Lactate (Liquid) Reagent Set

Intended Use
For the quantitative determination of lactate in human plasma on the Mindray BS-480 Analyzer. For *in vitro* diagnostic use only.

Clinical Significance
Lactate determinations are used in the diagnosis of lactate acidosis. Shock is the most widely recognized cause of lactic acidosis although, it is possible for elevated lactate levels to precede shock. Myocardial infarction, severe congestive heart failure, pulmonary edema and blood loss are the common causes of shock which will produce lactic acidosis. Lactic acidosis may also result from renal failure and leukemia. Thiamine deficiency and diabetic ketoacidosis will usually result in increased levels of lactate.

Method History
Originally lactic acid determinations were performed by either titrametric or colorimetric methods.
The first enzymatic method for lactic acid was based on the transfer of hydrogen from lactate to potassium ferrocyanide by lactate dehydrogenase (LD). This procedure was very cumbersome and did not gain wide acceptance. More current enzymatic methods involved the measurement of NADH formed from the oxidation of lactate by LD.[1,2] This method has become more widely used, but still suffers from instability in many analyzer systems. The current enzymatic method is based on the action of lactate oxidase.

Principle
Lactate oxidase catalyzes the oxidation of lactic acid to pyruvate and hydrogen peroxide. Peroxidase then catalyzes the reaction of hydrogen peroxide with a hydrogen donor, in the presence of 4-aminophenazone, to form a dye. Color intensity, measured at 550nm, is proportional to the lactate concentration in the sample.

$$\text{Lactate} + O_2 \xrightarrow{\text{Lactate Oxidase}} \text{Pyruvate} + \text{Hydrogen Peroxide}$$

$$\text{Hydrogen Peroxide} + \text{TOOS} + \text{4-AAP} \xrightarrow{\text{Peroxidase}} \text{Dye (550 nm)}$$

Reagents
Lactate Reagent (R1): TRIS Buffer 100mM, 4-aminoantipyrene 1.7mM, Peroxidase (Horseradish) > 10,000 U/L, Surfactant, Stabilizer, Sodium Azide (0.09%) as preservative.
Lactate Reagent (R2): TRIS Buffer 100mM, Lactate Oxidase (Microbial) > 1,000 U/L, TOOS 1.5mM, Surfactant, Stabilizer, Sodium Azide (0.09%) as preservative.

Precautions and Hazards
1. This reagent is for *in vitro* diagnostic use only.
2. Reagents contain sodium azide as preservative. Upon disposal flush with large volumes of water.
3. All specimens used in this test should be considered potentially infectious. Universal precautions as they apply to your facility should be used for handling and disposal of materials during and after testing.
4. Do not use the reagents beyond the expiration date printed on the kit label.

Hazards:
R1 and R2: Hazard Classifications: Not a hazardous substance or mixture.
Pictogram: Not required.
Signal Word: Not required.
Hazard Statements: Not a hazardous substance or mixture.
Precautionary Statements: Not a hazardous substance or mixture.
Refer to the Safety Data Sheet for this product (SDS-LAC480) available at www.medtestdx.com.

Reagent Preparation
Lactate reagents R1 and R2 are ready to use.

Reagent Storage and Stability
All reagents are stable until the expiration date on the label when stored at 2-8°C. Manufacturer studies have shown reagent is stable for 30 days once placed in the refrigerated reagent carousel (2-10°C).

Specimen Collection and Storage
Plasma collected in sodium fluoride/potassium oxalate is the recommended specimen. The specimen should be immediately placed on ice and the cells must be separated within 15 minutes.[3] The sample should be drawn from a stasis-free vein.[4] If not analyzed promptly, specimens may be stored at 2-8°C for up to 2 days. If specimens need to be stored for more than 2 days, they may be stored for one month frozen at –20°C.[5]

Interferences
All interference studies were conducted based on the procedures recommended in NCCLS guideline No. EP7-P.[6] Hemoglobin at levels up to 500 mg/dl and Bilirubin at levels up to 20 mg/dl were found to exhibit negligible interference (<5%) on this method. Samples with levels of interfering substances higher than the upper limits should be diluted with physiological saline before assaying. Multiply the result obtained from the manual dilution by the appropriate dilution factor. For a comprehensive review of drug interference on lactate levels see Young et al.[7]

Materials Provided
Lactate (Liquid) Reagent Set

Materials Required but not Provided

1. Lactate standard or suitable serum-based calibrator.
2. Controls with normal and elevated levels of lactate.
3. Mindray BS-480 Analyzer

Limitations

1. Anticoagulants containing citrate should not be used.
2. Protect the reagents from direct sunlight.
3. Samples with values greater than 15mmol/L must be diluted 1:1 with saline and re-assayed. Multiply the result by two.

Calibration

Use an NIST-traceable lactate standard, or a suitable serum-based lactate standard. The procedure should be calibrated according to the instrument manufacturer's instructions. If control results are found to be out of range, the test may need to be re-calibrated. Under typical operating conditions manufacturer calibration stability studies have shown the calibration curve will be stable for at least 14 days.

Quality Control

Reliability of test results should be routinely monitored with control materials that reasonably emulate performance of patient specimens. Quality control materials are intended for use only as monitors of accuracy and precision. The recovery of control values within the appropriate range should be the criteria used in evaluation of future assay performance. Controls should be run with every working shift in which lactate assays are performed. It is recommended that each laboratory establish their own frequency of control determination. Quality control requirements should be determined in conformance with local, state, and/or Federal regulations or accreditation requirements.

