



**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY ONLY**

**I Background Information:**

**A 510(k) Number**

K252607

**B Applicant**

Hangzhou Alltest Biotech Co.,Ltd

**C Proprietary and Established Names**

AllTest Urinary Tract Infection Test

**D Regulatory Information**

Product Code(s)	Classification	Regulation Section	Panel
JMT	Class I, meets the limitations of exemptions in 21 CFR 862.9 (c)(9)	21 CFR 862.1510 - Nitrite (Nonquantitative) Test System	CH - Clinical Chemistry
LJX	Class I, meets the limitations of exemptions in 21 CFR 862.9 (c)(9)	21 CFR 864.7675 - Leukocyte peroxidase test	HE - Hematology

**II Submission/Device Overview:**

**A Purpose for Submission:**

New Device

**B Measurand:**

Urinary nitrite and leukocytes

**C Type of Test:**

## Qualitative urinalysis

### III Intended Use/Indications for Use:

#### A Intended Use(s):

See Indications for Use below.

#### B Indication(s) for Use:

The AllTest Urinary Tract Infection Test is for the qualitative detection of Leukocytes (white blood cells) and nitrite in urine as an aid in the screening of a Urinary Tract infection (UTI). It is intended for over-the-counter home use only.

#### C Special Conditions for Use Statement(s):

OTC - Over The Counter

#### D Special Instrument Requirements:

Not Applicable

### IV Device/System Characteristics:

#### A Device Description:

AllTest Urinary Tract Infection Test is an in vitro diagnostic device for qualitative detection of leukocytes and nitrite in urine. The test uses the midstream collection method to detect nitrite and leukocytes in human urine. The device is composed of two-color pads aligned on a strip. One pad is employed for testing leukocytes and the other for nitrite by visually reading the color change of the pad and comparing with the corresponding blocks on a color chart. and the result for each pad is determined based on the minimum color distance between the developed colors and calibration colors. The test includes the following reactive reagents:

<b>Leukocytes (LEU)</b>	0.5% w/w pyrrole amino acid ester 0.4% w/w diazonium salt 99.1% w/w buffer and nonreactive ingredients
<b>Nitrite (NIT)</b>	4.5% w/w p-aminobenzene sulfonamide 1.5% w/w 1,2,3,4-tetrahydro-benzo(h)quinolon-3-pheno; 94% w/w buffer and nonreactive ingredients

#### B Principle of Operation:

The AllTest Urinary Tract Infection Test measures the color developed in 2 reaction zones (leukocytes and nitrite pads) on the test strips following application of a urine sample. The developed colors are then compared to calibration colors located on the AllTest color chart card and the result for each pad is determined based on the minimum color distance between the developed colors and calibration colors.

The leukocytes test uses the hydrolysis of an indoxyl ester derivative through the action of leukocyte esterase. The liberated indoxyl ester reacts with a diazonium salt to produce a colored compound (pink to purple).

The nitrite test uses the conversion of nitrate to nitrite by the action of p-arsanilic acid to form a diazonium compound in an acid medium. This compound then couples with 1, 2, 3, 4-tetrahydrobenzo (h) quinoline to produce a pink color.

**V Substantial Equivalence Information:**

**A Predicate Device Name(s):**

Healgen URS Test Strips

**B Predicate 510(k) Number(s):**

K231045

**C Comparison with Predicate(s):**

<b>Device &amp; Predicate Device(s):</b>	<u>K252607</u>	<u>K231045</u>
Device Trade Name	AllTest Urinary Tract Infection Test	Healgen URS Test Strips
<b>General Device Characteristic Similarities</b>		
Intended Use/Indications For Use	For the detection of nitrite and leukocytes in urine.	Same
Nitrite test methodology	By conversion of nitrate to nitrite using the action of p-arsanilic acid to form a diazonium compound in an acid medium. This compound then couples with 1, 2, 3, 4 - tetrahydrobenzo (h) quinoline to produce a pink color.	Same
Leukocyte test methodology	By hydrolysis of an indoxyl ester derivative through the action of leukocyte esterase. The liberated indoxyl ester reacts with a diazonium salt to produce a colored compound (pink to purple).	Same

Sample Type	Human urine	Same
Conditions for use	Over-the-Counter	Same
<b>General Device Characteristic Differences</b>		
Test Read Time	1 minute	2 minutes

## VI Standards/Guidance Documents Referenced:

None were referenced.

