Date of Approval: February 2, 2023

FREEDOM OF INFORMATION SUMMARY

ORIGINAL ABBREVIATED NEW ANIMAL DRUG APPLICATION

ANADA 200-737

Enrofloxacin

Flavored Antibacterial Tablets

Dogs and cats

Enrofloxacin flavored antibacterial tablets are indicated for the management of diseases associated with bacteria susceptible to enrofloxacin. Enrofloxacin flavored antibacterial tablets are indicated for use in dogs and cats.

Sponsored by:

ZYVET AH, Inc.

Executive Summary

Enrofloxacin flavored antibacterial tablets are approved for the management of diseases associated with bacteria susceptible to enrofloxacin in dogs and cats. Enrofloxacin flavored antibacterial tablets are a generic version of Baytril® Taste Tabs®.

	Proprietary Name	**Established Name**	**Application Type and Number**	**Sponsor**
Generic Animal Drug	Enrofloxacin	enrofloxacin	Abbreviated New Animal Drug Application (ANADA) 200-737	ZYVET AH, Inc.
Brand Name Animal Drug, also called the Reference Listed New Animal Drug (RLNAD)	Baytril® Taste Tabs®	enrofloxacin	New Animal Drug Application (NADA) 140-441	Elanco US Inc.

Enrofloxacin, a fluoroquinolone antibiotic, has bactericidal activity against a broad spectrum of gram-negative and gram-positive bacteria. When given orally, enrofloxacin is rapidly absorbed from the digestive tract, penetrating into body tissues and fluids.

Bioequivalence
The Federal Food, Drug, and Cosmetic (FD&C) Act allows an animal drug sponsor to submit an abbreviated new animal drug application (ANADA) for a generic version of an approved brand name animal drug (also called the reference listed new animal drug or RLNAD). This law typically requires the sponsor to show that the generic drug is bioequivalent to the approved RLNAD. Broadly, bioequivalence means the generic drug is absorbed by and performs the same way in the animal's body as the RLNAD, which has already been shown to be safe and effective when used according to the label. The FD&C Act doesn't require the sponsor to submit new effectiveness or target animal safety data in the ANADA for a generic animal drug.

The sponsor conducted one *in vivo* blood-level study in fasted dogs to show that the 136 mg Enrofloxacin flavored antibacterial tablets are bioequivalent to the 136 mg Baytril® Taste Tabs®. The sponsor also conducted one *in vivo* blood-level study in fasted cats to show that the 22.7 mg Enrofloxacin flavored antibacterial tablets are bioequivalent to the 22.7 mg Baytril® Taste Tabs®. No serious adverse events were reported during either study.

Baytril® Taste Tabs® are available in 22.7, 68, and 136 mg tablets. To qualify for a waiver from the requirement to perform *in vivo* bioequivalence studies (biowaiver) for each of these product strengths in each species, a comparative *in vitro* dissolution study was conducted to determine the dissolution profiles of generic and RLNAD tablets of all strengths. All tablets showed rapid dissolution profiles. Therefore, the 22.7-mg and 68-mg strength Enrofloxacin flavored antibacterial tablets qualified for a biowaiver in dogs and the 68-mg and 136-mg strength Enrofloxacin flavored antibacterial tablets qualified for a biowaiver in cats. FDA granted a biowaiver for the 22.7 mg and 68 mg tablet strengths in dogs and the 68 mg and 136 mg tablet strengths in cats.

User Safety
The labeling for Enrofloxacin flavored antibacterial tablets includes a warning that people who have a history of hypersensitivity to quinolones should avoid the drug. The labeling also includes a warning about the risk of photosensitization in people after excessive exposure to quinolones.

Conclusions
Based on the data submitted by the sponsor for the approval of Enrofloxacin flavored antibacterial tablets, FDA determined that the drug is safe and effective when used according to the label.

