculating standard concentrations. In-house prepared standards shall be assigned an expiration date that is no later than the stability stated in the method.

1. Standard Information

- a. Name: Florfenicol Amine - D-(threo)-1-(p-methylsulfonylphenyl)-2-amino-3-fluoro-1-propanol.
- b. Molecular weight: 247.08.
- c. Supplier: Schering-Plough (SCH 40458).
- d. Purity: $\geq 98\%$.

The reference standard will be supplied with a certificate of analysis indicating exact purity.

- e. Storage: Store at room temperature.

2. Preparation of Standard Solution(s)

- a. FA Stock Standard I ($100 \pm 5 \mu\text{g/mL}$):

Weigh amount of analytical standard (corrected for purity) equivalent to $10.0 \pm 0.5 \text{ mg}$ FA, and quantitatively transfer to a 100 mL volumetric flask. Add approximately 25 mL methanol, place flask in an ultrasonic bath, and swirl until all solids are dissolved. Dilute flask contents to volume with methanol, stopper, and invert to mix. Store in freezer at $\leq -10 \text{ }^\circ\text{C}$. Solution is stable for five months.

- b. FA Intermediate Standard ($10 \pm 0.5 \mu\text{g/mL}$):

Pipet 5 mL of the FA stock solution (D.2.a.) to a 50 mL volumetric flask, dilute the content to volume with methanol, stopper the flask, and invert to mix. Store in freezer ($\leq -10 \text{ }^\circ\text{C}$). Solution is stable for five months.

3. Preparation of External Calibration Curve

Prepare a standard curve containing at least three concentration levels ranging from approximately $0.15 \mu\text{g/mL}$ to $10.0 \mu\text{g/mL}$, depending on the range of concentrations to be quantified.

The following table lists some suggested concentrations. To prepare any concentration listed, transfer the amount of standard solution shown in column 2 to a 10 mL volumetric flask and dilute to volume with sample buffer. Stopper flasks and invert to mix.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 6 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

Nominal Standard Curve Concentration, $\mu\text{g/mL}$	μL of FA Stock Standard Added	μL of FA Intermediate Standard Added
0.15		150
0.3	30	
0.6	60	
1.2	120	
2.0	200	
2.5	250	
5.0	500	
10.0	1000	

Note: Standard curve concentrations in $\mu\text{g/mL}$ correspond to tissue concentrations in $\mu\text{g/g}$ (ppm) when this analytical procedure is followed as specified. Standard curve solutions are stable for two weeks when stored refrigeration.

E. SAMPLE RECEIPT AND PREPARATION

1. Preparation of Sample
 - a. Prepare entire sample (or at least 450 g if sample weight exceeds 450 g). If sample is frozen, allow to thaw. Trim sample of extraneous connective tissue. Cut entire sample into thin slices or small cubes. If only a sub-sample is to be prepared, assure that the portions selected are representative of the entire sample.
 - b. Using a food processor, thoroughly blend tissue to prepare a homogeneous sample mixture. Transfer mixture to a suitable container and store in a freezer at $\leq -10\text{ }^{\circ}\text{C}$. Take care to avoid any unnecessary thaw/freeze cycles.
2. Preparation of Test Sample

Allow sample to thaw. Analyze as soon as possible once thawed.

F. ANALYTICAL PROCEDURE

1. Preparation of Controls and Samples
 - a. Accurately weigh 2 ± 0.2 g of sample homogenate and controls into a 50 mL round-bottom screw-cap tube. Record the weight to at least three significant figures.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 7 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

i. Liver Controls

Prepare positive and negative muscle controls if needed at this time. Weigh two portions of blank (shown to have no florfenicol) liver tissue. Fortify with FA stock standard as follows

- (a) For beef liver - Divide 7400 by the concentration of FA stock standard in $\mu\text{g/mL}$. Add this amount, in microliters, to one of the blanks to produce a 3.7 ppm positive control.
- (b) For poultry liver - Divide 3000 by the concentration of the FA stock standard in $\mu\text{g/mL}$. Add this amount, in microliters, to one of the blanks to produce a 1.5 ppm positive control.

ii. Muscle controls

Prepare negative and positive muscle controls if needed at this time. Weigh two portions of blank (shown to have no florfenicol) muscle tissue. Fortify with FA intermediate standard as follows:

- (a) For beef muscle - Divide 600 by the concentration of the FA intermediate standard in $\mu\text{g/mL}$. Add this amount, in microliters, to one of the blanks to produce a 0.30 ppm positive control
- (b) For poultry muscle - Divide 1200 by the concentration of the FA intermediate standard in $\mu\text{g/mL}$. Add this amount, in microliters, to one of the blanks to produce a 0.60 ppm positive control.
- (c) For Siluriformes (catfish) muscle - Divide 1000 by the concentration of the FA intermediate standard in $\mu\text{g/mL}$. Add this amount, in microliters, to one of the blanks to produce a 0.50 ppm positive control.

