



A Honeywell Company

## Carbon Dioxide in Amine Solution

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### UOP Method 826-10

#### Scope

This method is for determining carbon dioxide in amine solution using a commercially available total inorganic carbon analyzer. The lower limit of quantitation is 20 mg/L.

#### References

ASTM Method D513, "Total and Dissolved Carbon Dioxide in Water," [www.astm.org](http://www.astm.org)

ASTM Method D1293, "pH of Water," [www.astm.org](http://www.astm.org)

UIC Application Note 9, "Determination of Carbon Dioxide in Amine Gas Scrubbing Solutions," [www.uicinc.com](http://www.uicinc.com)

UIC Total Inorganic Carbon Analyzer Instrument Manual, [www.uicinc.com](http://www.uicinc.com)

#### Outline of Method

The analyzer is purged of atmospheric CO<sub>2</sub> and an aliquot of the sample is injected. Acid is added to evolve the CO<sub>2</sub> and the evolved gas is scrubbed to remove potentially interfering gases. The CO<sub>2</sub> is then measured using coulometric titration.

#### Apparatus

References to catalog numbers and suppliers are included as a convenience to the method user. Other suppliers may be used. However, at this writing, UIC is the only known manufacturer of the apparatus required for this analysis.

*Balance*, analytical, readable to 0.0001 g

*Balance*, laboratory, readability 0.01-g

*Bottle*, 500-mL, clear glass, with poly-lined cap, VWR, Cat. No. 89043-070, if needed, see *Procedure*

*pH meter*, conforming to the requirements given in ASTM Method D1293, "pH of Water"

*Scrubber*, 500-mL, Ace Glass, Cat. No. 4055-06, if needed, see *Procedure*

*Syringe*, 250-μL, glass, cemented needle, VWR, Cat. No. 60373-061 or 60375-263

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| IT IS THE USER'S RESPONSIBILITY TO ESTABLISH APPROPRIATE PRECAUTIONARY PRACTICES AND TO DETERMINE THE APPLICABILITY OF REGULATORY LIMITATIONS PRIOR TO USE. EFFECTIVE HEALTH AND SAFETY PRACTICES ARE TO BE FOLLOWED WHEN UTILIZING THIS PROCEDURE. FAILURE TO UTILIZE THIS PROCEDURE IN THE MANNER PRESCRIBED HEREIN CAN BE HAZARDOUS. MATERIAL SAFETY DATA SHEETS (MSDS) OR EXPERIMENTAL MATERIAL SAFETY DATA SHEETS (EMSDS) FOR ALL OF THE MATERIALS USED IN THIS PROCEDURE SHOULD BE REVIEWED FOR SELECTION OF THE APPROPRIATE PERSONAL PROTECTION EQUIPMENT (PPE). |
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*Total inorganic carbon analyzer*, UIC, Model CM140, with CM5015 coulometer; includes CM5014 analyzer and CM5130 acidification module. Contact the manufacturer for options, accessories, spare parts, and supplies necessary for the specific installation. The following options and supplies are listed in Application Note 9:

*Auxiliary scrubber assembly*, with 100-mL flask, threaded, Cat. No. CM210-017

*Ring stand*, with clamp, for holding glassware

## Reagents and Materials

References to catalog numbers and suppliers are included as a convenience to the method user. Other suppliers may be used. References to water mean deionized or distilled.

Refer to UIC Application Note 9 and the total inorganic carbon analyzer instrument manual for reagents and materials needed for this analysis. The following reagents and materials are listed in Application Note 9:

*Carbon anode solution*, Cat. No. CM300-002

*Carbon cathode solution*, Cat. No. CM300-001

*External carrier gas* (optional, see Application Note 9)

*Post scrubbing solution*, 20% silver nitrate; prepared from reagent water containing 3% hydrogen peroxide and acidified with nitric acid to a pH of 2.

*Potassium iodide*, Cat. No. 300-003

*Pre scrubbing solution*, 40 to 45% potassium hydroxide solution (optional, see Application Note 9)

## Procedure

The analyst is expected to be familiar with general laboratory practices and the equipment being used.

Assemble the instrument and analyze samples as described in UIC Application Note 9, "Determination of Carbon Dioxide in Amine Gas Scrubbing Solutions," and the instrument manual. ASTM Method D513, "Total and Dissolved Carbon Dioxide in Water," may also be used for reference.

SO<sub>2</sub> and H<sub>2</sub>S will interfere with the analysis of CO<sub>2</sub>. If these compounds are present in the samples to be analyzed, insert an additional scrubber filled with a silver nitrate solution as described in Application Note 9.

Calibration is not required, but check the instrument's performance by analyzing a small amount of calcium carbonate or sodium bi carbonate and sodium carbonate as described in Application Note 9.

## Calculations

All calculations are performed by the instrument. For additional information, refer to the total inorganic carbon analyzer instrument manual.

## Precision

### Repeatability

Based on 8 tests performed on each of three samples by one analyst, the within day estimated standard deviations (esd) were calculated at the concentrations listed in the Table. Two analyses

performed in one laboratory by the same analyst on the same day should not differ by more than the repeatability allowable difference shown in the Table with 95% confidence.

The data in the Table represent short-term estimates of the repeatability of the method. When the test is run routinely, use of a control standard and a control chart is recommended to generate an estimate of long-term repeatability.

| <b>Table</b>                      |                                   |                                        |
|-----------------------------------|-----------------------------------|----------------------------------------|
| <b><u>Repeatability, mg/L</u></b> |                                   |                                        |
| <b><u>Concentration</u></b>       | <b><u>Within-<br/>Day esd</u></b> | <b><u>Allowable<br/>Difference</u></b> |
| <b>40</b>                         | <b>2.2</b>                        | <b>5</b>                               |
| <b>3693</b>                       | <b>29.1</b>                       | <b>69</b>                              |
| <b>30669</b>                      | <b>774.4</b>                      | <b>1831</b>                            |

#### **Reproducibility**

There is insufficient data to calculate the reproducibility of the test at this time.

#### **Time for Analysis**

The elapsed time and labor requirement for one analysis is less than 0.5 hour.

#### **Suggested Suppliers**

Ace Glass, Inc., 1430 North West Blvd., Vineland, NJ 08362-0688 USA (856-691-3333)  
[www.aceglass.com](http://www.aceglass.com)

UIC, Inc., Joliet, IL 60434-0863 USA (815-744-4477) [www.uicinc.com](http://www.uicinc.com)

VWR International, 1310 Goshen Pkwy., West Chester, PA 19380 USA (610-431-1700)  
[www.vwr.com](http://www.vwr.com)