Table of Contents

I. GENERAL INFORMATION

A. File Number

ANADA 200-737

B. Sponsor

ZYVET AH, Inc.
73 Route 31N
Pennington, NJ 08534

Drug Labeler Code: 086117

C. Proprietary Name

Enrofloxacin

D. Drug Product Established Name

enrofloxacin

E. Pharmacological Category

Antimicrobial

F. Dosage Form

Flavored antibacterial tablets

G. Amount of Active Ingredient

22.7 mg, 68 mg, or 136 mg of enrofloxacin per tablet

H. How Supplied

22.7 mg strength in bottles containing 100 and 500 double scored tablets.
68 mg strength in bottles containing 50 and 250 double scored tablets.
136 mg strength in bottles containing 50 and 200 double scored tablets.

I. Dispensing Status

Prescription (Rx)

J. Dosage Regimen

Dogs: Administer orally at a rate to provide 5-20 mg/kg (2.27 to 9.07 mg/lb) of body weight. Selection of a dose within the range should be based on clinical experience, the severity of disease, and susceptibility of the pathogen. Animals which receive doses in the upper-end of the dose range should be carefully monitored for clinical signs that may include inappetence, depression, and vomition.

Weight of Dog	**Once Daily Dosing Chart**			
	5.0 mg/kg	10.0 mg/kg	15.0 mg/kg	20.0 mg/kg
9.1 kg (20 lb)	2 x 22.7 mg tablets	1 x 22.7 mg plus 1 x 68 mg tablets	1 x 136 mg tablet	1 x 136 mg plus 2 x 22.7 mg tablets
27.2 kg (60 lb)	1 x 136 mg tablet	2 x 136 mg tablets	3 x 136 mg tablets	4 x 136 mg tablets

Cats: Administer orally at 5 mg/kg (2.27 mg/lb) of body weight. The dose for dogs and cats may be administered either as a single daily dose or divided into two (2) equal daily doses administered at twelve (12) hour intervals. The dose should be continued for at least 2-3 days beyond cessation of clinical signs, to a maximum of 30 days.

Weight of Cat	**Once Daily Dosing Chart (5 mg/kg/day)**
5 lb (2.27 kg)	½ x 22.7 mg tablet
10 lb (4.5 kg)	1 x 22.7 mg tablet
15 lb (6.8 kg)	1 and ½ x 22.7 mg tablets or ½ x 68 mg tablet

K. Route of Administration

Oral

L. Species/Class

Dogs and cats

M. Indications

Enrofloxacin flavored antibacterial tablets are indicated for the management of diseases associated with bacteria susceptible to enrofloxacin. Enrofloxacin flavored antibacterial tablets are indicated for use in dogs and cats.

N. Reference Listed New Animal Drug

Baytril® Taste Tabs®; enrofloxacin; NADA 140-441; Elanco US Inc.

II. BIOEQUIVALENCE

The FD&C Act, as amended by the Generic Animal Drug and Patent Term Restoration Act (GADPTRA) of 1988, allows for an ANADA to be submitted for a generic version of an approved new animal drug (RLNAD). The ANADA sponsor is required to show that the generic product is bioequivalent to the RLNAD, which has been shown to be safe and effective. Effectiveness, target animal safety and human food safety data (other than tissue residue data) are not required for approval of an ANADA. If bioequivalence is demonstrated through a clinical endpoint study in a food-producing animal, then a tissue residue study to establish the withdrawal period for the generic product is also required.

For this ANADA, two *in vivo* blood-level studies were conducted to demonstrate product bioequivalence using the generic and RLNAD enrofloxacin 136 mg chewable tablets in dogs and 22.7 mg chewable tablets in cats. The RLNAD is available in 22.7, 68, and 136 mg chewable tablet sizes. The *in vivo* blood-level study in dogs was conducted in 18 healthy, fasted dogs, and the *in vivo* blood-level study in cats was conducted in 18 healthy, fasted cats. The pivotal parameters to evaluate bioequivalence are the observed maximum plasma drug concentration (C_{MAX}) and area under the concentration-time curve (AUC) from time 0 to the last sampling time before the first unquantifiable concentration after C_{MAX}.

