510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K232604

B Applicant

Hangzhou Laihe Biotech Co., Ltd.

C Proprietary and Established Names

LYHER® Urine Marijuana (THC) Test Kit (Strip), LYHER® Urine Marijuana (THC) Test Kit (Cassette)

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
LDJ	Class II	21 CFR 862.3870 - Cannabinoid Test System	TX - Clinical Toxicology

II Submission/Device Overview:

A Purpose for Submission:

New device

B Measurand:

11-nor-Δ9-THC-9-COOH

C Type of Test:

Qualitative, lateral flow immunoassay

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The LYHER® Urine Marijuana (THC) Test Kit (Strip) and LYHER® Urine Marijuana (THC) Test Kit (Cassette) are rapid lateral flow immunoassays for the qualitative detection of THC-COOH in human urine. The test cut-off concentrations and the compounds the tests are calibrated to are as follows:

Test	Calibrator	Cut-off (ng/mL)
Marijuana (THC)	l1-nor-Δ9-THC-9-COOH	50

The drug screen tests are intended for prescription use only.

The tests provide only a preliminary result. A more specific alternate chemical method must be used in order to obtain a confirmed analytical test result. Gas Chromatography/Mass Spectrometry (GC/MS), Liquid Chromatography/Mass Spectrometry (LC/MS) and their tandem mass-spectrometer versions are the preferred confirmatory methods. Careful consideration and judgment should be applied to any drugs of abuse screen test result, particularly when evaluating preliminary positive results.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

None

IV Device/System Characteristics:

A Device Description:

The LYHER® Urine Marijuana (THC) Test Kit (Strip) and LYHER® Urine Marijuana (THC) Test Kit (Cassette) are immunochromatographic assays that use a lateral flow system for the qualitative detection of THC-COOH in human urine. The LYHER® Urine Marijuana (THC) Test Kit (Cassette) device consists of a cassette device, dropper, and package insert. The LYHER® Urine Marijuana (THC) Test Kit (Strip) device consists of a test strips and package insert.

B Principle of Operation:

The Urine Marijuana (THC) Test Kit is an immunoassay based on the principle of competitive binding. The metabolite of Marijuana (11-nor-Δ9-THC-9-COOH) which may be present in the

urine specimen compete against its respective drug conjugate for binding sites on their specific antibody.
During testing, a urine specimen migrates upward by capillary action. A drug, if present in the urine specimen below its cut-off concentration, will not saturate the binding sites of its specific antibody. The antibody will then react with the drug-protein conjugate and a visible colored line will show up in the test line region of the specific drug strip. The presence of drug above the cut-off concentration will saturate all the binding sites of the antibody. Therefore, the colored line will not form in the test line region.
A drug-positive urine specimen will not generate a colored line in the specific test line region of the strip because of drug competition, while a drug-negative urine specimen will generate a line in the test line region because of the absence of drug competition.
To serve as a procedural control, a colored line will always appear at the control line region, indicating that proper volume of specimen has been added and membrane wicking has occurred.

V Substantial Equivalence Information:

A Predicate Device Name(s):

BIOEASY Marijuana Test Dip Card 40, BIOEASY Marijuana Test Dip Card 20, BIOEASY Marijuana Test Strip 40, BIOEASY Marijuana Test Strip 20

B Predicate 510(k) Number(s):

K192515

C Comparison with Predicate(s):

Device & Predicate Device(s):	K232604	K192515
Device Trade Name	LYHER® Urine Marijuana (THC) Test Kit (Strip) and LYHER® Urine Marijuana (THC) Test Kit (Cassette)	BIOEASY Marijuana Test Dip Card 40, BIOEASY Marijuana Test Dip Card 20, BIOEASY Marijuana Test Strip 40, BIOEASY Marijuana Test Strip 2
General Device Characteristic Similarities		
Intended Use/Indications For Use	For the qualitative determination of Marijuana metabolites in human urine.	Same
Test Principle	Lateral flow immunochromatographic assay based on	Same

	competitive binding	
Specimen Type	Human Urine	Same
General Device Characteristic Differences		
Configurations	Strip, Cassette	Dip card, strip
Cut-off Values	Marijuana (THC) 50 ng/mL	Marijuana (THC) 20 ng/ml or 40 ng/ml

VI Standards/Guidance Documents Referenced:

None referenced.

