Carolina Liquid Chemistries
Cocaine Metabolite Enzyme Immunoassay (COCM)

K163570

510(k) Summary

I. Submitters Identification

Establishment: Carolina Liquid Chemistries, Corp.
Registration Number: 3009880320
Address: 313 Gallimore Dairy Road
Greensboro, NC 27409
Telephone/Fax: 877-722-8910/336-722-8915
Contact Name: Philip G. Shugart
Contact Title: CEO/President
Correspondent: Mica A. Welsh, Regulatory Affairs Manager

II. Device Description

Common Name of Device: Cocaine and cocaine metabolite test system
Trade Name of Device: Carolina Liquid Chemistries Cocaine and Cocaine Metabolite Test System (COCM)
Classification of the Device: Class II
Classification Panel: 91 Toxicology
Product Code: DIO
Regulation Number: 21 CFR 862.3250

III. Identification of the Predicate Device

Common Name of Device: Cocaine and cocaine metabolite test system
Trade Name of Device: Lin-Zhi International, Inc. Cocaine Metabolite Enzyme Immunoassay
Classification of the Device: Class II
Classification Panel: 91 Toxicology
Product Code: DIO
Regulation Number: 21 CFR 862.3250

IV. Intended Use and Device Descriptions

Intended Use: The Carolina Liquid Chemistries Cocaine and Cocaine Metabolite Test System (COCM) is for the qualitative determination of benzoylecgonine (cocaine metabolite) in human urine at a cutoff value of 300 ng/mL. The assay is designed for professional use with a clinical chemistry analyzer. For in vitro diagnostic use only.

This assay provides a rapid screening procedure for determining the presence of benzoylecgonine in urine. The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or Liquid Chromatography/Mass Spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical considerations and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive.

Device Description: Carolina Liquid Chemistries Cocaine and Cocaine Metabolite Test System (COCM) is a ready-to-use, liquid reagent, homogenous enzyme immunoassay. The assay uses a specific antibody that can detect benzoylecgonine (cocaine metabolite) in human urine with minimal cross-reactivity to various, common prescription drugs and abused drugs. The assay is based on competition between benzoylecgonine and glucose-6-phosphate dehydrogenase (G6PDH) enzyme, and free drug from the urine sample for a fixed amount of the specific antibody. In the absence of free drug from the urine sample the specific antibody binds to the drug labeled with G6PDH enzyme causing a decrease in enzyme activity. The G6PDH enzyme activity is determined spectrophotometrically and 340nm by measuring its ability to convert nicotinamide adenine dinucleotide (NAD) to NADH.

V. Performance Characteristics of the Device as Compared to Predicate Device

	Candidate Device: Carolina Liquid Chemistries Cocaine Metabolite Enzyme Immunoassay (COCM)	**Predicate Device: Lin-Zhi International, Inc. Enzyme Immunoassay (K020763)**
Intended Use	The Carolina Liquid Chemistries Cocaine and Cocaine Metabolite Test System (COCM) is for the qualitative determination of benzoylecgonine (cocaine metabolite) in human urine at a cutoff value of 300 ng/mL. The assay is designed for professional use with a clinical chemistry analyzer. For in vitrodiagnostic use only. This assay provides a rapid screening procedure for determining the presence of benzoylecgonine in urine. The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or Liquid Chromatography/Mass Spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical considerations and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive.	The Lin-Zhi International, Inc. Cocaine Metabolite Enzyme Immunoassay is intended for the qualitative and semi-quantitative determination of Benzoylecgonine (Cocaine Metabolite) in human urine at a cutoff value of 300ng/mL. The assay is designed for professional use with a number of automated clinical chemistry analyzers.
Method	Enzyme Immunoassay	Enzyme Immunoassay
Reagent Composition	<u>COCM R1, Antibody/Substrate Reagent:</u> Contains mouse monoclonal anti-benzoylecgonine antibody, glucose-6-phosphate (G6P), and nicotinamide adenine dinucleotide (NAD), stabilizers, and sodium azide as preservative.	<u>Antibody/Substrate Reagent (R1)</u>: Contains mouse monoclonal anti-benzoylecgonine antibody, glucose-6-phosphate (G6P), and nicotinamide adenine dinucleotide (NAD), stabilizers, and sodium azide as preservative. <u>Enzyme-drug Conjugate Reagent (R2)</u>:

<table>
<tr><td></td><td><u>COCM R2, Enzyme-Drug Conjugate Reagent</u>: Contains benzoylecgonine-labeled glucose-6-phosphate dehydrogenase (G6PDH) in buffer with sodium azide as preservative.</td><td>Contains benzoylecgonine-labeled glucose-6-phosphate dehydrogenase (G6PDH) in buffer with sodium azide as preservative.</td></tr>
<tr><td>Sample Type</td><td>Urine</td><td>Urine</td></tr>
<tr><td>Expected Values</td><td>The cutoff calibrator which contains 300 ng/mL benzoylecgonine is used as a reference for distinguishing positive from negative samples. A sample with a change in absorbance (ΔmA/min) equal to, or greater than, that obtained with the cutoff calibrator is considered positive. A sample with a change in absorbance (ΔmA/min) lower than that obtained with the cutoff calibrator is considered negative.</td><td>The cutoff calibrator which contains 300 ng/mL benzoylecgonine is used as a reference for distinguishing positive from negative samples. A sample with a change in absorbance (ΔmA/min) equal to, or greater than, that obtained with the cutoff calibrator is considered positive. A sample with a change in absorbance (ΔmA/min) lower than that obtained with the cutoff calibrator is considered negative.</td></tr>
<tr><td>Accuracy</td><td>Candidate device compared to LCMS
<table>
<tr><td colspan="2">n = 100
Cutoff = 300ng/mL</td><td>Drug Free (0.00 ng/mL)</td><td>< 50% of cutoff</td><td>≥ 50 to <100% of cutoff</td><td>≥ 100 to ≤150% of cutoff</td><td>> 150% of cutoff</td></tr>
<tr><td rowspan="2">LCMS</td><td>Positive</td><td>0</td><td>0</td><td>0</td><td>24</td><td>26</td></tr>
<tr><td>Negative</td><td>30</td><td>11</td><td>9</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Candidate Device</td><td>Positive</td><td>0</td><td>0</td><td>0</td><td>24</td><td>26</td></tr>
<tr><td>Negative</td><td>30</td><td>11</td><td>9</td><td>0</td><td>0</td></tr>
</table></td><td>Predicate device compared to GCMS
<table>
<tr><td colspan="2">n = 22
Cutoff = 300ng/mL</td><td>≥ 75 to <100% of cutoff</td><td>≥ 100 to ≤125% of cutoff</td></tr>
<tr><td rowspan="2">GCMS</td><td>Positive</td><td>0</td><td>9</td></tr>
<tr><td>Negative</td><td>13</td><td>0</td></tr>
<tr><td rowspan="2">Predicate Device</td><td>Positive</td><td>3</td><td>9</td></tr>
<tr><td>Negative</td><td>10</td><td>0</td></tr>
</table></td></tr>
<tr><td>Interfering Substances/ Cross-Reactivity Specificity</td><td><u>Specific Gravity & pH</u>: Study results show that neither pH (range tested: 3-11), nor specific gravity conditions (range tested 1.000-1.030) will interfere with this assay.</td><td>Specificity: Various potentially interfering substances were tested for cross-reactivity with the assay. Test compounds were spiked into the drug-free urine calibrator matrix to various concentrations and evaluated against the cutoff calibrator. The table lists the concentration of each test compound that gave a response approximately equivalent to that of the cutoff calibrator (as positive) or the maximal concentration of the compound tested that gave a response below the response of the cutoff calibrator (as negative).