Bioequivalence was demonstrated between the 136 mg Baytril® (enrofloxacin) Taste Tabs® antibacterial tablets and the 136 mg generic Enrofloxacin flavored antibacterial tablets in dogs, and the 22.7 mg Baytril® (enrofloxacin) Taste Tabs® antibacterial tablets and the 22.7 mg generic Enrofloxacin flavored antibacterial tablets in cats by the average bioequivalence approach as described in the Statistical Methods section below.

A biowaiver for the generic 22.7 mg and 68 mg flavored antibacterial tablets in dogs, and for the generic 68 mg and 136 mg flavored antibacterial tablets in cats was requested. Dissolution data was used to demonstrate that the generic 22.7 mg and 68 mg tablets are comparable to the generic 136 mg tablet strength used in the *in vivo* blood-level bioequivalence dog study, and the generic 68 mg and 136 mg tablets are comparable to the generic 22.7 mg tablet strength used in the *in vivo* blood-level bioequivalence cat study. Therefore, a biowaiver for the generic 22.7 mg and 68 mg generic tablets in dogs, and the generic 68 mg and 136 mg tablets in cats was granted. The study information is summarized below.

A. Blood-level Bioequivalence Study in Dogs

Title: A Masked, Balanced, Randomized, Two Period, Two Sequence, Single Oral Dose, Crossover BE Study of Enrofloxacin Flavored Antibacterial Tablets 136 mg and Baytril® Taste Tabs® Antibacterial Tablets 136 mg in Healthy Adult Beagle Dogs under Fasting Conditions. (Study No. 20235621)

Study Dates: April 29, 2021, to September 28, 2021

Study Locations:

In-life phase:	The Netherlands
Bioanalytical testing:	ON, Canada

Study Design:

Objective: The objective of this study was to determine the comparative *in vivo* blood-level bioequivalence for the generic 136 mg Enrofloxacin and the RLNAD 136 mg Baytril® (enrofloxacin) Taste Tabs® in fasted dogs.

Study Animals: Eighteen healthy intact male dogs between 8.5 months to 3 years of age and weighing 8.52 to 10.83 kg on study Day -1.

Experimental Design: A randomized, masked, two-period, two-sequence, single-dose crossover study conducted according to the Organization for Economic Cooperation and Development (OECD) Principles of Good Laboratory Practice.

Drug Administration: Each animal received 136 mg of either the generic or RLNAD enrofloxacin according to their randomized treatment sequence (generic/RLNAD or RLNAD/generic).

Measurements and Observations: The plasma concentrations of enrofloxacin were measured using a validated bioanalytical method. Pharmacokinetic parameters were determined for each animal individually in each period. Animal observations were made throughout the study for assessment of general health and adverse events.

Statistical Methods:

The laboratory study was conducted as a randomized, masked two-period, two-sequence, two-treatment, single-dose crossover design using 18 dogs with a 7-day washout between periods. Appropriate randomization of animal to sequence and pen/treatment order was performed. Primary variables evaluated were C_{MAX} and AUC. T_{MAX} was summarized and evaluated clinically.

A mixed-effect model was used to evaluate bioequivalence. The model included fixed effects of treatment, sequence and period, and a random effect of room and subject nested within sequence. Prior to the analysis, C_{MAX} and AUC were natural logarithm transformed. Bioequivalence is established because the back-transformed estimated upper and lower bounds of the 90% confidence interval for geometric mean ratios (generic:RLNAD) of both C_{MAX} and AUC are contained within the acceptance limits of 0.80 to 1.25.

Results:

As seen in the table below, C_{MAX} and AUC fall within the prescribed bounds (Table II.1.). The mean values of T_{MAX} obtained for the generic article and RLNAD were summarized.

Table II.1. Bioequivalence Evaluation

Parameter	Generic Mean	RLNAD Mean	Ratio◇	Lower 90% CI	Upper 90% CI
AUC (ng/mL)*hour	12292†	11613†	1.06	1.02	1.10
C_{MAX} (ng/mL)	2913†	2700†	1.08	1.03	1.13
T_{MAX} (hours) (SD)‡	2.5 (0.75)‡	2.0 (0.75)‡	NE	NE	NE

† Geometric mean
‡ Arithmetic mean and standard deviation (SD)
◇ Ratio = Test/Reference
CI = confidence interval
NE = not estimated

Adverse Reactions:

There were no serious adverse events reported during the study.