2. Extraction Procedure

- a. Add 8 mL of 6N HCl to all blanks, fortified controls, and sample tubes, cap tightly, and vortex mix for approximately 1 minute at a high setting.
- b. Place tube in a shaking water bath set to maintain a temperature of 95 -100 °C, for at least 2 hours. The water bath must be covered to maintain this temperature. Briefly remove tube from the water bath and vortex mix at a high setting every 30 to 45 minutes during hydrolysis to ensure complete digestion.
Caution! Check to be sure the cap is tight. Wear necessary hand and eye protection.
- c. After approximately 2 hours, remove tube and inspect its contents. The solution should be dark brown to black with only charred black flocculent material remaining. If pieces of undigested tissue remain, continue heating and mixing until digestion is complete. Allow tube to cool to room temperature.

Stopping Point: Digest may be held at room temperature for up to 3 hours.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 8 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- d. Add approximately 20 mL of ethyl acetate to tube, cap, and shake vigorously or vortex for 2 minutes. Centrifuge tube for 5 minutes at approximately 2000 - 2500 rpm (~900 - 1400 g) to separate layers. Aspirate and discard the upper (ethyl acetate) layer. Do not disturb or transfer the black tarry interface.

Stopping point: Samples may be stored in a refrigerator overnight.

- e. Adjust the pH of the hydrolyates to 12.5 or higher by slowly adding approximately 7 mL of 30% NaOH in small portions. After the addition of each portion, gently swirl tube to mix. After adding all the portions, gently invert and/or vortex mix tube, and then check pH of contents with pH paper. If necessary, more 30% NaOH can be added in smaller portions and the pH re-checked until the specified value is achieved. If desired, the tubes can be immersed in an ice bath during and/or after the addition of NaOH.

Caution! Reaction is highly exothermic. Take care to work in a hood and wear eye and hand protection.

- f. Attach a stopcock to the sorbent column mounted above a 125 mL round bottom flask. When sample tube is cool to the touch, manually invert a few times and pour contents onto the top of the column (If addition displaces column packing, a glass wool plug may be placed on top of the column prior to adding sample solution). Once the solution passes just below the surface of the sorbent bed (may require application of pressure/vacuum), let the column stand 15 - 60 minutes to allow extract to thoroughly adsorb.
- g. Add 20 mL of ethyl acetate or methylene chloride to sample tube, manually invert several times and then pour this solution into the corresponding sorbent column. The column eluent should drip slowly (approx. one drop per second). If the tube drips too fast, adjust flow using the stopcock at the end of the column. Collect eluent in a round bottom flask. This step should be performed in a hood.

Note: In cases where substantial interference is observed in the HPLC assay of the control liver tissue extracts, methylene chloride may be substituted for ethyl acetate to reduce the background interference.

Note: Routine use of methylene chloride is discouraged due to safe handling and disposal issues.

- h. Repeat step g twice, adding each 20 mL portion of solvent as the previous eluent passes below the top of the column bed. Collect the combined eluents into the round bottom flask.
- i. When the last portion of eluting solvent is added, allow the column to stand until the eluent flow completely stops. Do not force the remaining solvent through the column. Remove column from the flask and discard.

Stopping Point: Flask may be stoppered and stored overnight in a freezer, refrigerator, or at room temperature.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 9 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- j. Gently evaporate the contents of the round-bottom flask to dryness under vacuum using a rotary evaporator at 45 - 50 °C. If solutions are prone to bumping or spattering, rinse rotary evaporator adaptor with ethyl acetate between samples. Remove flask from the rotary evaporator upon dryness. The total evaporation process should take 10 -15 minutes.

Stopping point: Flasks may be stoppered and stored in a freezer overnight.

- k. Add 2 mL of sample buffer to the round bottom flask and dissolve the residue by mixing on a vortex mixer for about 30 seconds, then gently rotating the flask in an ultrasonic bath for about 30 seconds. During both vortexing and sonication, ensure that the buffer solution contacts all glass surfaces. Using a 3 cc plastic syringe, filter the solution through 0.2 µm Acrodisc filter into an injection vial for HPLC analysis.

Stopping point: Vials may be stored in a refrigerator up to 5 days. If there is any interruption in the HPLC analysis, the extracts are stable for 48 hours at room temperature and can be reinjected.

Note: If solutions become cloudy on standing prior to HPLC analysis, they should be re-filtered to remove all particulates.

3. Instrumental Settings

Note: The instrument parameters may be optimized to ensure system suitability.

a. HPLC Instrument Operating Conditions

Note: Analyst may need to make minor modifications to injection volume or gradient to optimize the performance of the instrument used.