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

Precision of the product was characterized at three different labs using 3 operators for strips or cassettes. The specimens were prepared for this study using drug-free urine specimens collected from volunteers. 11-nor-Δ9-THC-9-COOH was added to the drug-free urine to the following concentrations: 100 ng/ml (+100% cut off), 87.5 ng/ml (+75% cut off), 75 ng/ml (+50% cut off), 62.5 ng/ml (+25% cut off), 50 ng/ml (cut off), 37.5 ng/ml (-25% cut off), 25 ng/ml (-50% cut off), 12.5 ng/ml (-75% cut off), 0 ng/ml (-100% cut off). Each specimen was analyzed in 50 replicates (2 runs/day, 25 days) by each of the testing personnel at each lab by using three lots of the product according to the product labeling. The test results of the specimens at the concentrations at and below -25% of the cut off obtained by all the three personnel were all negative while the test results of the specimens at the concentration at and above +25% of the cut off value were all positive, see the representative results from one operator with strips below.

Lot	-100% cut off	-75% cut off	-50% cut off	-25% cut off	Cut off	25% cut off	50% Cut off	75% cut off	100% cut off
Lot1:2303321	0+/50-	0+/50-	0+/50-	0+/50-	39+/11-	50+/0-	50+/0-	50+/0-	50+/0-
Lot2:2303322	0+/50-	0+/50-	0+/50-	0+/50-	40+/10-	50+/0-	50+/0-	50+/0-	50+/0-
Lot3:2303323	0+/50-	0+/50-	0+/50-	0+/50-	39+/11-	50+/0-	50+/0-	50+/0-	50+/0-

2. Linearity:

Not applicable

3. Analytical Specificity/Interference:

a. Cross-reactivity

11-nor-Δ9-THC-9-COOH and structural analogues of 11-nor-Δ9-THC-9-COOH were spiked into negative urine. These urine specimens were tested by three different batches of the strips and cassettes according to the product labeling and each concentration of specimen was tested for 20 replicates. The lowest concentration that caused a positive result for each compound are listed below. There were no differences observed for stripes and cassettes.

Compound	Concentration (ng/mL)	%Cross Reactivity
Cannabinol	20000	0.25%
11-nor- Δ 8-THC-9 COOH	30	167%
11-nor- Δ 9 -THC-9 COOH	50	100%
Δ 8 -THC	15000	0.33%
Δ 9 -THC	15000	0.33%
(±)-11-Hydroxy-Δ9-THC	5000	1%
Cannabidiol	20000	0.25%

b. Interferences

The potential interference from compounds chemically dissimilar to target analyte, and known endogenous agents was also determined for the LYHER® Urine Marijuana (THC) Test Kit (Strip) and LYHER® Urine Marijuana (THC) Test Kit (Cassette). The potential interfering substances (the final concentration 100 μg/ml) were added at concentrations of 100 μg/ml to drug-free urine and target drugs urine with 11-nor-Δ9-THC-9-COOH concentrations at 25% below (37.5 ng/ml) and 25% above (62.5 ng/ml) cut-off levels. These urine samples were tested using three batches of each device. Compounds that showed no interference at a concentration of 100 μg/mL are summarized in the following tables. There were no differences observed for 3 different lots of devices (both strips and cassettes).

