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

A. 510(k) Number:

k111929

B. Purpose for Submission:

New device

C. Measurand:

Cannabinoids

D. Type of Test:

Qualitative chemiluminescent enzyme immunoassay EIA

E. Applicant:

Psychemedics Corp.

F. Proprietary and Established Names:

Psychemedics Microplate EIA for Cannabinoids in Hair

G. Regulatory Information:

Product Code	Classification	Regulation Section	Panel
LDJ	Class II	862.3870 – Cannabinoid test system	91 - Toxicology

H. Intended Use:

1. Intended use(s):

   See indications for use below.

2. Indication(s) for use:
   The Psychemedics Microplate EIA for Cannabinoids in Hair is an enzyme immunoassay (EIA) for the preliminary qualitative detection of cannabinoids in human head and body hair samples using a 11-nor-9-Carboxy- Δ_9-THC calibrator at 10 pg/10 mg hair cutoff for the purpose of identifying marijuana use. This is an *in vitro* diagnostic device

intended exclusively for Psychemedics use only and is not intended for sale to anyone.

The Psychemedics Chemiluminscent Microplate EIA for Cannabinoids assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas Chromatography/Mass Spectrometry/Mass Spectrometry (GC/MS/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary result is positive.

3. Special conditions for use statement(s):

   This assay is for over the counter use.

4. Special instrument requirements:

   The device is for use with a microplate reader capable of measuring at 450 and 650 nm. Plate washing also requires an instrument specifically designed to effectively and reproducibly wash all wells uniformly.
   Confirmation testing is done by GC-MS/MS using a triple stage quadrupole instrument operating in the negative chemical ionization (CI) mode. The confirmatory method was cleared under k011426 and has not been modified.

I. Device Description:

The EIA screening test consists of two parts; a pre-analytical hair treatment procedure to recover the cannabinoids from the hair and the screening assay, the Psychemedics Chemiluminescent EIA for Cannabinoids in Hair. The device comprises a white microplate coated with the antigen (11-nor-9-carboxy-delta-8-tetrahydrocannabinol) conjugated to BSA, polyclonal rabbit anticannabinoid antibody, goat anti-rabbit secondary antibody conjugated to HRP (horseradish peroxidase), a chemiluminescent substrate, and plate-washing buffer. Confirmation testing is done by GC-MS/MS using a triple stage quadrupole instrument operating in the negative chemical ionization (CI) mode.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Psychemedics Marijuana Screening and Confirmatory Test System

2. Predicate K number(s):

   k011426

3. Comparison with predicate:

Item	Device	Predicate
Indications/ Intended Use	The Psychemedics Microplate EIA for Cannabinoids in human head and body hair is an enzyme immunoassay (EIA) for the preliminary qualitative detection of cannabinoids in human head and body hair samples using a 11-nor-9-Carboxy- Δ9-THC calibrator at 10 pg/10 mg hair cutoff for the purpose of identifying marijuana use.	Same
Test Principle	EIA	RIA
Sample matrix	Hair	Same
Method of measurement	Microplate reader- luminescence	Gamma counter
Cutoff	10 pg carboxy-THC/10 mg hair	20 pg carboxy-THC/10 mg hair

K. Standard/Guidance Document Referenced (if applicable):

None were referenced

L. Test Principle:

Hair extract is combined with the primary antibody in microtubes and incubated for one hour at room temperature (RT). An aliquot of the pre-incubated mixture is transferred to antigen-coated wells of the microplate. After incubation the plate is washed with wash buffer and second antibody-HRP is added. After further incubation the wells are emptied and washed with wash buffer, and chemiluminescent substrate is added. The plate is mixed, and results are read in a reader capable of reading luminescence. Results (expressed as RLU, or relative light units) are normalized by expression as B/B0 x 100.

If cannabinoids are present in the sample, less primary antibody will be bound to the solid-phase antigen, thereby resulting in less binding of HRP-labeled secondary antibody to the primary antibody; the RLU's produced by the action of the HRP on the substrate are inversely proportional to the amount of cannabinoids in the sample. Samples determined positive by the screening assay are re-weighed, washed, and by GC/MS/MS for the presence of carboxy-THC.

