



**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY AND INSTRUMENT**

**I Background Information:**

**A 510(k) Number**

K241869

**B Applicant**

VivaChek Biotech (Hangzhou) Co., Ltd

**C Proprietary and Established Names**

BioSieve™ Fentanyl FIA Home Test Kit; BioSieve™ Fentanyl FIA Pro Test Kit; BioSieve™ Toxismart Reader

**D Regulatory Information**

Product Code(s)	Classification	Regulation Section	Panel
NGL	Class II	21 CFR 862.3650 - Opiate Test System	TX - Clinical Toxicology
KHO	Class I	21 CFR 862.2560 - Fluorometer for clinical use	CH - Clinical Chemistry

**II Submission/Device Overview:**

**A Purpose for Submission:**

Addition of new claims (OTC) to a cleared device.

**B Measurand:**

Fentanyl

**C Type of Test:**

Qualitative, fluorescence immunoassay (FIA)

### **III Intended Use/Indications for Use:**

#### **A Intended Use(s):**

See Indications for Use below.

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

BioSieve™ Fentanyl FIA Home Test Kit is a fluorescence immunoassay (FIA) for the qualitative determination of fentanyl in human urine at a cutoff concentration of 1.0 ng/mL. The assay is intended for use with BioSieve™ Toxismart Reader.

The test provides only preliminary test results. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. GC/MS or LC/MS is the preferred confirmatory method.

BioSieve™ Fentanyl FIA Pro Test Kit is a fluorescence immunoassay (FIA) for the qualitative determination of fentanyl in human urine at a cutoff concentration of 1.0 ng/mL. The assay is intended for use with BioSieve™ Toxismart Reader.

It is for in vitro diagnostic use only.

The tests provide only preliminary results. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas Chromatography/Mass Spectrometry (GC/MS) or Liquid Chromatography/Tandem Mass Spectrometry (LC/MS-MS) is the preferred confirmatory method.

Clinical consideration and professional judgment should be exercised with any drug test result, particularly when the preliminary test result is positive.

BioSieve™ Toxismart Reader is a portable fluorescence instrument for in vitro diagnostic use only. The Reader is designed to perform in vitro diagnostic tests on urine specimens. This Reader is intended for OTC use.

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

OTC - Over the Counter

#### **D Special Instrument Requirements:**

BioSieve™ Toxismart Reader

### **IV Device/System Characteristics:**

#### **A Device Description:**

The test system consists of a test strip enclosed in a plastic cassette (the test device), a dropper, the BioSieve™ Toxismart Reader, and associated labeling. External quality control materials are recommended but not included. The test device is the same physical device as was cleared in k240124.

## **B Principle of Operation:**

The BioSieve™ Fentanyl FIA Test Kit uses the principle of competitive and fluorescence immunochromatography. The nitrocellulose membrane test area (T) of the test strip is coated with fentanyl-bovine serum albumin conjugate, and the quality control area (C) is coated with goat anti-rabbit IgG polyclonal antibody. Both Fentanyl monoclonal antibody and rabbit IgG polyclonal antibody labeled with fluorescent microspheres are embedded on the conjugate pad. The labeled antibody will flow forward with the sample when the urine sample is applied to the sample well of the test device. When the concentration of fentanyl in the sample is higher than or equal to the cut-off of the product, it will compete with the corresponding conjugate coated on the test area (T) to bind to the fluorescently labeled monoclonal antibody. Thus, fluorescence signal rendering of the test line is inhibited, and the result is positive. If the sample does not contain fentanyl or its concentration is lower than the cut-off of the product, the corresponding conjugate on the test line reacts with sufficient fluorescently-labeled monoclonal antibodies. Thus, the test line will develop a fluorescence signal and the result is negative. The quality control area (C) will also develop a fluorescence signal, indicating that the testing has been performed correctly.

## **C Instrument Description Information:**

### **1. Instrument Name:**

BioSieve™ Toxismart Reader

### **2. Specimen Identification:**

Each sample is assigned a numerical identifier.

### **3. Specimen Sampling and Handling:**

Specimen collection, preparation, and handling conditions are described in the package insert of the assay.

### **4. Calibration:**

The analyzer is factory calibrated and does not need to be recalibrated by the operator.

### **5. Quality Control:**

Quality control materials are recommended but not provided.