Results

To convert from S.I. units to conventional units, multiply the S.I. units by 9.01.

Example: mmol/L x 9.01 = mg/dL Lactate

Expected Values

The following reference range is suggested for L-Lactate.[8]

Venous	0.5-2.2 mmol/L
Arterial	0.5-1.6 mmol/L

It is highly recommended that each laboratory establish its own range of expected values.

Performance

1. Assay Range: 0.0-15.0 mmol/L.
2. Correlation: A study was performed between the Mindray BS-480 and a similar analyzer using this method, resulting in the following:

Method	Lactate
N	80
Mean Lactate (mmol/L)	4.21
Range (mmol/L)	0.5-15.0
Standard Deviation	4.54
Regression Analysis	y = 0.967x + 0.08
Correlation Coefficient	0.9989

3. Precision: Precision studies were performed following a modification of the guidelines contained in the NCCLS document EP5-T2.[9]

Within Day

Sample	LOW	MID	HIGH
N	20	20	20
Mean	1.60	2.51	11.76
Standard Deviation	0.00	0.03	0.05
Coefficient of Variation (%)	0.0%	1.2%	0.4%

Total

Sample	LOW	MID	HIGH
N	40	40	40
Mean	1.60	2.57	11.82
Standard Deviation	0.19	0.02	0.06
Coefficient of Variation (%)	1.4%	2.2%	1.6%

4. Sensitivity**:** 2SD limit of detection (95% Conf) = 0.0 mmol/L

References

1. Gutmann, I., Wahlefeld, A., Methods of Enzymatic Analysis. 2nd Ed., Academic Press, New York, 1974, 1464.
2. Noll, F., Methods of Enzymatic Analysis. 2nd Ed., Academic Press, New York, 1974, 1465.
3. Tietz, N.W., Fundamentals of Clinical Chemistry, 4th Ed., W.B. Saunders Company, Philadelphia, 1996, 367.
4. Tietz, N.W., Clinical Guide to Laboratory Tests, 3rd Ed., W.B. Saunders Company, Philadelphia, 1995, 382-383.
5. Westgard, J.O., Lahmeyer, B.L, Birnbaum, M.L, Clin Chem 1972, 18:1334-1338.
6. National Committee for Clinical Laboratory Standards, National Evaluation Protocols for Interference Testing, Evaluation Protocol Number 7, Vol. 4, No. 8, June 1984.
7. Young, D.S., effects of Drugs on Clinical Laboratory Tests, 3rd Ed., AACC Press, Washington D.C., 1990.
8. Tietz, N.W., Fundamentals of Clinical Chemistry, 4th Ed., W.B. Saunders Company, 1996, 801.
9. NCCLS document "Evaluation of Precision Performance of Clinical Chemistry Devices" 2nd Ed., 1992.

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CHEMISTRY PARAMETERS

Chem:	LACT	No.:	222	Sample Type:	Plasma
Chemistry:	Lactate			Print Name:	LACT
Reaction Type:	End Point			Reaction Direction:	Positive
Pri Wave:	546			Sec Wave:	660
Unit:	mmol/L			Decimal	0.1
Blank Time:	47 49			Reaction Time:	80 82

	Sample Vol.	Aspirated	Diluent	Reagent Vol.	Diluent
Standard:	2.7 ul	--- ul	--- ul	R1: 120 ul	--- ul
Decreased:	--- ul	--- ul	--- ul	R2: 80 ul	-- ul
Increased:	--- ul	--- ul	--- ul	R3: --- ul	-- ul
	☐ Sample Blank	☑ Auto Rerun		R4: --- ul	--- ul

Slope/Offset Adjustment

Slope: 1 Offset: 0

Linearity Range (Standard)	0	15	Linearity Limit:	
Linearity Range (Decreased)	____	____	Substrate Depletion:	
Linearity Range (Increased)	____	____	Mixed Blank Abs:	
R1 Blank Abs:	____	____	Uncapping Time	
Blank Response:	____	____	Reagent Alarm Limit:	
Twin Chemistry:			☐ Enzyme Linear Extension	

☐ Prozone Check ○ Rate Check ○ Antigen Addition

Q1: Q2: Q3: Q4:

PC: ABS:

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CALIBRATION PARAMETERS

Calibrator Definition

Calibrator:	*	Lot No.:	*
Exp Date:	*		

Carousel	**Pos**
Sample Carousel 1	*
Sample Carousel 2	
Sample Carousel 3	

Reagent/Calibration

Calibrator	Pos	Lot No	Exp Date	Chem	Conc	Unit
Water	W	*	*	LACT	0	mmol/L
Lactate Standard	*	*	*	LACT	*	mmol/L

Calibration Setup

Chem: LACT

Calibration Settings

Math Model: Two-Point Linear

Factor: Replicates: 2

Acceptance Limits

Cal Time:	*	Hour	
Slope Diff:	---	SD:	---
Sensitivity :	---	Repeatability:	---
Deter Coeff:	---		

Auto Calib.

☐ Bottle Changed ☐ Lot Changed ☐ Cal Time

It is recommended that two levels of control material be assayed daily.
* Indicates user defined parameter.

REF LAC480

Manufactured for MedTest DX
5449 Research Drive Canton, MI 48188

2°C 8°C

IVD

Symbol Key

Use by (YYYY-MM-DD)	LOT Lot and batch code	REF Catalog number	Manufacturer
Temperature limitation	Consult instructions for use	IVD *In vitro* diagnostic medical device	