Confirmation testing of samples presumptively positive from the device are confirmed by first weighing out a new portion of the sample (approximately 12 mg). The samples are washed for 15 minutes at 37 ºC with dry isopropanol, then three times for 30 minutes in phosphate buffer (0.01 M, pH 6.0) containing 0.1% albumin.

Samples are then dissolved and extracted for confirmation of 11-nor-9-Carboxy-Δ9-THC by GC/MS/MS.

Carboxy-THC standard solutions are purchased from multiple vendors, prepared in the laboratory, and validated by GC/MS/MS confirmation. In addition, controls made in-house of known cannabinoid-positive hair are also employed in the assay.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Precision studies were performed by taking commercially available materials consisting of carboxy-THC in methanol, to prepare spiking solutions at the following concentrations; negative, ±75%, ±50%, ±25% and 100% of the cutoff. The concentration of each sample was confirmed by LC/MS/MS. The carboxy-THC solutions were then used to spike 15 replicates of negative hair samples. Intra-assay precision was performed in one run and inter-assay precision was performed over 5 non-consecutive days. The results are presented in the tables below:

Intra-assay

THC (pg/10 mg hair)	Percent of Cut-off	Replicate Number	Pos/Neg
0	-100%	15	0/15
2.5	-75%	15	0/15
5.0	-50%	15	0/15
7.5	-25%	15	0/15
12.5	+25%	15	15/0
15.0	+50%	15	15/0
17.5	+75%	15	15/0
20	+100%	15	15/0

Inter-assay

THC (pg/10 mg hair)	Percent of Cut-off	Replicate Number	Pos/Neg
0	-100%	75	0/75
2.5	-75%	75	0/75
5.0	-50%	75	0/75
7.5	-25%	75	0/75
12.5	+25%	75	75/0
15.0	+50%	75	75/0
17.5	+75%	75	75/0
20	+100%	75	75/0

b. *Linearity/assay reportable range:*

Not applicable. This is a qualitative assay.

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

Psychemedics manufactures calibrators and control materials using drug stocks purchased from a commercial vendor. Each lot of drug is received with its specific certificate of analysis. The commercially obtained stock is made into the calibrators and controls to the desired concentrations. The concentrations are confirmed by GC/MS.

Stability studies for both controls and calibrators have been conducted. Protocols and acceptance criteria were described and found to be acceptable. The manufacturer claims the following expiration date for both controls and calibrators:

When stored at less than or equal to -20 ºC for calibrators and -10 ºC quality control the product is stable for 12 months.

d. *Detection limit:*

Not required since this is a qualitative test

e. *Analytical specificity:*

Cross-reactivity was established by spiking various concentrations of each substance into drug-free sample and evaluating the result against the cutoff control.

Results are expressed as a concentration of compound required to produce a response approximately equivalent to the cutoff concentration of the assay. The results are presented in the table below:

Compound	Approximate concentration of compound (pg/mg) Equivalent to 10 pg/10 mg hair THC Cutoff	% Cross reactivity
(+/-) -11-Hydroxy-Δ9- THC	30	33
(-) - Δ9-THC	800	1.25
(+/-) - Δ8-THC	1500	0.67
(-) - Δ8-THC	950	1.05
(-) -11-nor-9-Carboxy-Δ9-THC	90	11
(+/-) -11-nor-9-Carboxy-Δ9-THC	350	2.9
(-)-9-Carboxy-11-nor- Δ9-THC glucuronide	1100	0.9
Cannabinol	16000	0.06
Cannabidiol	3600	0.27
Nabilone	120,000	< 0.1

