CO2-L

cobas®

Bicarbonate Liquid

Order information

REF	CONTENT		Analyzer(s) on which **cobas c** pack(s) can be used
05446376 191	Bicarbonate Liquid (1100 tests)	System-ID 05 6725 6	Roche/Hitachi **cobas c** 701/702
06407102 190*	Bicarbonate Liquid (700 tests)	System-ID 03 6725 5	Roche/Hitachi **cobas c** 701/702
06407102 214*	Bicarbonate Liquid (700 tests)	System-ID 03 6725 5	Roche/Hitachi **cobas c** 701/702
20751995 190	Ammonia/Ethanol/CO2 Calibrator (2 x 4 mL)	Code 688	
20752401 190	Ammonia/Ethanol/CO2 Control Normal (5 x 4 mL)	Code 100	
20753009 190	Ammonia/Ethanol/CO2 Control Abnormal (5 x 4 mL)	Code 101	
12149435 122	Precinorm U plus (10 x 3 mL)	Code 300	
12149435 160	Precinorm U plus (10 x 3 mL, for USA)	Code 300	
12149443 122	Precipath U plus (10 x 3 mL)	Code 301	
12149443 160	Precipath U plus (10 x 3 mL, for USA)	Code 301	

* Some kits shown may not be available in all countries.

English

System information

CO2-L: ACN 8156

SCO2L: ACN 8763 (STAT, reaction time: 4)

Intended use

In vitro test for the quantitative determination of bicarbonate (HCO_3^-) in human serum and plasma on Roche/Hitachi **cobas c** 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, which is proportional to the concentration of bicarbonate in the sample being assayed.

Reagents - working solutions

R1 Phosphoenolpyruvate: ≥ 40 mmol/L; NADH analog: ≥ 2 mmol/L; MDH (porcine): ≥ 314.3 µkat/L; PEPC (microbial): ≥ 30.8 µkat/L

Cat. No. **05446376** 191: R1 is in position B and position C is empty.

Cat. No. **06407102** 190: R1 is in position B and position C is empty.

Cat. No. **06407102** 214: R1 is in position B and position C is empty.

Precautions and warnings

For in vitro diagnostic use.
Exercise the normal precautions required for handling all laboratory reagents.
Disposal of all waste material should be in accordance with local guidelines.
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 and refrigerated on the analyzer:	4 weeks
On-board on the Reagent Manager:	24 hours

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: Li-heparin 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]

Storage of serum at -20 °C or -80 °C for up to 6 months had no significant effect.[7]

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.

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

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.

CO2-L

Bicarbonate Liquid

cobas®

Stability:	7 days at 4-8 °C[8]
	40 hours at 15-25 °C[9,10]

Separate from erythrocytes and store tightly stoppered.

Materials provided

See "Reagents – working solutions" section for reagents.

Materials required (but not provided)

- See "Order information" section
- General laboratory equipment

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.

The performance of applications not validated by Roche is not warranted and must be defined by the user.

Application for serum and plasma

cobas c 701/702 **test definition**

Assay type	2-Point Rate		
Reaction time / Assay points	10 / 3-15 (STAT 4 / 3-15)		
Wavelength (sub/main)	505/415 nm		
Reaction direction	Decrease		
Unit	mmol/L		
Reagent pipetting		Diluent (H_2O)	
R1	50 µL	130 µL	
Sample volumes	*Sample*	*Sample dilution*	
		Sample	*Diluent (H_2O)*
Normal	2 µL	–	–
Decreased	2 µL	–	–
Increased	4 µL	–	–

Calibration

Calibrators	S1: H_2O S2: Ammonia/Ethanol /CO_2 Calibrator
Calibration mode	Linear
Calibration frequency	2-point calibration - after 14 days on board - after reagent lot change - 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.

Quality Control

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

Roche/Hitachi **cobas c** systems automatically calculate the analyte concentration of each sample.

Limitations – interference

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

Icterus:[11] 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:[11] No significant interference up to an H index of 600 (approximate hemoglobin concentration: 372.6 µmol/L or 600 mg/dL).

Lipemia (Intralipid):[11] No significant interference up to an L index of 1800. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

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

Drugs: No interference was found at therapeutic concentrations using common drug panels.[12,13]

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.[14]

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 Roche/Hitachi **cobas c** systems. All special wash programming necessary for avoiding carry-over is available via the **cobas** link, manual input is required in certain cases. The latest version of the carry-over evasion list can be found with the NaOHD/SMS/SmpCln1+2/SCCS Method Sheet and for further instructions refer to the operator's manual.

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

Limits and ranges

Measuring range

2-50 mmol/L

Lower limits of measurement

Lower detection limit of the test:

2 mmol/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 (standard 1 + 3 SD, repeatability, n = 21).

Values below the lower detection limit (< 2 mmol/L) will not be flagged by the instrument.

Expected values[1]

22-29 mmol/L

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 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:

Repeatability	*Mean mmol/L*	*SD mmol/L*	*CV %*
Ammonia/Ethanol/CO2 Control Normal	23.0	0.2	0.7
Ammonia/Ethanol/CO2 Control Abnormal	32.4	0.3	1.0
Human serum A	11.1	0.2	1.4

Human serum B	25.1	0.4	1.5
Human serum C	43.1	0.4	0.9
Intermediate precision	*Mean mmol/L*	*SD mmol/L*	*CV %*
Ammonia/Ethanol/CO2 Control Normal	17.6	0.2	1.3
Ammonia/Ethanol/CO2 Control Abnormal	30.5	0.4	1.4
Human serum 3	9.90	0.23	2.3
Human serum 4	26.3	0.3	1.3

Results for intermediate precision were obtained on the master system **cobas c** 501 analyzer.

Method comparison

Bicarbonate values for human serum and plasma samples obtained on a Roche/Hitachi **cobas c** 701 analyzer (y) were compared with those determined using the corresponding reagent on a Roche/Hitachi **cobas c** 501 analyzer (x).

Sample size (n) = 134

Passing/Bablok[15]	Linear regression
y = 0.979x + 0.706 mmol/L	y = 0.976x + 0.786 mmol/L
τ = 0.965	r = 0.999

The sample concentrations were between 2.26 and 48.8 mmol/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.

Symbols

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

CONTENT	Contents of kit
→	Volume after reconstitution or mixing
GTIN	Global Trade Item Number

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