- i. UV absorbance: 220 nm.
- ii. Injection Volume: 80 - 100 µL (Use a constant volume for all injections).
- iii. Flow Rate: 1 mL/minute.
- iv. Gradient:

Time (min.)	% A	%B	Action
0	100	0	(Initial conditions)
9	100	0	Hold at initial conditions
11	5	95	Linear gradient to flush column
13	5	95	Hold (column flush)
15	100	0	Linear gradient to initial conditions
25	100	0	Hold for equilibration

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 10 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- b. Determining initial System Suitability
Test for system suitability during initial HPLC setup. See "Determining Initial System Suitability in section J.3.
 - c. Injection Sequence for Samples, Controls and Standards
 - i. Equilibrate HPLC system with mobile phase A at 1.0 mL/min until a stable baseline is achieved prior to starting any series of injections.
 - ii. Inject standard curve series. Verify that FA elutes prior to start of the LC column flush gradient.
 - iii. Process samples and controls such that no more than 12 are injected between standards, and that standards are also injected at the end of the sequence.
Note: If system is stable, only a mid level standard need be re-injected during and after the sample injection sequence to verify instrumental response consistency.
 - d. Sample Chromatograms: See Section J.2.
4. Sample Set
- For each batch of up to 20 samples, include:
- a. Solvent Blank
 - b. Calibration Curve (one per analysis)
 - c. Negative control (tissue blank)
 - d. Positive control (fortified blank)
 - e. Intra-laboratory Check Sample (if needed)
 - f. Samples
 - g. Standard (e.g., 1ppm)

G. DECISION CRITERIA / CALCULATIONS

- 1. Determine retention times and peak areas for all standards, controls, and samples injected.
- 2. Using linear regression analysis, construct a standard curve from external standard calibration values. Plot peak area (y coordinate) against standard concentration in $\mu\text{g/mL}$ (x coordinate). Calculate slope (m), intercept (b), and correlation coefficient (r) of the regression line.
- 3. Samples may be quantified only if the correlation coefficient calculated for the standard curve equals or exceeds 0.99.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 11 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

4. Identification of FA in a sample requires that its chromatogram show a peak eluting with a retention time within $\pm 5\%$ of that determined for the FA peak in the positive control.
5. Calculate FA concentrations in samples using the equation:

$$\text{FA, ppm} = \frac{(y - b) \times V}{m \times W}$$

Where:

y = FA peak area of the sample extract

m = slope of the standard curve

b = intercept of the standard curve

W = sample weight, in grams

V = volume of the sample extract, in mL

Note: Samples showing florfenicol amine responses outside the range of the standard curve must be diluted with sufficient sample buffer to bring response within range for best quantitation. In such cases V must be adjusted to reflect this dilution.

H. SAFETY INFORMATION AND PRECAUTIONS

1. Personal Protective Equipment — Safety glasses, lab coat, protective gloves.
2. Hazards

Consult all Safety Data Sheets (SDS) associated with the method.
3. Disposal Procedures

Follow federal, state and local regulations.

I. QUALITY ASSURANCE PLAN

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06		Page 12 of 22
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

1. Performance Standard

<i>Analyte</i>	<i>Analytical Range</i>			<i>Acceptable Recovery (%)</i>
	Bovine	Poultry	Siluriformes (Catfish)	
Florfenicol Amine	≥ 0.3 ppm (liver)	≥ 1.5 ppm (liver)	NA	57 - 110%
	≥ 0.2 ppm (muscle)	≥ 0.6 ppm (muscle)	≥ 0.5 ppm (muscle)	

2. Intralaboratory Check Samples

a. Acceptability criteria.

Refer to I. 1.

If unacceptable values are obtained, then:

- i. Investigate following established procedures.
- ii. Take corrective action as warranted.

J. APPENDIX

1. References

“High Performance Liquid Chromatography Method for the Determination of Florfenicol Amine in Cattle Liver”. (Revision Date: March 14, 1996). Alice M. Bova, Schering-Plough Research Institute, Lafayette, New Jersey.

“Florfenicol Amine – Method for the Determination of Residues in Poultry Tissues using HPLC with UV Detection version 1.1”. Schering-Plough Research Institute.

“Determination of Florfenicol Amine Residues in Aquaculture Species by HPLC with UV Detection (v. 2.0)”. (Revision Date: May 31, 2007). Mohammad Mushtaq, Schering-Plough Research Institute, Lafayette, New Jersey.

