CO2-L

cobas®

Bicarbonate liquid

Order information

REF	CONTENT		Analyzer(s) on which **cobas c** pack(s) can be used
03289923190	Bicarbonate liquid (250 tests)	System-ID 07 6725 5	COBAS INTEGRA 400 plus

Materials required (but not provided):

20751995190	Ammonia/Ethanol/CO_2 Calibrator (2 × 4 mL)	System-ID 07 5199 5	
20752401190	Ammonia/Ethanol/CO_2 Control Normal (5 × 4 mL)	System-ID 07 5240 1	
20753009190	Ammonia/Ethanol/CO_2 Control Abnormal (5 × 4 mL)	System-ID 07 5300 9	
12149435122	Precinorm U plus (10 × 3 mL)	System-ID 07 7999 7	
12149435160	Precinorm U plus (10 × 3 mL, for USA)	System-ID 07 7999 7	
12149443122	Precipath U plus (10 × 3 mL)	System-ID 07 8000 6	
12149443160	Precipath U plus (10 × 3 mL, for USA)	System-ID 07 8000 6	

English

System information

Test CO2-L, test ID 0-625

Intended use

In vitro test for the quantitative determination of the bicarbonate (HCO_3^-) concentration in human serum and plasma on COBAS INTEGRA systems.

Summary

Bicarbonate is the second largest fraction of the anions in plasma. Included in this fraction are the bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) ions, as well as the carbamino compounds. At the physiological pH of blood, the concentration of carbonate is 1/1000 that of bicarbonate. The carbamino compounds are also present in such low quantities that they are generally not mentioned specifically.

Several different methods for the determination of bicarbonate in serum and plasma have been reported. Most of these procedures utilize acidification of the sample and conversion of all carbon dioxide forms to CO_2 gas.[1] The amount of gas formed is measured by manometric or volumetric devices, ion selective electrodes, or spectrophotometric techniques.[2,3] These methods are either cumbersome, time-consuming, technique-oriented, and/or require special equipment.

Enzymatic procedures using phosphoenolpyruvate carboxylase (PEPC) have been described.[4,5]

The bicarbonate content of serum or plasma is a significant indicator of electrolyte dispersion and anion deficit. Together with pH determination, bicarbonate measurements are used in the diagnosis and treatment of numerous potentially serious disorders associated with acid-base imbalance in the respiratory and metabolic systems.

Test principle

Bicarbonate reacts with phosphoenolpyruvate (PEP) in the presence of PEPC to produce oxaloacetate and phosphate:

$$PEP + HCO_3^- \xrightarrow{PEPC} \text{oxaloacetate} + H_2PO_4^-$$

The above reaction is coupled with one involving the transfer of a hydrogen ion from NADH analog to oxaloacetate using MDH.

$$\text{Oxaloacetate} + \text{NADH analog} + H^+ \xrightarrow{MDH} \text{malate} + NAD^+ \text{ analog}$$

The resultant consumption of NADH analog causes a decrease in absorbance at 409 nm, which is proportional to the concentration of bicarbonate in the sample being assayed.

Reagents - working solutions

R Phosphoenolpyruvate: ≥ 40 mmol/L; NADH analog: ≥ 2 mmol/L; MDH (porcine): ≥ 314.3 µkat/L; PEPC (microbial): ≥ 30.8 µkat/L

R is in position B.

Precautions and warnings

For in vitro diagnostic use for health care professionals. Exercise the normal precautions required for handling all laboratory reagents.

Infectious or microbial waste:
Warning: handle waste as potentially biohazardous material. Dispose of waste according to accepted laboratory instructions and procedures.

Environmental hazards:
Apply all relevant local disposal regulations to determine the safe disposal.

Safety data sheet available for professional user on request.

For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

Reagent handling

Ready for use

Storage and stability

Shelf life at 2-8 °C	See expiration date on **cobas c** pack label
On-board in use at 10-15 °C	6 weeks

Specimen collection and preparation

For specimen collection and preparation only use suitable tubes or collection containers.

Only the specimens listed below were tested and found acceptable.
Serum
Plasma: Heparin (Li-, Na-, NH_4^+-) plasma

The preferred specimen is from venous blood collected anaerobically in the usual manner for bicarbonate analysis. Bicarbonate content in uncapped tubes decreases approximately 4 mmol/L after one hour.[6] It has been reported that alkalinized serum stored in open cups is stable for up to 4 hours.[6]

The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube manufacturer.

Centrifuge samples containing precipitates before performing the assay.

Separate from erythrocytes and store tightly stoppered.

See the limitations and interferences section for details about possible sample interferences.

Stability:	7 days at 4-8 °C[7]
	40 hours at 15-25 °C[8,9]

Storage of serum at -20 °C or -80 °C for up to 6 months had no significant effect.[10]

Sample stability claims were established by experimental data by the manufacturer or based on reference literature and only for the temperatures/time frames as stated in the method sheet. It is the responsibility of the individual laboratory to use all available references and/or its own studies to determine specific stability criteria for its laboratory.

Materials provided

See “Reagents – working solutions” section for reagents.

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Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator's manual for analyzer-specific assay instructions.