Structurally Related Cocaine Compounds:
<table>
<tr><th>Compound</th><th>Concentration (µg/mL)</th><th>Cross-reactivity</th></tr>
<tr><td>Benzoylecgonine</td><td>0.3</td><td>Positive</td></tr>
<tr><td>Cocaine</td><td>30</td><td>Positive</td></tr>
<tr><td>Norcocaine</td><td>60</td><td>Positive</td></tr>
<tr><td>Ecgonine, Methyl Ester</td><td>350</td><td>Positive</td></tr>
</table></td></tr>
</table>

Structurally Unrelated Compounds:

Compound	Concentration (µg/mL)	Cross-reactivity
Acetaminophen	1500	Negative
Acetylsalicyclic Acid	1500	Negative
Amobarbital	1000	Negative
Amphetamine	1000	Negative
Compound	**Concentration (µg/mL)**	**Cross-reactivity**
Bupropion	1000	Negative
Caffeine	1000	Negative
Codeine	1000	Negative
Chlorpheniramine	1000	Negative
Chlorpromazine	1000	Negative
Dextromethorphan	1000	Negative
Ecgonine	1000	Negative
Lidocaine	1000	Negative
Meperidine	1500	Negative
Methadone	1000	Negative
Morphine	2000	Negative
Nicotine	1000	Negative
Oxazepam	1000	Negative
Phencyclidine	1000	Negative
Phenobarbital	1000	Negative
Propoxyphene	1000	Negative
Ranitidine	1000	Negative
Secobarbital	1000	Negative
Methamphetamine	1000	Negative
Methaqualone	1000	Negative
Valproic Acid	1000	Negative

It is possible that other substances and/or factors not listed above may interfere with the test and cause false positive results

Specific Gravity & pH: No study was performed on the predicate device for pH or Specific Gravity.

<table>
<tr>
<td>Precision

DRI Multi-Drug Calibrators
K#983159

MGC Primary DAU Controls
K#040758</td>
<td><u>Qualitative analysis</u>: Twenty Replicates of drug free, real human urine were spiked with benzoylecgonine to nine concentrations and tested in a single run using the COCM EIA on a Biolis 24i. Results are as follows:
Within Run
<table>
<tr><th>Concentration (ng/mL)</th><th>% cutoff (300ng/mL)</th><th># of Samples</th><th>Results</th></tr>
<tr><td>0</td><td>0%</td><td>20</td><td>20 Negative</td></tr>
<tr><td>75</td><td>-75%</td><td>20</td><td>20 Negative</td></tr>
<tr><td>150</td><td>-50%</td><td>20</td><td>20 Negative</td></tr>
<tr><td>225</td><td>-25%</td><td>20</td><td>20 Negative</td></tr>
<tr><td>300</td><td>Cutoff (100%)</td><td>20</td><td>15 Negative / 5 Positive</td></tr>
<tr><td>375</td><td>+25%</td><td>20</td><td>20 Positive</td></tr>
<tr><td>450</td><td>+50%</td><td>20</td><td>20 Positive</td></tr>
<tr><td>525</td><td>+75%</td><td>20</td><td>20 Positive</td></tr>
<tr><td>600</td><td>+100%</td><td>20</td><td>20 Positive</td></tr>
</table>
Run-to-Run
<table>
<tr><th>Concentration (ng/mL)</th><th>% of cutoff</th><th># of samples</th><th>Results</th></tr>
<tr><td>Negative: 0 ng/mL</td><td>0%</td><td>90</td><td>90 Negative</td></tr>
<tr><td>75 ng/mL</td><td>-25%</td><td>90</td><td>90 Negative</td></tr>
<tr><td>150 ng/mL</td><td>-50%</td><td>90</td><td>90 Negative</td></tr>
<tr><td>225 ng/mL</td><td>-75%</td><td>90</td><td>90 Negative</td></tr>
<tr><td>300 ng/mL</td><td>100%</td><td>90</td><td>84 Positive/ 6 Negative</td></tr>
<tr><td>375 ng/mL</td><td>125%</td><td>90</td><td>90 Positive</td></tr>
<tr><td>450 ng/mL</td><td>150%</td><td>90</td><td>90 Positive</td></tr>
<tr><td>525 ng/mL</td><td>175%</td><td>90</td><td>90 Positive</td></tr>
<tr><td>600 ng/mL</td><td>200%</td><td>90</td><td>90 Positive</td></tr>
</table>
</td>
<td><u>Qualitative analysis</u>: The three calibrators and two levels of controls were evaluated. Typical results (ΔmA/min) are as follows:
<table>
<tr><th>(mA/min)</th><th colspan="3">Within Run</th></tr>
<tr><td>n=20</td><td>Mean</td><td>SD</td><td>%CV</td></tr>
<tr><td>Negative</td><td>219.8</td><td>1.25</td><td>0.6</td></tr>
<tr><td>225 ng/mL</td><td>289.4</td><td>1.92</td><td>0.7</td></tr>
<tr><td>300 ng/mL</td><td>310.1</td><td>1.15</td><td>0.4</td></tr>
<tr><td>375 ng/mL</td><td>327.3</td><td>1.05</td><td>0.3</td></tr>
<tr><td>1000 ng/mL</td><td>497.8</td><td>3.47</td><td>0.7</td></tr>
</table>
<table>
<tr><th>(mA/min)</th><th colspan="3">Run-to-Run (taken in 3 weeks)</th></tr>
<tr><td>n=88</td><td>Mean</td><td>SD</td><td>%CV</td></tr>
<tr><td>Negative</td><td>247.6</td><td>3.2</td><td>1.25</td></tr>
<tr><td>225 ng/mL</td><td>340.8</td><td>4.8</td><td>1.38</td></tr>
<tr><td>300 ng/mL</td><td>360.2</td><td>4.5</td><td>1.22</td></tr>
<tr><td>375 ng/mL</td><td>370.2</td><td>4.2</td><td>1.09</td></tr>
<tr><td>1000 ng/mL</td><td>524.4</td><td>5.6</td><td>1.07</td></tr>
</table>
</td>
</tr>
<tr>
<td>Carryover</td>
<td>0.00 ng/mL</td>
<td>Test was not performed on the predicate device.</td>
</tr>
</table>