Substance	**Substance**	**Substance**
Acetaminophen	Erythromycin	Penicillin-G
Acetone	Ethanol	Pheniramine
Acetylsalicylic acid	Furosemide	Phenothiazine
Albumin	Gabapentin	Pregablin
Ampicillin	Glucose	Procaine
Ascorbic acid	Guaiacol glyceryl ether	Propoxyphene
Aspartame	Hemoglobin	Quinidine
Atropine	Ibuprofen	Ranitidine
Benzocaine	Isoproterenol	Riboflavin
Bilirubin	Isoproterenol	Sertraline
Caffeine	Ketamine	Sodium chloride
Chloroquine	Lidocaine	Sulindac
Chlorpheniramine	l-Phenylephrine	Theophylline
Creatine	Methadone	Tyramine
Dexbrompheniramine	Methylephedrine	β-Phenylethylamine
Dextromethorphan	Naproxen	Phencyclidine(PCP)
Dimenhydrinate	Niacinamide	Cocaine
Dimethylaminoantipyrine	Nicotine	Morphine
Diphenhydramine	Norephedrine	Methylamphetamine

Dopamine	Oxalic acid	MDMA
EDDP	Oxycodone	Amphetamine
Ephedrine	Pantoprazole	

c. Urine pH and specific gravity

To evaluate the potential effect of variances of urine specific gravity on the assays, sodium chloride was added to urine specimens containing target drugs at -/+25% of the cut off concentrations to achieve specific gravity results of 1.003,1.006, 1.0125, 1.019, 1.021, 1.025 and 1.032. Each solution was tested on 3 lots of the stripes and cassettes. The specimens were tested in 10 replicates.

To evaluate the potential effect of variances of urine pH on the assays, 0.1mol/L HCl or 0.1mol/l NaOH was added to urine specimens containing target drugs at -/+25% of the cut off concentrations to achieve pH 3, 4, 5, 6, 7, 8, 9. Each solution was tested on 3 lots of the candidate product. The specimens were tested in 10 replicates.

The results demonstrated that pH levels of 3 to 9 and specific gravity levels of 1.006 to 1.032 do not affect any cassette and strip results.

4. Assay Reportable Range:

Not applicable.

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

The device is traceable commercially available standards.

6. Detection Limit:

Not applicable.

7. Assay Cut-Off:

See the precision study in section VII A1 above.

B Comparison Studies:

1. Method Comparison with LC/MS:

Method comparison studies for the LYHER® Urine Marijuana (THC) Test Kit (Strip) and LYHER® Urine Marijuana (THC) Test Kit (Cassette) were performed in-house with three operators for each device. Operators ran at least 80 (40 negative and 40 positive) unaltered urine samples. The samples were blind labeled and compared to LC/MS results. The results are presented in the tables below:

Cassettes	Test result	Negative urine	<-50% cut off	-50% cut off~cut off	Cut off~+50%cut off	>+50%cut off

Operator 1	Negative	44	4	17	1	0
	Positive	0	0	0	24	15
Operator 2	Negative	44	4	16	2	0
	Positive	0	0	1	23	15
Operator 3	Negative	44	4	17	0	0
	Positive	0	0	0	25	15

Discordant Results of THC Cassettes

Operator	Specimen No.	LC/MS results	Results of Lyher kit
Operator 1	202301036	50.5	Neg
Operator 2	202301060	52.3	Neg
Operator 2	202301069	49.6	Pos
Operator 2	202301651	51.1	Neg

Strips	Test result	Negative urine	<-50% cut off	-50% cut off~cut off	Cut off~+50%cut off	>+50%cut off
Operator 1	Negative	44	4	17	2	0
	Positive	0	0	0	23	15
Operator 2	Negative	44	4	17	0	0
	Positive	0	0	0	25	15
Operator 3	Negative	44	4	16	2	0
	Positive	0	0	1	23	15

Discordant Results of THC Strips

Operator	Specimen No.	LC/MS results	Results of Lyher kit
Operator 3	202301036	50.5	Neg
Operator 3	202301060	52.3	Neg
Operator 1	202301099	52.3	Neg
Operator 1	202301651	51.1	Neg

2. Matrix Comparison:

Not applicable

C Clinical Studies:

1. Clinical Sensitivity:

Not applicable

2. Clinical Specificity:

Not applicable

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

Not applicable

D Clinical Cut-Off:

Not applicable.

E Expected Values/Reference Range:

Not applicable.

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.