## VII Performance Characteristics (if/when applicable):

### A Analytical Performance:

#### 1. Precision/Reproducibility:

The precision study was performed at three different sites with two operators at each site. The evaluation included three (3) replicate assays over five (5) days. A total of forty-five (45) assay results on each of eight levels of control were obtained. All sample concentrations were masked. Three lots of the device were used with each level of control. The obtained results are listed in the following tables.

Control	Analyte	Concentration	Expected Value	N	% Agreement with Expected results
Level 1	Leukocyte	0 cells/ $\mu$ L	Negative	45	100
	Nitrite	0 mg/dL	Negative	45	100
Level 2	Leukocyte	15 cells/ $\mu$ L	Trace (15)	45	100
	Nitrite	0 mg/dL	Negative	45	100
Level 3	Leukocyte	70 cells/ $\mu$ L	Small (70)	45	100
	Nitrite	0 mg/dL	Negative	45	100
Level 4	Leukocyte	125 cells/ $\mu$ L	Moderate (125)	45	100
	Nitrite	0 mg/dL	Negative	45	100
Level 5	Leukocyte	500 cells/ $\mu$ L	Large (500)	45	100
	Nitrite	0 mg/dL	Negative	45	100
Level 6	Leukocyte	0 cells/ $\mu$ L	Negative	45	100
	Nitrite	0.1 mg/dL	Positive	45	100
Level 7	Leukocyte	0 cells/ $\mu$ L	Negative	45	100
	Nitrite	0.3 mg/dL	Positive	45	100
Level 8	Leukocyte	70 cells/ $\mu$ L	Small (70)	45	100
	Nitrite	0.1 mg/dL	Positive	45	100

#### 2. Linearity:

Not Applicable.

3. Analytical Specificity/Interference:

Potentially interfering substances were added to negative urine or urine with different leukocyte and nitrite concentrations. These samples were tested with three lots of the AllTest Urinary Tract Infection Test by three different operators (one operator per lot). The following substances showed no interference with the tests at the specified concentrations.

Substances	Concentration (mg/dL)
Albumin	1000
Ammonium Chloride	400
Ascorbic Acid	100
Bilirubin	10
Ciprofloxacin	1
Creatinine	600
Fructose	18
Galactose	15
Glucose	500
Glycine	900
Hemoglobin	100
Lactose	29
Oxalic Acid	1
Phenazopyridine	30
Phenolphthalein	4
Potassium Chloride	1200
Riboflavin	50
Sodium Nitrate	10
Sodium Nitrite*	10
Sodium Phosphate	1000
Sulfamethoxazole	40
Theophylline	4
Urea	4000

\* This interferent is tested for Leukocyte results only.

High glucose levels ( $\geq 1000$  mg/dL) and high ascorbic acid ( $\geq 150$  mg/dL) may decrease leukocyte readings. High ascorbic acid ( $\geq 150$  mg/dL) may cause a false negative nitrite reading.

To investigate the effect of urine specific gravity and urine pH on the AllTest Urinary Tract Infection Test, urine samples, with 1.000 to 1.035 specific gravity and urine samples with pH 5 to 9 were tested at different leukocyte and nitrite concentrations. The test results show that pH  $> 8.0$  may cause false positive leukocyte readings, and specific gravity  $\geq 1.035$  may cause false negative leukocyte readings. Neither pH nor specific gravity affects nitrite testing.

To address the observed interference, the labeling indicates that dehydration (high specific gravity), high glucose, and high vitamin C (ascorbic acid) may interfere with results. The labeling also describes that urine with abnormal color (e.g., bright yellow or green) should not be tested.

#### Sample Carryover

A sample carryover study was performed. Three (3) lots of test strips were used for testing. The study was performed by dipping the test strip into the sample and holding the test strip vertically upward or downward for 10 seconds to allow the sample flow from one pad to the other pad (e.g., i.e., runover of high concentration leukocyte samples from the leukocyte pad to the nitrite pad and runover of high-concentration nitrite samples from the nitrite pad to the leukocyte pad). Testing was also repeated in the other direction. The study demonstrated that carryover (runover) does not impact the test results.

#### 4. Assay Reportable Range:

The results of the analytical studies support the following measurement ranges:

Analyte	Measurement Range
Leukocytes	qualitative: Negative, Trace, +, ++, +++ Semi-quantitative: Negative, 15, 70, 125, 500 (cells/ $\mu$ L)
Nitrite	qualitative: Negative, Positive

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

##### Traceability

The nitrite test is traceable to NIST SRM 8040 and the leukocyte pad is traceable to a commercially available solution.

##### Stability

The sponsor provided information to support that the device is stable for 24 months when stored at 2-30°C based on real-time stability studies. The package insert recommends that users store the strips at 15-30°C (59-86°F).

