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

A. 510(k) Number:
k091455

B. Purpose for Submission:
New device

C. Measurand:
Potassium

D. Type of Test:
Quantitative, Enzymatic assay

E. Applicant:
Diazyme Laboratories

F. Proprietary and Established Names:
Diazyme Liquid Stable Enzymatic Potassium Assay Kit
Diazyme Liquid Stable Enzymatic Potassium Assay Calibrator Kit
Diazyme Liquid Stable Enzymatic Potassium Assay Controls

G. Regulatory Information:

Product Code	**Classification**	**Regulation Section**	**Panel**
Potassium (MZV)	Class II	21 CFR 862.1600 Potassium test system	Clinical Chemistry (75)
Product Code	**Classification**	**Regulation Section**	**Panel**
Calibrator (JIT)	Class II	21 CFR 862.1150 Calibrator	Clinical Chemistry (75)
Product Code	**Classification**	**Regulation Section**	**Panel**
Controls (JJX)	Class I, reserved	21 CFR 862.1660 Quality control material (assayed and unassayed)	Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):
   Refer to Indications for use below.

2. Indication(s) for use:
   Diazyme Liquid Stable Enzymatic Potassium Assay Kit
   For in vitro quantitative determination of potassium in human serum. Measurements obtained by this device are used to monitor electrolyte balance in the diagnosis and treatment of diseases conditions characterized by low or high blood potassium levels. For In Vitro Diagnostic use only.

Calibrators
The Diazyme Liquid Stable Enzymatic Potassium Assay Calibrator Kit is intended for use in the calibration of quantitative Diazyme Liquid Stable Enzymatic Potassium Assay Kit (DZ113C). For In Vitro Diagnostic use only.

Controls
The Diazyme Liquid Stable Enzymatic Potassium Assay Control Kit is intended for use as quality controls for the Diazyme Liquid Stable Enzymatic Potassium Assay (DZ113C). For In Vitro Diagnostic use only.

3. Special conditions for use statement(s):
For Prescription use only

4. Special instrument requirements:
To be used with Olympus AU400 analyzers.

I. Device Description:

The device is supplied as ready-to-use, two-reagent kit. Reagent 1 contains Lactate Dehydrogenase, substrate, NADH analog, lithium azide, and stabilizers, while reagent bottle 2 contains Pyruvate kinase, lithium azide, and stabilizers.

Ready-to-use liquid calibrators at two levels of (3.04 and 7.69 mM) are provided with the device.

Two levels of lyophilized controls (expected range: 04.46±0.67 for Control 1; 6.86±1.03 mM for Control 2) for validating the performance of the potassium reagents are sold separately.

Potassium controls are human serum based and were tested and found negative for HIV1, HIV2, HBV, and HCV using FDA approved methods

J. Substantial Equivalence Information:

1. Predicate device name(s):

Easylyte Sodium/Potassium/Lithium Analyzer

2. Predicate 510(k) number(s):
k914810

3. Comparison with predicate:

Characteristics	**New Device (k091455) Diazyme Liquid Stable Potassium Enzymatic Assay Kit**	**Predicate Device (k914810) Easylyte sodium/potassium/lithium Analyzer**
Type of test	Spectrophotometry; Quantitative	Ion selective electrode technology; Quantitative

Characteristics	New Device (k091455) Diazyme Liquid Stable Potassium Enzymatic Assay Kit	Predicate Device (k914810) Easylyte sodium/potassium/lithium Analyzer
Intended Use (Reagent)	For in vitro quantitative determination of potassium in human serum. Measurements obtained by this device are used to monitor electrolyte balance in the diagnosis and treatment of diseases conditions characterized by low or high blood potassium levels. For IVD use only.	The EasyLyte is an automated, microprocessor-controlled analyzer for measurement of sodium, potassium, chloride, calcium and pH in serum, plasma, whole blood and urine (urine results on Na/K, Na/K/Cl and Na/K/Li only)
Measuring Range	2.0-8.0 mmol/L	0.4 – 7.5 mmol/L
Specimen Type	Human serum	Human serum, plasma or whole blood
Controls	Lyophilized powder	Liquid
Calibrators	2 levels in liquid form	Automatic on-demand ISE

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

- CLSI EP5-A2: Evaluation of Precision Performance of Clinical Chemistry Devices; Approved Guideline Vol 19, No 2.
- CLSI EP6-A: Evaluation of the Linearity of Quantitative Analytical Measurement Procedure: A Statistical Approach; Approved Guideline, Vol 23 No 16.
- CLSI EP17-A: Protocol for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline. Vol 24, No 34.
- CLSI EP7-A2: Interference Testing in Clinical Chemistry: Approved Guideline-Second Edition.

L. Test Principle:

Potassium is determined spectrophotometrically through a kinetic coupling assay system using potassium dependent pyruvate kinase. Pyruvate generated is converted to lactate accompanying conversion of NADH analog to NAD analog. The corresponding decrease of optical density at 380nm is proportional to the potassium concentration in the serum.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Following CLSI EP5-A, the sponsor evaluated the precision using two serum based control materials, at 4.62, and 6.96 mM Potassium, assayed in duplicate, 2 runs per day for 20 days (n=80). The results are tabulated below.