1.Similarities:

- ✓ Test methodology is identical
- ✓ Reagent composition is identical
- ✓ Sample type (urine) is the same
- ✓ Expected values for the qualitative assay are identical

2.Differences:

- ✓ The intended use for the predicate device is qualitative and semi-quantitative, whereas, the intended use of the CLC Cocaine Metabolite Enzyme Immunoassay (COCM) is qualitative only.

3.Summary for Performance Testing

The CLC Cocaine Metabolite Enzyme Immunoassay demonstrated similar performance characteristics as compared to the predicate device when tested using the approved guidelines provided in the CLSI Standards listed below. The candidate device utilizes a chemical make-up for both Reagent 1 and Reagent 2 that is identical to what is in use with the predicate device. No new

issues of safety or effectiveness are introduced by using this CLC Cocaine Metabolite Enzyme Immunoassay (COCM).

4. Performance Standards Used

1) CLSI EP05-A3: Evaluation of Precision Performance of Quantitative Measurement Procedures; Approved Guideline-Third Edition
2) CLSI EP07-A2: Interference Testing in Clinical Chemistry; Approved Guideline-Second Edition
3) CLSI EP09-A3: Measurement Procedure Comparison and Bias Estimation Using Patient Samples; Approved Guideline-Third Edition
4) CLSI EP10-A3: Preliminary Evaluation of Quantitative Clinical Laboratory Measurement Procedures; Approved Guideline-Third Edition

5. Conclusion

The Carolina Liquid Chemistries Cocaine Metabolite Enzyme Immunoassay (COCM) is substantially equivalent to the Lin-Zhi International Cocaine and Cocaine Metabolites Enzyme Immunoassay (the predicate device), for purposes of Section 510(k) of the federal Food, Drug and Cosmetic Act. The predicate device is currently available for commercial distribution in interstate commerce.