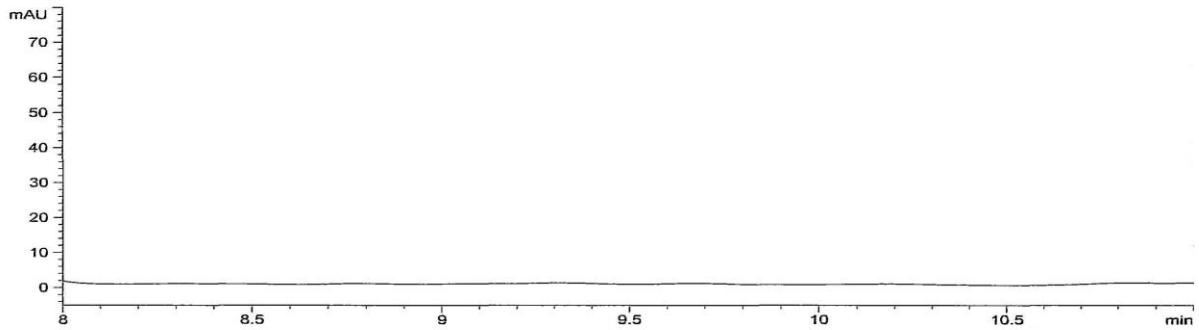
2. Chromatograms/spectra

United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science

CLG-FLOR1.06	Page 13 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

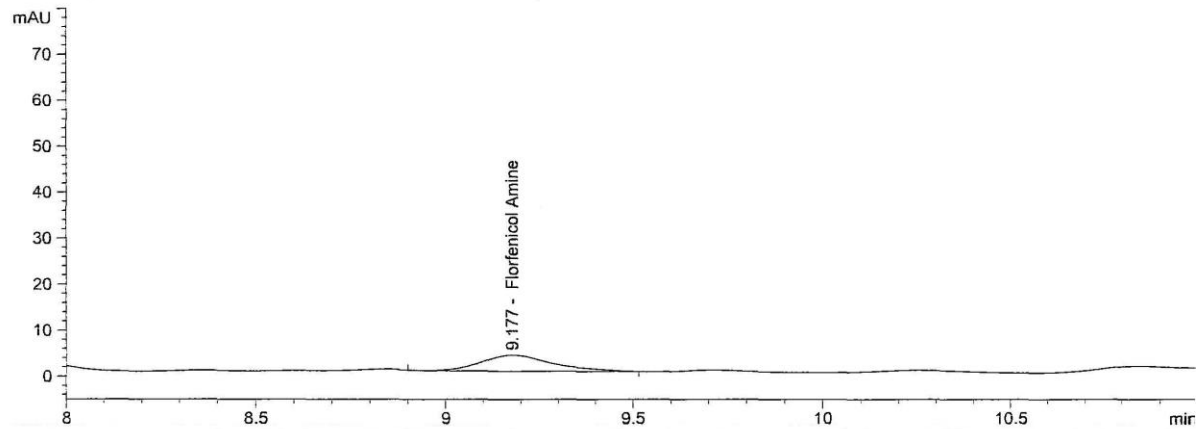
a. Bovine Liver Blank

FLORFENICOL

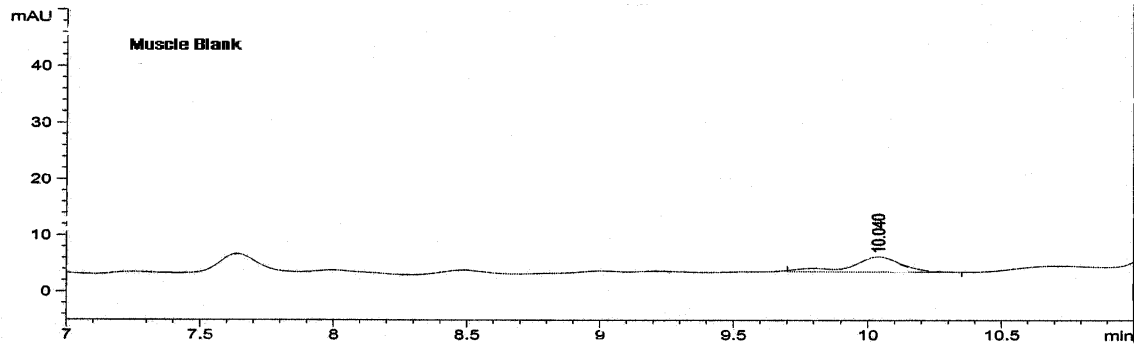


b. Bovine Liver Recovery, 0.3 ppm

FLORFENICOL



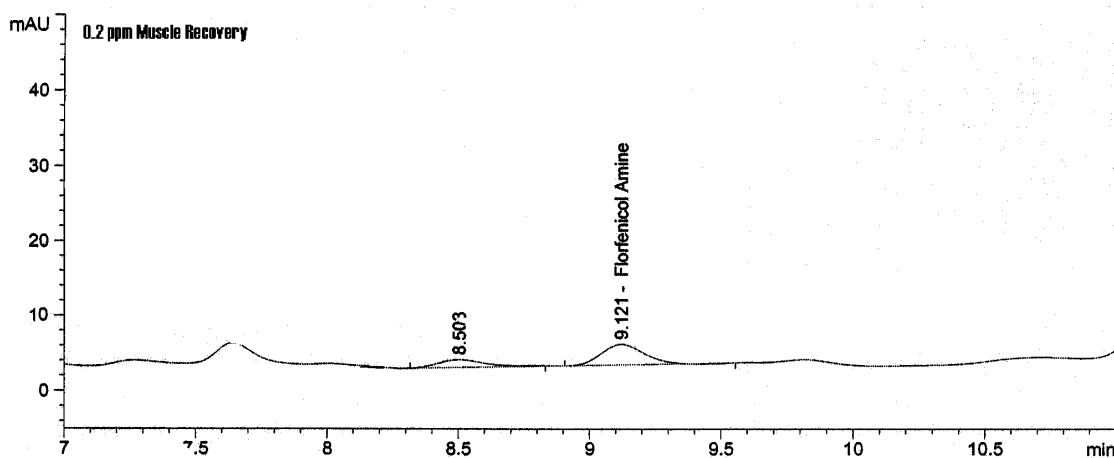
c. Bovine Muscle Blank



**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 14 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

d. Bovine Muscle Recovery, 0.2 ppm



3. Determining System Suitability

Perform the following system suitability at initial HPLC setup:

- a. Inject (at least three replicates) of a middle range standard. The percent relative standard deviation of the peak area response should be < 5%.
- b. Peak asymmetry (AS) of a middle range standard should be < 2. Calculate AS as follows:
AS = CB/AC, where:
AC = peak width from start of peak to center at 10% peak height.
CB = peak width from center to end of peak at 10% peak height.
- c. The florfenicol amine peak should elute prior to beginning of the column flush gradient (approximately 8 - 10 minutes). For one day's analysis the retention time for florfenicol amine should not vary more than ± 30 seconds from the mean.

The UV Detector should be capable of providing a 10:1 signal to noise ratio when 10 ng florfenicol amine (e.g. 20 μ L injection of the 0.5 μ g/mL standard) is injected on-column

4. Minimum Level of Applicability (MLA)

- a. Bovine Liver: 0.3 ppm
- b. Poultry Liver: 1.5 ppm
- c. Bovine Muscle: 0.2 ppm
- d. Poultry Muscle: 0.6 ppm
- e. Siluriformes (catfish)Muscle: 0.5 ppm

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 15 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

PART II: Confirmatory Method

A. INTRODUCTION

1. Background / Summary of Procedure

Florfenicol is extracted from tissue using the procedure described in Part I: Determinative Method. The extract is injected into the HPLC/MS/MS and confirmation is accomplished using positive ion chemical ionization.