## **V Substantial Equivalence Information:**

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

BioSieve™ Fentanyl FIA Test Kit; BioSieve™ ToxiSmart FIA Reader

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

K240124

**C Comparison with Predicate(s):****Comparison of BioSieve™ Fentanyl FIA Home/Pro Test Kit to the Predicate Device**

<b>Device &amp; Predicate Device(s):</b>	<u>K241869</u>	<u>K240124</u>
Device Trade Name	BioSieve™ Fentanyl FIA Home Test Kit; BioSieve™ Fentanyl FIA Pro Test Kit	BioSieve™ Fentanyl FIA Test Kit
<b>General Device Characteristic Similarities</b>		
Intended Use/Indications For Use	For the qualitative determination of fentanyl in human urine.	Same
Calibrator and Cut-Off Values	Fentanyl (FTY) 1 ng/mL	Same
Methodology	Competitive binding, lateral flow immunochromatographic assays based on the principle of antigen antibody immunochemistry	Same
Specimen Type	Urine	Same
Configurations	Cassette	Same
Analyzer	Immunofluorescence Analyzer	Same
Storage	2-30 °C	Same
<b>General Device Characteristic Differences</b>		
Use Settings	Over-the-counter use	Prescription use only

**Comparison of BioSieve™ Toxismart Reader to the Predicate Device**

<b>Device &amp; Predicate Device(s):</b>	<u>K241869</u>	<u>K240124</u>
Device Trade Name	BioSieve™ Toxismart Reader	BioSieve™ ToxiSmart FIA Reader
<b>General Device</b>		

<b>Device &amp; Predicate Device(s):</b>	<u>K241869</u>	<u>K240124</u>
<b>Characteristic Similarities</b>		
Intended Use/Indications For Use	Immunofluorescence analyzer designed to perform in vitro diagnostic tests on clinical specimens including drug urine test.	Same
Principles of Assay Operation	Competitive immunofluorescence immunoassay	Same
Calibration Check	A Quality control test device is supplied with the Reader and used to check the Reader optics and calculation systems.	Same
<b>General Device Characteristic Differences</b>		
Test Modes	Standard test	Standard test Quick test

## VI Standards/Guidance Documents Referenced:

None referenced.

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

### A Analytical Performance:

#### 1. Precision/Reproducibility:

Provided in k240124.

#### 2. Linearity:

Not applicable, this device is intended for qualitative use only.

#### 3. Analytical Specificity/Interference:

Provided in k240124.

#### 4. Assay Reportable Range:

Not applicable, this device is intended for qualitative use only.

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

Provided in k240124.

6. Detection Limit:

Provided in k240124.

7. Assay Cut-Off:

Provided in k240124.

8. Accuracy (Instrument):

See accuracy study in Section VII.B.1.

9. Carry-Over:

Provided in k240124.

**B Comparison Studies:**

1. Method Comparison with Predicate Device:

Provided in k240124.

2. Matrix Comparison:

Not applicable. The assay is intended to be used with urine samples only.

**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.

## F Other Supportive Instrument Performance Characteristics Data:

### 1) Lay User Study:

A lay user study was performed at three intended user sites with 140 lay persons. They had diverse educational and professional backgrounds and ranged in age from 21 to >50 years. Urine samples were prepared at the following concentrations: -100%, +/-75%, +/-50%, +/-25% of the 1 ng/mL cut-off, by spiking fentanyl into drug free-pooled urine specimens. Each sample was aliquoted into individual containers, blind-labeled and randomized. Testing was conducted using one lot of BioSieve™ Fentanyl FIA Test Kit and a total of 8 BioSieve™ Toxismart Readers. Each participant was provided with the package insert, one blind labeled sample and a device. The concentrations of the samples were confirmed by LC/MS. The results are summarized below:

% of Cutoff	Number of samples	Fentanyl Concentration by GC/MS (ng/mL)	Lay Person Results		Percentage of Correct Results (%)
			No. of Positive	No. of Negative	
<b>-100% Cutoff</b>	20	0	0	20	100
<b>-75% Cutoff</b>	20	0.248	0	20	100
<b>-50% Cutoff</b>	20	0.504	0	20	100
<b>-25% Cutoff</b>	20	0.745	0	20	100
<b>+25% Cutoff</b>	20	1.267	20	0	100
<b>+50% Cutoff</b>	20	1.508	20	0	100
<b>+75% Cutoff</b>	20	1.768	20	0	100

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

### 2) Effect of Temperature and Humidity:

A study was conducted to investigate the effect of using a test device outside of the temperature and humidity operating conditions. The product labeling instructs the operator to allow the test device to reach operating temperature (64.4-77°F, 18-25°C) prior to use. The claimed humidity operating range for the system is 10 to 90% RH. Temperatures ranging from 45-110°F (7.2-43.3°C) and relative humidity from 10-90% were tested. Each drug concentration was confirmed by LC-MS/MS. The following conditions were tested:

- Condition 1: ambient condition (20°C and 50% RH)
- Condition 2: excessive temperature (40°C) and humidity's of 5% RH
- Condition 3: excessive temperature (40°C) and humidity's of 95% RH

- Condition 4: stored in the refrigerator, 2-8°C for 1 hour. The test devices were run immediately after taking out of the refrigerator.
- Condition 5: low temperature (7.2 °C) and 5% RH
- Condition 6: low temperature (7.2 °C) and 95% RH

Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff for fentanyl cutoff concentration of 1 ng/mL were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that the test device is tolerant to inappropriate temperature and humidity.

