September 5, 2019

Qingdao Hightop Biotech Co., Ltd.
% Joe Shia, Manager
LSI International
504 E. Diamond Ave., Suite I
Gaithersburg, MD 20877

Re: K192123
Trade/Device Name: HIGHTOP Pregnancy Rapid Test Cassette
HIGHTOP Pregnancy Rapid Test Strip
HIGHTOP Pregnancy Rapid Test Midstream
Regulation Number: 21 CFR 862.1155
Regulation Name: Human chorionic gonadotropin (HCG) test system
Regulatory Class: Class II
Product Code: LCX
Dated: July 26, 2019
Received: August 6, 2019

Dear Joe Shia:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Kellie Kelm, Ph.D.
Acting Director
Division Director of Chemistry and Toxicology Devices
OHT7: Office of In Vitro Diagnostics
and Radiological Health
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K192123

Device Name
HIGHTOP Pregnancy Rapid Test Cassette
HIGHTOP Pregnancy Rapid Test Strip
HIGHTOP Pregnancy Rapid Test Midstream

Indications for Use *(Describe)*
HIGHTOP Pregnancy Rapid Test Cassette is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

HIGHTOP Pregnancy Rapid Test Strip is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

HIGHTOP Pregnancy Rapid Test Midstream is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

Type of Use *(Select one or both, as applicable)*

☐ Prescription Use (Part 21 CFR 801 Subpart D) ☒ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

This section applies only to requirements of the Paperwork Reduction Act of 1995.

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K192123
510(k) SUMMARY

1. Date: September 4, 2019

2. Submitter:
Qingdao Hightop Biotech Co., Ltd.
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Shandong, China 266112

3. Contact person:
Joe Shia
LSI International Inc.
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4. Device Name:
HIGHTOP Pregnancy Rapid Test Cassette
HIGHTOP Pregnancy Rapid Test Midstream
HIGHTOP Pregnancy Rapid Test Strip

Classification: Class II
Product Code LCX
CFR 862.1155

5. Predicate Devices: WONDFO One Step HCG Urine Pregnancy Test (k043443)

6. Device Description

HIGHTOP Pregnancy Rapid Test measures the presence of the hormone Human Chorionic Gonadotrophin (HCG) in human urine for the detection of pregnancy. The test devices are in three different formats: Strip, Cassette and Midstream. Each test kit contains a test device sealed in a desiccated aluminum pouch and a package insert. The cassette format also contains a dropper.

7. Intended Use

HIGHTOP Pregnancy Rapid Test Cassette is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

HIGHTOP Pregnancy Rapid Test Midstream is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

HIGHTOP Pregnancy Rapid Test Strip is intended for the qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy.

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8. Substantial Equivalence Information

Similarities		
Item	Candidate device	Predicate device k043443, WONDFO One Step HCG Urine Pregnancy Test
Intended use	Early detection of pregnancy	Early detection of pregnancy
Specimen	Urine	Urine
Assay technical	Immunochromatographic assay	Immunochromatographic assay
Sensitivity	25 mIU/mL	25 mIU/mL
Results	Qualitative	Qualitative
Target user	Over the counter use	Over the counter use
Device format	Strip, Cassette, Midstream	Strip, Cassette, Midstream
Reading Time	5 minutes	5 minutes

9. Test Principle

The test uses colloidal gold immunochromatography assay to detect human chorionic gonadotropin (hCG) in urine at cut-off 25 mIU/ml. When hCG concentration is higher than the cut-off, it will bind to rat anti β-hCG monoclonal antibody which is labelled by colloidal gold. As the sample migrates on the nitrocellulose matrix of test strip by tomographic action, the complexes of detector antibody with β-hCG are separately captured to α-hCG antibody that has been immobilized on test strip, a red line appears in test zone (T) and the test result is positive. When hCG concentration is lower than the cut-off, there is no red line shows in test zone (T) and test result is negative. There is goat anti-mouse IgG polyclonal antibody immobilized in nitrocellulose filter membrane control zone (C) that bind to mouse anti α-hCG monoclonal antibody labelled by colloidal gold. When proper amount sample is applied a red line will appear in control zone (C).

10. Performance Characteristics

A. Analytical performance

a. Precision/Reproducibility/Sensitivity

Negative urine was spiked with hCG standard (traceable to the 5th WHO) to hCG concentrations of 0, 12.5, 18.75, 22.5, 25, 50, 100 and 200mIU/mL. The spiked

samples were measured in replicates using 3 different lots for each format. Tests were performed by three different operators for each sample concentration in 10 runs per day for 5 days. The results are summarized in the table below:

Strip format

hCG Concentration (mIU/mL)	Lot 1		Lot 2		Lot 3		Total result		% Negative	% Positive
	-	+	-	+	-	+	-	+		
0	50		50		50		150		100%	
12.5	50		50		50		150		100%	
18.75	50		50		50		150		100%	
22.5	23	27	25	25	23	27	71	79	47.33%	52.67%
25		50		50		50		150		100%
50		50		50		50		150		100%
100		50		50		50		150		100%
200		50		50		50		150		100%

Cassette format

hCG Concentration (mIU/mL)	Lot 1		Lot 2		Lot 3		Total result		% Negative	% Positive
	-	+	-	+	-	+	-	+		
0	50		50		50		150		100%	
12.5	50		50		50		150		100%	
18.75	50		50		50		150		100%	
22.5	26	24	24	26	26	24	76	74	50.67%	49.33%
25		50		50		50		150		100%
50		50		50		50		150		100%
100		50		50		50		150		100%
200		50		50		50		150		100%