2. Applicability

This method is suitable for the confirmation of florfenicol (as florfenicol amine) in bovine liver and muscle at levels ≥ 0.3 ppm, poultry liver at levels ≥ 1.5 ppm, poultry muscle at levels ≥ 0.6 ppm, and fish of the order Siluriformes (catfish) muscle at levels ≥ 0.5 ppm

Note: Refer to 21CFR for tolerance values set by FDA and 40CFR for tolerance values set by EPA.

Note: This method may be performed using standards/solutions that contain fewer analytes than the method is applicable for, if the excluded analytes will not be included in the reported results.

B. EQUIPMENT

Note: Equivalent equipment may be substituted.

1. Apparatus

a. Refer to Part I: Determinative Method, section B.1.

2. Instrumentation

- a. HPLC/Mass Spectrometer - Micromass Quattro Micro API equipped with APCI LC interface coupled to a Waters HPLC and autosampler.
- b. LC column - Hewlett Packard, Zorbax Rx, C8, 2.1 x 150 mm, 5 μ m packing.
- c. Guard column - Agilent XDB-CN, 2.1 x 12.5 mm, 5 μ m packing.
- d. Data System - MassLynx™ Software.

C. REAGENTS AND SOLUTIONS

Note: Equivalent reagents / solutions may be substituted.

1. Reagents

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 16 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- a. Refer to Part I: Determinative Method, Section C.1.
- b. Ammonium Acetate ($\text{CH}_3\text{COONH}_4$) - Spectrum Chemical MFG Corp

2. Solutions

- a. Refer to Part I: Determinative Method, Section C.2.
- b. HPLC Mobile Phases:
 - i. Mobile Phase A: 0.01 M ($\text{CH}_3\text{COONH}_4$)
Add 0.8 ± 0.02 g of $\text{CH}_3\text{COONH}_4$ to a 1 L volumetric flask and dilute to volume with deionized water, stopper, and mix. Filter the solution through a $0.45 \mu\text{m}$ HPLC aqueous filter and degas with vacuum or helium sparge. Solution is stable for 1 week at room temperature.
 - ii. Mobile Phase B, 100% Methanol:
Filter methanol through a $0.45 \mu\text{m}$ HPLC organic filter and degas with vacuum or helium sparge.