Conclusion:

The *in vivo* bioequivalence study demonstrated that the generic 136 mg Enrofloxacin flavored antibacterial tablets and the RLNAD 136 mg Baytril® (enrofloxacin) Taste Tabs® tablets are bioequivalent in dogs.

B. Blood-level Bioequivalence Study in Cats

Title: A Masked, Balanced, Randomized, Two Period, Two Sequence, Single Oral Dose, Cross Over Bioequivalence Study of Enrofloxacin Flavored Antibacterial Tablets 22.7mg and Baytril® Taste Tabs® Antibacterial Tablets 22.7mg in Healthy Cats under Fasted Conditions. (Study No. KFI-113-BF-3620)

Study Dates: May 10, 2021, to October 12, 2021

Study Locations:

In-life phase: ON, Canada

Bioanalytical testing: ON, Canada

Study Design:

Objective: The objective of this study was to determine the comparative *in vivo* blood-level bioequivalence data for the generic 22.7 mg Enrofloxacin and the RLNAD 22.7 mg Baytril® (enrofloxacin) Taste Tabs® in fasted cats.

Study Animals: Eighteen healthy neutered male cats between 447 to 1594 days of age and weighing 4.8 to 6.3 kg on study Day -5.

Experimental Design: A randomized, masked, two-period, two-sequence, single-dose crossover study conducted according to Good Laboratory Practice for Nonclinical Laboratory Studies.

Drug Administration: Each animal received 22.7 mg of either the generic or RLNAD enrofloxacin according to their randomized treatment sequence (generic/RLNAD or RLNAD/generic).

Measurements and Observations: The plasma concentrations of enrofloxacin were measured using a validated bioanalytical method. Pharmacokinetic parameters were determined for each animal individually in each period. Animal observations were made throughout the study for assessment of general health and adverse events.

Statistical Methods:

The laboratory study was conducted as a randomized, masked, two-period, two-sequence, two-treatment, single-dose crossover design using 18 cats with a 14-day washout between periods. Appropriate randomization of animal to sequence and pen/treatment order was performed. Primary variables evaluated were C_{MAX} and AUC. T_{MAX} was summarized and evaluated clinically.

A mixed-effect model was used to evaluate bioequivalence. The model included fixed effects of treatment, sequence and period, and a random effect of subject

nested within sequence. Prior to the analysis, C_{MAX} and AUC were natural logarithm transformed. Bioequivalence is established because the back-transformed estimated upper and lower bounds of the 90% confidence interval for geometric mean ratios (generic:RLNAD) of both C_{MAX} and AUC are contained within the acceptance limits of 0.80 to 1.25.

Results:

As seen in the table below, C_{MAX} and AUC fall within the prescribed bounds (Table II.2.). The mean values of T_{MAX} obtained for the generic article and RLNAD were summarized.

Table II.2. Bioequivalence Evaluation

Parameter	Generic Mean	RLNAD Mean	Ratio◇	Lower 90% CI	Upper 90% CI
AUC (ng/mL)*hour	14563†	14152†	1.03	0.99	1.07
C_{MAX} (ng/mL)	1283†	1243†	1.03	0.96	1.11
T_{MAX} (hours) (SD)‡	2.18 (1.54)‡	2.10 (1.42)‡	NE	NE	NE

† Geometric mean
‡ Arithmetic mean and standard deviation (SD)
◇ Ratio = Test/Reference
CI = confidence interval
NE = not estimated

Adverse Reactions:

There were no serious adverse events reported during the study.

Conclusion:

The *in vivo* bioequivalence study demonstrated that the generic 22.7 mg Enrofloxacin flavored antibacterial tablets and the RLNAD 22.7 mg Baytril® (enrofloxacin) Taste Tabs® tablets are bioequivalent in cats.