Application for serum and plasma

Test definition

Measuring mode	Absorbance
Abs. calculation mode	Endpoint
Reaction mode	R-S
Reaction direction	Decrease
Wavelength A/B	409/512 nm
Calc. first/last	21/45
Unit	mmol/L

Pipetting parameters

		Diluent (H_2O)
R	50 µL	120 µL
Sample	2 µL	10 µL
Total volume	182 µL	

Calibration

Calibrator	Roche Ammonia/Ethanol/CO_2 Calibrator Use deionized water as zero calibrator.
Calibration mode	Linear regression
Calibration replicate	Duplicate recommended
Calibration interval	Each lot and as required following quality control procedures

Calibration interval may be extended based on acceptable verification of calibration by the laboratory.

Traceability: This method has been standardized against a primary standard traceable to NIST.

Quality control

Reference range	Roche Ammonia/Ethanol/CO_2 Control Normal or Precinorm U plus
Pathological range	Roche Ammonia/Ethanol/CO_2 Control Abnormal or Precipath U plus
Control interval	24 hours recommended
Control sequence	User defined
Control after calibration	Recommended

For quality control, use control materials as listed in the "Order information" section. In addition, other suitable control material can be used.

The control intervals and limits should be adapted to each laboratory's individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

Follow the applicable government regulations and local guidelines for quality control.

Calculation

COBAS INTEGRA analyzers automatically calculate the analyte concentration of each sample. For more details, please refer to Data Analysis in the Online Help.

Conversion factor: mmol/L x 1 = mEq/L[11]

Limitations - interference

Criterion: Recovery within ± 10 % of initial value.

Icterus:[12] No significant interference up to an I index of 60 for conjugated and unconjugated bilirubin (approximate conjugated and unconjugated bilirubin concentration: 1026 µmol/L or 60 mg/dL).

Hemolysis:[12] No significant interference up to an H index of 1000 (approximate hemoglobin concentration: 621 µmol/L or 1000 mg/dL).

Lipemia (Intralipid):[12] No significant interference up to an L index of 2000. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

Drugs: No interference was found at therapeutic concentrations using common drug panels.[13,14]

Criterion: Recovery within ± 10 % of initial value at a bicarbonate concentration of 22 mmol/L.

Immunoglobulins: No significant interference from immunoglobulins up to a concentration of 35 g/L (233.5 µmol/L) (simulated by human immunoglobulin G)

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.[15]

An abnormally elevated concentration of ambient carbon dioxide (CO_2) may occur under certain environmental conditions in the laboratory. The fluctuating ambient CO_2 concentration may interfere with the CO2-L assay leading to higher CO_2 results. Under these circumstances, the reduction of the re-calibration interval may become necessary if the laboratory is unable to keep the ambient CO_2 concentration at a normal level by appropriate countermeasures.

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.

ACTION REQUIRED

Special Wash Programming: The use of special wash steps is mandatory when certain test combinations are run together on COBAS INTEGRA analyzers. Refer to the CLEAN Method Sheet for further instructions and for the latest version of the Extra wash cycle list.

Where required, special wash/carry-over evasion programming must be implemented prior to reporting results with this test.

Limits and ranges

Measuring range

2.0-50 mmol/L (2.0-50 mEq/L)

Lower limits of measurement

Lower detection limit of the test:
2.0 mmol/L (2.0 mEq/L)

The lower detection limit represents the lowest measurable analyte level that can be distinguished from zero. It is calculated as the value lying 3 standard deviations above that of the lowest standard (lowest standard + 3 SD, repeatability, n = 21).

Expected values

22-29 mmol/L (22-29 mEq/L)[1]

Each laboratory should investigate the transferability of the expected values to its own patient population and if necessary determine its own reference ranges.

Specific performance data

Representative performance data on the COBAS INTEGRA analyzers are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using human samples and controls in an internal protocol with repeatability (n = 21) and intermediate precision (3 aliquots per run, 1 run per day, 21 days). The following results were obtained:

	Level 1	Level 2
Mean	19.7 mmol/L (19.7 mEq/L)	35.4 mmol/L (35.4 mEq/L)
CV repeatability	0.6 %	0.5 %

	Level 1	Level 2
Mean	16.8 mmol/L (16.8 mEq/L)	28.8 mmol/L (28.8 mEq/L)
CV intermediate precision	3.5 %	3.8 %

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Method comparison

Bicarbonate values for human serum and plasma samples obtained on a COBAS INTEGRA 800 analyzer using the COBAS INTEGRA Bicarbonate liquid reagent (y) were compared with those determined using the COBAS INTEGRA Carbon Dioxide reagent (CO2-S) on a COBAS INTEGRA 800 analyzer (x) and using the Bicarbonate liquid assay on a Roche/Hitachi 917 analyzer (x).

COBAS INTEGRA 800 analyzer	Sample size (n) = 57
Passing/Bablok[16]	Linear regression
y = 0.981x + 0.176 mmol/L	y = 0.973x + 0.355 mmol/L
τ = 0.984	r = 1.000
SD (md 95) = 0.400	Sy.x = 0.195

The sample concentrations were between 1.13 and 46.2 mmol/L (1.13 and 46.2 mEq/L)

Roche/Hitachi 917 analyzer	Sample size (n) = 57
Passing/Bablok[16]	Linear regression
y = 1.010x + 0.128 mmol/L	y = 1.004x + 0.467 mmol/L
τ = 0.969	r = 0.998
SD (md 95) = 1.06	Sy.x = 0.434

The sample concentrations were between 1.1 and 44.3 mmol/L (1.1 and 44.3 mEq/L).

References

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A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard (for USA: see dialog.roche.com for definition of symbols used):

CONTENT	Contents of kit
→	Volume for reconstitution
GTIN	Global Trade Item Number

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