D. STANDARD(S)

Note: Equivalent standards / solutions may be substituted. Purity and counterions are to be taken into account when calculating standard concentrations. In-house prepared standards shall be assigned an expiration date that is no later than the stability stated in the method.

Refer to Part I: Determinative Method, Section D.

E. SAMPLE RECEIPT AND PREPARATION

Refer to Part I: Determinative Method, Section E.

F. ANALYTICAL PROCEDURE

1. Preparation of Controls and Samples

Refer to Part I: Determinative Method, Section F.1.

2. Extraction Procedure

- a. Refer to Part I: Determinative Method, Section F.2.
- b. Inject the extract generated from step F.2.k. from Part I: Determinative Method

3. Instrumental Settings

Note: The instrument parameters may be optimized to ensure system suitability.

- a. HPLC Instrument Operating Conditions

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 17 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

Note: Analyst may need to make minor modifications to system parameters to optimize the performance of the instrument used.

- i. Flow rate: 0.3 mL/min
- ii. Injection volume: 50 µL
- iii. Gradient:

Time (min.)	% A	%B	Action
0.00	100	0	(Initial conditions)
1.00	100	0	1 min. hold at initial conditions
6.00	80	20	concave gradient
11.00	80	20	hold
21.00	0	100	convex gradient
23.00	0	100	hold column flush
28.00	100	0	convex gradient
32.50	100	0	hold at initial conditions

Inject standard. Verify that all monitored product ions are present.

- iv. Inject the recovery and blank. Verify the absence of analyte carryover in the blank. If significant carryover is detected, inject solvent or blank until reduced to an acceptable level.
- b. MS Tuning parameters

Note: Table contains recommended values. Instrumental settings may be adjusted if necessary to optimize performance.

Parameter	Setting
Ion Source	APCI (positive mode)
Corona	2 µA
Cone	25 v
Extractor	5 v
RF Lens	0.2 v
Source Temperature	130 °C
APCI Probe Temperature	500 °C
Desolvation Gas Flow	300 L/hr
Cone Gas Flow	100 L/hr

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 18 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- c. Fragment ions Monitored:
 - 230 m/z
 - 197 m/z
 - 151 m/z
 - 130 m/z
 - d. Chromatograms: Refer to section J.2.
4. Sample Set
- For each batch of up to 20 samples, include:
- a. Solvent Blank
 - b. Standard (e.g., 1ppm)
 - c. Positive Control or Recovery 2 (fortified blank)
 - d. Negative control (tissue blank)
 - e. Positive control or Recovery (fortified blank)
 - f. Intra-laboratory Check sample (if needed)
 - g. Samples
 - h. Standard (e.g., 1ppm)

G. DECISION CRITERIA / CALCULATIONS

- 1. Confirmation Criteria
 - a. The retention time of the sample must be within 5% of that for the florfenicol amine standard or the recovery.
 - b. The observation of all four ions is needed to identify florfenicol amine.
 - c. The relative ion abundance ratios of at least two of the ions (m/z 151, m/z 197 and m/z 230) to that of m/z 130 must be within 10% of that of the reference. If all three ions are used to determine ratios the criteria is extended to 20% that of the reference.
 - d. The signal to noise ratio of all ion chromatogram peaks used to calculate abundance ratios in the reference and the sample is at least 3:1.
- 2. The florfenicol amine fragment ions of m/z 151, 197 and 230 are expressed as a percentage of the base fragment ion of m/z 130.

Calculate the relative percentages of the florfenicol amine fragment ions as follows:

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 19 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

$$\frac{P_n}{P_b} \times 100 = \% \text{ relative abundance}$$

Where:

P_n = Peak area or height of fragment ion at m/z = 151, 197 or 230

P_b = Peak area or height of the base fragment ion at m/z = 130

H. SAFETY INFORMATION AND PRECAUTIONS

1. Personal Protective Equipment — Safety glasses, lab coat, protective gloves.
2. Hazards
Consult all Safety Data Sheets (SDS) associated with the method.
3. Disposal Procedures
Follow federal, state and local regulations

I. QUALITY ASSURANCE PLAN

1. Performance Standard

<i>Analyte</i>	<i>Analytical Range</i>			<i>False positive rate</i>	<i>False negative rate</i>
	Bovine	Poultry	Siluriformes (Catfish)		
Florfenicol Amine	≥ 0.3 ppm (liver)	≥ 1.5 ppm (liver)	NA	0%	0%
	≥ 0.3 ppm (muscle)	≥ 0.6 ppm (muscle)	≥ 0.5 ppm (muscle)		

2. Intralaboratory Check Samples
 - a. Acceptability criteria.
Refer to I. 1.
If unacceptable values are obtained, then:
 - i. Investigate following established procedures.
 - ii. Take corrective action as warranted.