C. Bioequivalence Waiver

A pivotal *in vivo* blood bioequivalence study was conducted using the generic 136 mg enrofloxacin flavored antibacterial tablet strength in dogs and the generic 22.7 mg enrofloxacin flavored antibacterial tablet strength in cats. A biowaiver for the generic 22.7 mg and 68 mg tablets in dogs, and the generic 68 mg and 136 mg tablets in cats was requested. To qualify for a biowaiver for each of these product strengths, comparative *in vitro* dissolution studies were conducted to determine the dissolution profiles of the generic and RLNAD 22.7 mg, 68 mg, and 136 mg enrofloxacin chewable tablets. Comparisons were made between the following tablets:

- Generic 22.7 mg and generic 68 mg
- Generic 22.7 mg and generic 136 mg
- Generic 22.7 mg and RLNAD 22.7 mg
- Generic 68 mg and RLNAD 68 mg
- Generic 136 mg and RLNAD 136 mg

The objective was to satisfy similarity factor (f_2) criteria between the generic 136 mg tablet strength and the generic and/or RLNAD 22.7 mg and 68 mg tablet strengths, and to satisfy f_2 criteria between the generic 22.7 mg tablet strength and the generic and/or RLNAD 68 mg and 136 mg tablet strength.

Test conditions were as follows:

- Dissolution apparatus: USP Apparatus II
- Dissolution medium: 50 mM Citrate buffer, pH 4.0
- Dissolution medium volume: 1000 mL
- Temperature: 37 °C
- Paddle speed: 100 rpm
- Number of vessels: 12
- Data points: 5, 10, 15, 20, and 30 minutes

The generic drug lot number used in the *in vivo* bioequivalence study was the same lot used to support the *in vitro* profile comparisons. Analytical method validation was required to ensure that the quantification of drug concentrations in all samples was accurate and precise.

To allow use of mean data, the percent coefficient of variation at the earlier time points (e.g., 15 minutes) should not be more than 20%, and at other time points should not be more than 10%. The percent coefficient of variation for all generic product profiles was within acceptable limits. Only one measurement should be considered after 85% dissolution of one of the products. The f_2 should be greater than 50 to ensure sameness or equivalence of two profiles.

Study results demonstrate similar dissolution profiles for all comparisons. However, because of rapid dissolving characteristics (> 85% in 15 minutes) in all strengths, a dissolution profile comparison using the f_2 test is unnecessary. When comparative profiles between tablets do not require an f_2 test because of rapid dissolution or when the f_2 value is ≥ 50, the product strengths used in the comparison qualify for a biowaiver. Therefore, a biowaiver for the generic 22.7 mg and 68 mg enrofloxacin flavored antibacterial tablets in dogs, and the generic 68 mg and 136 mg enrofloxacin flavored antibacterial tablets in cats is granted.

III. HUMAN FOOD SAFETY

This drug is intended for use in dogs and cats. Because this new animal drug is not intended for use in food-producing animals, CVM did not require data pertaining to drug residues in food (i.e., human food safety) for approval of this ANADA.

IV. USER SAFETY

The product labeling contains the following information regarding safety to humans handling, administering, or exposed to Enrofloxacin:

For use in animals only. Keep out of reach of children.

Avoid contact with eyes. In case of contact, immediately flush eyes with copious amounts of water for 15 minutes. In case of dermal contact, wash skin with soap and water. Consult a physician if irritation persists following ocular or dermal exposure. Individuals with a history of hypersensitivity to quinolones should avoid this product.

In humans, there is a risk of user photosensitization within a few hours after excessive exposure to quinolones. If excessive accidental exposure occurs, avoid direct sunlight.

Keep out of reach of children. Not for human use. Consult a physician in cases of accidental ingestion by humans.

V. AGENCY CONCLUSIONS

The data submitted in support of this ANADA satisfy the requirements of section 512(c)(2) of the FD&C Act. The data demonstrate that Enrofloxacin, when used according to the label, is safe and effective for the indications listed in Section I.M. above.