3) Effect of Vibration:

A study was conducted to evaluate the effect of vibrations produced by nearby laboratory equipment on the performance of the fentanyl test device when run on the analyzer. Test devices were prepared with samples at with concentrations of -100% cutoff, -50% cutoff and +50% cutoff. 3 lots of cartridges and 3 analyzers were used for testing. Samples were tested at ambient temperature, placed in close proximity (within 1 foot) to a centrifuge running at 9,500 rpm or to a centrifuge running at 15,000 rpm. All samples generated expected results, indicating that the device is tolerant to vibrations coming from a centrifuge at the rpm tested.

4) Effect of Time Lapse:

A study was conducted to evaluate the effect of time lapse between applying the sample on the test device and inserting the test device into the reader. The product labeling instructs that during the test procedure, insert the sample-added test device into the slot of BioSieve™ Toxismart Reader immediately. The testing was performed by evaluating time lapse from 0 to 3 minutes (i.e., 0, 1, 2, and 3 minutes). Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that that the test device is tolerant to inappropriate time lapse between applying the sample on the test device and inserting the test device into the reader.

5) Effect of Drop

A was conducted to evaluate the potential of the invisible damage to the test device when inadvertently dropped or knocked over during the procedure both before and after sample addition to the device.

- Condition 1: reader plus test device were dropped from the test height (6.5 foot, 2 meters) onto the floor prior to sample addition. After dropping, samples were added, and each test device was tested.
- Condition 2: reader plus test device were dropped from the test height (6.5 foot, 2 meters) onto the floor after sample addition. After dropping, each device was tested.

Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that the test device is tolerant to drop of 6.5 feet (higher than the normal expected height when an operator drops a test device).

6) Effect of Sample Volume:

The study was conducted to investigate the effect of adding insufficient or excess number of drops from the specimen collection container into the sample well. The product labeling instructs that during the test procedure, user should add three drops (~75 µL) of the sample to the sample well of the test device using the Dropper. The testing was



performed by evaluating number of drops from 0.67x to 1.67x the nominal volume (i.e., 2, 3, 4, and 5 drops of sample). Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that the test device is tolerant to incorrect sample addition to the sample well.

7) Effect of Using Expired Test Devices:

A study was conducted to evaluate the effect of using expired test devices. Three lots of expired cassettes (different expiration dates) were used in this study. Results support that the test device yields an error code when expired cassettes are used.

8) Effect of Analyzer Assembly Held at an Angle While Reading Results:

A study was conducted to evaluate the effect of placing the assembled fentanyl test device in holder with the analyzer at different angle facing the operator reading of the results. Test devices were prepared with sample (with concentrations of -100% cutoff, -50% cutoff and +50% cutoff) and tested at different angle of from 15-90 degrees (i.e., 15, 30, 45, 60, 75 and 90 degree). 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that holding the analyzer assembly at an angle while reading results has no impact on the performance.

9) Effect of Incorrect Orientation of Test Device in Holder:

A study was conducted to evaluate the effect of incorrect orientation of the test device in the holder on reading the results by the Analyzer. Three incorrect orientations were tested with respect to the correct orientation of the test device in the holder:

- Condition 1: correct orientation
- Condition 2: upside down from the correct orientation
- Condition 3: 180° rotation from correct orientation
- Condition 4: 180° rotation and upside down from correct orientation

Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. Results support that when the orientation is incorrect, the test device cannot be scanned.

10) Effect of Reader Button Pressed Throughout the Run:

A study was to evaluate the effect of touching the left and/or right reader button by mistake throughout the run (from start of the run to result display). Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that pressing of the left and/or right reader button by mistake during the run does not affect the final test results.

11) Effect of Environmental Light:

A study was conducted to evaluate the effect of environmental light (with and without direct sunlight) on reading of test results by BioSieve™ Toxismart Reader. The testing was performed across the following three conditions: (1) indoors with only light and no sunlight; (2) outdoors in direct sunlight and (3) indoors with indirect sunlight. Samples with concentrations of -100% cutoff, -50% cutoff and +50% cutoff were tested. 3 lots of test devices and 3 readers were used for testing. All samples generated expected results, indicating that the test device is tolerant to different lighting conditions.

12) Cleaning and Disinfection Robustness Evaluation:

The sponsor provided information to support the potency of the chosen disinfectant, Clorox Healthcare Bleach Germicidal Wipes. Robustness studies were also performed by the sponsor demonstrating that there was no change in performance or external materials of the reader after 365 cycles of cleaning and disinfection using the chosen disinfectant, simulating cleaning and disinfection over the 3-year use life of the reader. Labeling was reviewed for adequate instructions for the validated cleaning and disinfection procedures.

**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.