**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 20 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

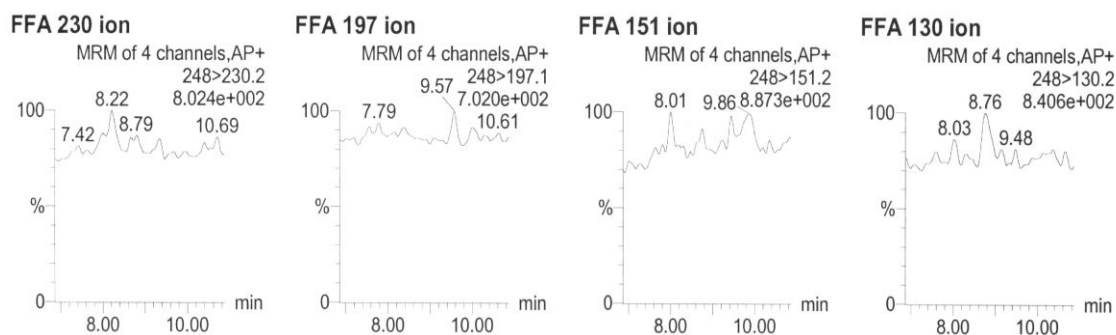
J. APPENDIX

1. References

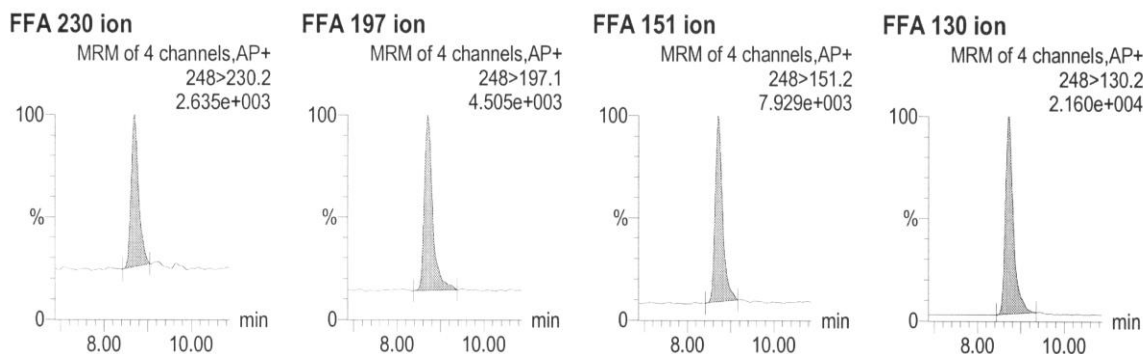
Florfenicol Amine-Method for the Confirmation of Residues in Swine Liver Using HPLC and MS/MS Detection-version 1.0. Schering-Plough Research Institute, Lafayette, New Jersey.