Structurally unrelated:
Negative hair samples were spiked with cannabinoids to -50%, and +50% of the cutoff. Structurally related and unrelated compounds were added to methanol to a concentration of 100 ng/10 mg hair then added to the negative hair sample. The following compounds do not cause interference at +/- 50% of the cutoff; acetaminophen, caffeine, dyphylline, methaqualone, theophylline, amphetamine, imipramine, methamphetamine, phencyclidine, phenmetrazine, phenylpropanolamine, amitryptiline, dextromethorphan, lidocaine, methocarbamol, nordoxepin, pentazocine, phenylephrine, triamterene, bromazepam carbamazepine, diazepam, nordiazepam, oxazepam, flurazepam, lorazepam, medazepam, temazepam, glutethimide, meprobromate, methyprylon, amitriptylinr, desipramine, doxepin, imipramine, nordoxepin, nortriptyline, protriptyline, trimipramine, butabarbital, amobarbital, secobarbital, hexobarbital, phenobarbital, ethosuximide, _-methyl----propylsuccimide, methabrital, barbital, methsuccimide, phensuccimide, N-normethsuccimide, mephenytoin, ethotoin, mephobarabital, PEMA, phenobarbital, methyl PEMA, 10, 11-dihydrocarbamazepine, primidone, carbamazepine, 5,5-diphenylhydantoin, 4-methylprimidone, tyraine, quinacrine, propanolol

There is the possibility that other substances and/or factors not listed above may interfere with the test and cause false results.

Cosmetic Treatment

Tests were performed to determine the effects of various hair treatments (i.e. bleaching, dyeing, relaxer, shampoo, permanent) on samples tested using the Psychemedics Microplate EIA for THC. The ethnic origin, hair color and curvature were documented.

Effects on Positive Samples:

60 specimens determined to be positive for THC were used in the study. The study was conducted with two different hair treatments for each hair sample. ELSIA absorbance readings before and after treatment were compared. Average changes in absorbance values after were 1.7% for bleach, -3.5% for dye, -1.75% for perm, -1.7% for relaxer and 3.8% for shampoo, where a negative sign indicates a sample becoming "more negative" due to treatment an a positive sign indicates a sample becoming "more positive." None of the positive samples became negative after treatment.

Effect on Negative Samples:

One hundred specimens previously determined to be negative were used in the study. The study was conducted with two different hair treatments for each hair sample. ELSIA absorbance readings before and after treatment were compared. All samples determined to be negative prior to treatment remained negative post treatment.

Environmental Study

Twelve hair samples were contaminated with marijuana smoke and stored for two days. These samples were then split into two additional samples and soaked in either saline or water. The washed and unwashed samples were then analyzed by the screening method and confirmation method for the THC and carboxy-THC. All samples were positive by the screening method. The confirmation tests, which queries carboxy-THC, were negative for all samples.

Preliminary positive hair sample results by the screening method could be due to environmental contamination. All positive should be sent for confirmation testing on a reference method to distinguish between true positive and those samples that were positive due to external exposure.

f. Assay cut-off:

Analytical performance of the device around the claimed cutoff is described in

precision section M.1a above

2. Comparison studies:

a. Method comparison with predicate device:

The Cannabinoids EIA assay is the screening component in the test system which also includes, as the second component of the cleared system (cleared under k011426), a GC/MS/MS confirmation test of carboxy-THC in hair. The study was performed by comparing EIA results against the full test system results on the same head or body hair samples. A total of 315 donor hair samples were tested first using the screening method and then confirmed by GC/MS/MS for the presence of carboxy-THC. 183 presumptively positive samples were confirmed positive by GC/MS/MS for carboxy-THC. Five presumptively positive samples were negative by GC/MS/MS for carboxy-THC with GC/MS/MS results between 50% below the cutoff and the cutoff concentration. The discrepant results between screening and confirmation parts of the system are presented in the table below:

Screening Cutoff (pg/10 mg hair)	ELSIA THC Test Results (POS/NEG)	Carboxy-THC GC/MS/MS Drug Result (pg/10 mg hair)
10	POS	0.6 (NEG)
10	POS	0.8 (NEG)
10	POS	0.6 (NEG)
10	POS	0.5 (NEG)
10	POS	0.9 (NEG)

b. Matrix comparison:

Not applicable. The assay is intended for only one sample matrix.

3. Clinical studies:

a. Clinical Sensitivity:

Not applicable.

b. Clinical specificity:

Not applicable.

c. Other clinical supportive data (when a. and b. are not applicable):

Not applicable.

4. Clinical cut-off**:**

   Not applicable.

5. Expected values/Reference range:

   Not applicable.

N. Proposed Labeling:

They have not provided adequate labeling.

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

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