The sponsor instructs the user to use the test strip immediately after the foil pouch is opened based on the results of the open-pouch stability study that demonstrated an open-pouch stability of 2 hours.

#### 6. Detection Limit:

See Assay Cut-off section below.

#### 7. Assay Cut-Off:

A sensitivity study was performed to evaluate the lower limits of detection for each analyte on the device. Urine samples were spiked to known concentrations of each analyte. These

samples were then diluted to the lowest positive concentrations that are indicated on the color chart. Each sample was tested in duplicate (2) with three (3) device lots by five (5) different operators in a total of 30 determinations per sample. The sponsor defined the LOD as the concentration of analyte that produces positive test results > 50% of the time. The results support the claim that the sensitivity of the leukocyte test is 15 cells/ $\mu$ L and the sensitivity of the nitrite test is 0.05 mg/dL.

Leukocyte Concentration (cells/ $\mu$ L)	Negative	Positive	Limit of Detection
30	0	30	100%
<b>15</b>	<b>0</b>	<b>30</b>	<b>100%</b>
10	16	14	47%
5	28	2	7%
3	30	0	0

Nitrite Concentration (mg/dL)	Negative	Positive	Limit of Detection
0.1	0	30	100%
0.08	0	30	100%
0.06	3	27	90%
<b>0.05</b>	<b>14</b>	<b>16</b>	<b>53%</b>
0.04	30	0	0

The sponsor provided studies to support the recommended wetting time (1-2 seconds) and the recommended reading time (1 minute), and the AllTest Urinary Tract Infection Test can be correctly read under fluorescent, incandescent, and natural lighting conditions.

## B Comparison Studies:

### 1. Method Comparison with Predicate Device:

Three (3) sites were selected to perform the lay-user studies. Two hundred and eleven (211) lay users with UTI symptoms were recruited to test their own urine sample using the AllTest Urinary Tract Infection Test. Laypersons performed one test with the AllTest Urinary Tract Infection Test according to the product insert and then collected a sample of their urine for comparison testing by healthcare professionals using the predicate device.

The results obtained by the lay users using the AllTest Urinary Tract Infection Test compared to the results obtained by the healthcare professionals using the predicate device when used following its product insert are summarized below.

Results from 211 subjects testing their own urine samples using the midstream collection method for leukocytes:

Leukocytes	HCP Results (predicate device)
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		Large (+++)	Moderate (++)	Small (+)	Trace	Negative	Total
Layperson Results (candidate device)	Large (+++)	17	2	0	0	0	19
	Moderate (++)	1	40	0	0	0	41
	Small (+)	0	3	43	2	0	48
	Trace	0	0	3	28	0	31
	Negative	0	0	0	2	70	72
Total		18	45	46	32	70	211
% Agreement (Exact Match)		94.4	88.9	93.4	87.5	100.0	
% Agreement (+/- Color Block)		100	100	100	100	100	

Results from 211 subjects testing their own urine samples using the midstream collection method for nitrite:

Nitrite		HCP Results (predicate device)		
		Positive	Negative	Total
Layperson Results (candidate device)	Positive	100	0	100
	Negative	1	110	111
Total		101	111	211
% Agreement (Exact Match)		99	100	

Lay users were also given surveys on the ease of understanding the package insert instructions. All lay users indicated that the device instructions can be easily followed. A The sponsor conducted a Flesch-Kincaid reading analysis on the package insert and the score revealed a reading grade level of less than 8.

2. Matrix Comparison:

Not Applicable. This device is intended to be used for urine samples using the midstream collection method.

**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:**

The following information is provided in the labeling:

TEST STRIP RESULTS		RECOMMENDATIONS
Leukocytes (LEU)	Nitrite (NIT)	
Negative	Negative	No sign of UTI detected. However, if you still have symptoms, consult your physician; there are some cases of UTI that the test may not detect.
Trace	Negative	Results suggest additional testing is required. Test again the following day with a new strip. If you have symptoms or if you get another trace leukocyte result, consult with your physician.
Negative or Trace	Positive	Results suggest a sign of a UTI. Consult your physician immediately.
Positive +, ++, +++	Positive	Results suggest a sign of a UTI. Consult your physician immediately.
Positive +, ++, +++	Negative	Results suggest a sign of a UTI. Repeat the test next time you urinate using a new test strip. Make sure to wash the genital area first. If LEU is still positive, consult your physician.

Interpret the results by comparing the test pads to the color blocks on the foil pouch. Match the color of the test pad to the closest color block on the foil pouch.

**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.