2. Chromatograms/spectra

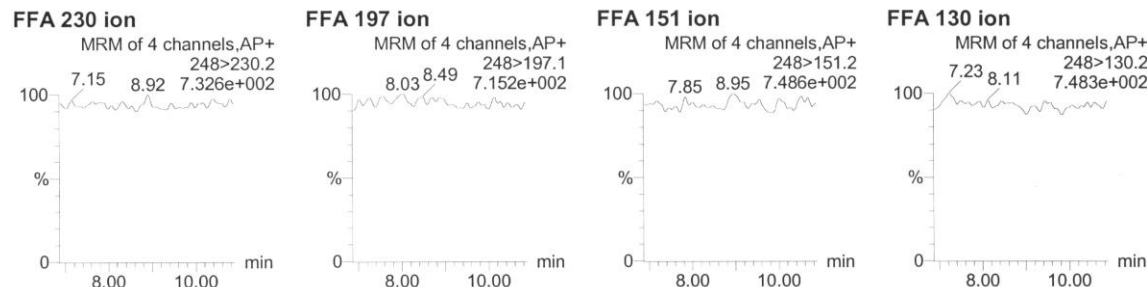
a. Bovine liver blank



b. Bovine liver recovery, 0.3 ppm



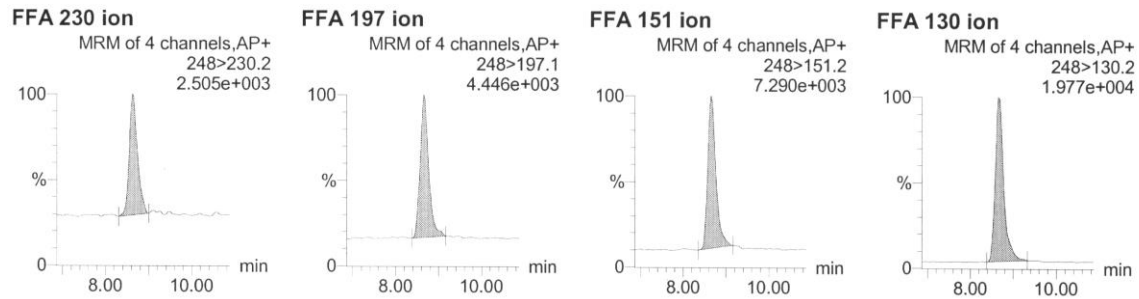
c. Bovine muscle blank



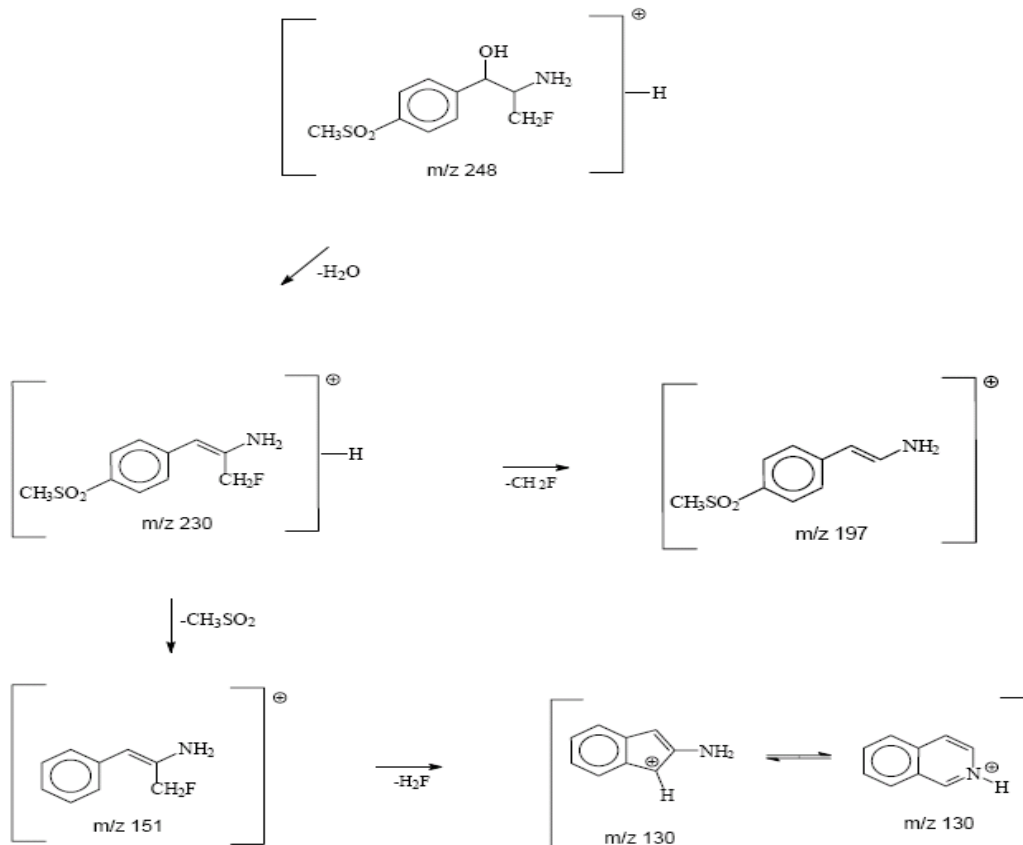
**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06		Page 21 of 22
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

d. Bovine muscle recovery, 0.3 ppm,



3. Proposed Daughter Ion Fragmentation Pathway for Florfenicol Amine



**United States Department of Agriculture
Food Safety and Inspection Service, Office of Public Health Science**

CLG-FLOR1.06	Page 22 of 22	
Title: Determination and Confirmation of Florfenicol		
Revision: 06	Replaces: CLG-FLOR1.05	Effective: 03/09/21

- 4. Minimum Level of Applicability (MLA)
 - a. Bovine Liver: 0.3 ppm
 - b. Poultry Liver: 1.5 ppm
 - c. Bovine Muscle: 0.3 ppm
 - d. Poultry Muscle: 0.6 ppm
 - e. Siluriformes (catfish) Muscle: 0.5 ppm

K. APPROVALS AND AUTHORITIES

- 1. Approvals on file.
- 2. Issuing Authority: Director, Laboratory Quality Assurance Staff.