Sample mM	N	Mean (mM)	Within Run SD	Within Run %CV	Total SD	Total %CV
Level 1 (4.62)	80	4.62	0.052	1.12	0.081	1.77
Level 2 (6.96)	80	6.96	0.084	1.20	0.122	1.77

b. Linearity/assay reportable range:

This assay has a claimed range of 2.0-8.0 mmol/L. The sponsor conducted studies on the Olympus AU400 instrument to evaluate the dilution linearity of the potassium assay, using CLSI Document EP6-A as a guide. Two samples were prepared from defibrinated, delipidized human serum and a potassium stock solution to create potassium concentrations of 2.0 and 8.0 mmol/L. These two samples were mixed to create nine intermediate levels.

The linear regression analysis generated the equation, y=1.0271x-0.1502 with regression coefficient (R^2) of 0.9961. The results of the study support the sponsor's claimed that the assay is linear from 2.0 to 8.0 mmol/L.

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

Traceability of potassium calibrator: The calibrator is a ready-to-use liquid, including two different levels of concentrations of potassium in two separate vials. The value of the calibrator is traceable to an in-house calibration procedure that used the predicate device for value assignment.

Stability of the calibrators and controls: Real time stability studies have been conducted and are still on-going. Protocols and acceptance criteria were described and found to be acceptable. The sponsor claimed that reagents including calibrators were stable for at least 10 days at 37°C, 21 days at 25°C.and 12 months when stored at 2-8 °C. The on-board stability of the reagent is 14 days when stored at 2-8 °C. The shelf-life of the controls would be 18 months when stored at 2-8°C. Once reconstituted, the controls are stable for 16 days when stored at 37°C.

d. Limit of Detection:

To demonstrate the lower limit of the assay range, the sponsor performed the limit of detection (LOD) and limit of blank (LOB) tests following CLSI document EP17-A. LOB tests were conducted using blank samples conducted over a day using 3 runs with 20 replicates for each run. For LOD studies, five serum samples were selected and diluted to obtain lower concentrations and the samples were run over one day with 3 runs and 4 replicates per run for a total of 60 total replicates. Tests were run on Olympus AU400 System. Based on 12 replicates of a zero calibrator, LOB was

determined to be 0.79 mmol/L and using this value, LOD was determined to be 0.87 mmol/L.

e. Analytical specificity:

The sponsor evaluated the effect of known endogenous interferents on potassium assay in Olympus AU400 System using serum samples at two potassium levels. The interferents were tested at five levels and the test range included triglycerides (0-1000 mg/dL), hemoglobin (0-500 mg/dL), free bilirubin (0-20 mg/dL), bound bilirubin (0-20 mg/dL), and ascorbic acid (0-10 mM/L). The low and high potassium serum samples were spiked with varied concentrations of interfering substances and the results compared to the potassium samples without added interferant. The sponsor defined noninterference as <10% deviation from the un-spiked samples. Based on data, the sponsor claims no interference for the substances and concentrations listed in the table below:

Interference	Concentration
Ascorbic Acid	10 mM
Bilirubin	15 mg/dL
Bilirubin Conjugate	20 mg/dL
Hemoglobin	500 mg/dL
Triglyceride	1000 mg/dL

To determine the level of interference from other cations and substances normally present in the serum, potassium serum based control pools concentrations of 4.2 and 6.4 mM were spiked with various concentrations of cations and compared to the same control pools without added cation. Based on the sponsor's definition of intereference (greater than ± 10% of non-interfered value), the sponsor claims no interference for the cations and concentrations listed in the table below:

Interference	Concentration
NH_4^+	0.5 mM
P_i	2.0 mM
Ca^{2+}	7.5 mM
Na^+	150 mM
Cu^{2+}	0.5 mM
Fe^{3+}	0.5 mM
Zn^{2+}	0.5 mM

f. Assay cut-off:
Not Applicable.

2. Comparison studies:

a. Method comparison with predicate device:

To demonstrate the substantial equivalence to the predicate device, EasyLyte ISE Na/K/Li instrument (K914810) method, the sponsor conducted a method comparison study using Olympus AU400 System. A total of 52 unaltered serum samples (range: 2.7-7.7 mM/L) were used for this study. Linear regression analysis of the data generated produced the regression equation y = 1.0703x - 0.3042 with correlation (r) of 0.9805. The analysis of data using Passing & Bablok method generated regression equation y = 1.0769x -0.3577 with 95% CI of -0.550 to -0.1893 for intercept and 95% CI of 1.0357 to 1.1250 for the slope.

b. Matrix comparison:
Not Applicable.

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):

4. Clinical cut-off**:**
Not Applicable.

5. Expected values/Reference range:

The expected values of extracellular potassium levels were based on literature*. The expected value is 3.5 - 5.5mM. However, the sponsor recommends each laboratory should establish a range of normal values for the population in their region.

* Wu, A.H.B., ed. Tietz clinical guide to laboratory tests, 4th edition, p. 880. W.B. Saunders Company, St. Louis (2006).

N. Proposed 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.