Midstream format

hCG Concentration (mIU/mL)	Lot 1		Lot 2		Lot 3		Total result		% Negative	% Positive
	-	+	-	+	-	+	-	+		
0	50		50		50		150		100%	
12.5	50		50		50		150		100%	
18.75	50		50		50		150		100%	
22.5	26	24	24	26	25	25	75	75	50%	50%
25		50		50		50		150		100%
50		50		50		50		150		100%
100		50		50		50		150		100%
200		50		50		50		150		100%

Based on the above results, the sensitivity of HIGHTOP Pregnancy Rapid Test is demonstrated to be 25 mIU/mL.

b. Linearity/assay reportable range:
Linearity is not applicable since this is a qualitative test.

c. Hook effect test:
Negative urine samples were spiked with varying hCG concentrations (3125, 6250, 62500, 125000, 250000, 500000, 1000000 and 2000000 mIU/mL). All tested concentrations gave a positive result. The results demonstrated that no hook effect was observed at hCG concentrations ranging from 3125 to 2000000 mIU/mL.

d. Traceability, Stability, Expected values (controls, calibrators, or methods):
HIGHTOP Pregnancy Rapid Test is calibrated against reference material traceable to WHO International Standard 5th edition.
A shelf-life stability test of the devices was performed by accelerated testing. The results showed that the devices were stable for 24 months when stored at 4~30℃ in the sealed foil pouch. Real time stability studies are ongoing.

e. Specificity and cross reactivity
To evaluate specificity and cross-reactivity, negative and positive urine samples (10 mIU/mL and 25 mIU/mL) were spiked with various concentrations of glycoprotein hormones LH, FSH, TSH and hCG β-core fragment. The results showed that there is no interference at 500 mIU/mL LH, 1000 mIU/mL FSH, 1000 mIU/L TSH and 2,000,000 pmol/L hCG β-core fragment for both negative and positive urine samples.

f. Interfering substance
To evaluate the potential for interference by certain exogenous compounds, each interfering substance was prepared by diluting stock interfering material to the desired concentration. Urine samples containing 10 mIU/mL and 25 mIU/mL hCG were spiked with the interfering substance to obtain the desired test concentration. No interferences were observed from exogenous compounds at the following concentrations for both negative and positive hCG urine samples.

Substances	**Concentration**
Acetaminophen	20mg/dL
Acetoacetic Acid	2000mg/dL
Asorbic Acid	20mg/dL
B-hydroxybutyrate	2000mg/dL
Caffeine	20mg/dL
Ephedrine	20mg/dL
Gentisic Acid	20mg/dL
Phenylpropanolamine	20mg/dL
Salicylic Acid	20mg/dL
Phenothiazine	20mg/dL
EDTA	80mg/dL

Acetylsalicylic Acid	20mg/dL
Benzoylecgonine	10mg/dL
Cannabinol	10mg/dL
Codeine	6ug/dL
Ethanol	1.0%
Methanol	10%
Albumin	2000mg/dL
Glucose	2000mg/dL
Bilirubin	2mg/dL
Atropine	20mg/dL
Estriol-17-beta	1400ug/dL
Hemoglobin	500mg/dL
Pregnanediol	1500ug/dL
Thiophene	20mg/dl
Ampicillin	20mg/dl
Tetracycline	20mg/dl
Ketone	20mg/dl

To evaluate potential interference from changes in pH, urine samples containing 10 mIU/mL and 25 mIU/mL hCG were tested at pH values of 4, 5, 6, 7, 8 and 9. The results indicated that changes in pH range of 4~9 do not interfere in the results that were either positive or negative for hCG.

To evaluate potential interference from changes in specific gravity, urine samples containing 10 mIU/mL and 25 mIU/mL hCG were tested at density values ranging from 1.002, 1.009, 1.012, 1.018, 1.028 and 1.032. The results indicated that changes in specific gravity do not interfere in the results that were either positive or negative for hCG.

B. Method comparison study

Method comparison with predicate device

The performance of the new device was compared to the predicate test. Urine samples were collected from 120 women presenting to test for pregnancy at OB/GYN Physician's offices. Approximately half of the 120 women were suspected to be pregnant and most of them are in the early stage of less than 5 weeks. All samples were stored in refrigerators after collection and prior to testing by health professionals. All samples were tested by ten different health professionals at the 3 OB/GYN Physician's offices with the proposed and the predicate devices.

Strip Format		Predicate device	
		Positive	Negative
HIGHTOP Rapid Pregnancy Test	Positive	57	0
	Negative	1	62

Cassette	Predicate device

		Positive	Negative
HIGHTOP Rapid Pregnancy Test	Positive	56	0
	Negative	2	62

Midstream		Predicate device	
		Positive	Negative
HIGHTOP Rapid Pregnancy Test	Positive	57	0
	Negative	1	62

The above results indicate an over 96% agreement between the proposed and the predicate.

C. Lay person study:

300 women's individual pregnancy status was self-tested. Women with varying educational and occupational backgrounds from three sites were chosen for the study. Each subject tested her own urine sample using the candidate device according to the package insert. Each subject also provided a sample for professional testing with the candidate device as well.

HIGHTOP Pregnancy Rapid Test Strip		Professional	
		+	-
Lay person	+	49	0
	-	0	51

HIGHTOP Pregnancy Rapid Test Cassette		Professional	
		+	-
Lay person	+	47	0
	-	0	53

HIGHTOP Pregnancy Rapid Test Midstream		Professional	
		+	-
Lay person	+	52	0
	-	0	48

From the above tables, the lay person results showed 100% positive and negative conformity with the professional results.

Each lay person was given a questionnaire to assess the readability of the labeling. The results of the questionnaire reflected that the consumers found the test easy to

use and that they did not have trouble understanding the labeling and interpreting the results.

11. Conclusion

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