

MBTH Method¹

Method 8110

3 to 500 µg/L CH₂O

Powder Pillows

Scope and Application: For water.

¹ Adapted from Matthews, T.G. and Howell, T.C., *Journal of the Air Pollution Control Association*, 31 (11) 1181-1184 (1981).



Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Adapter
DR 5000	2495402	A23618
DR 2800	2495402	—
DR 2700	2495402	—
DR/2500	2427606	—
DR/2400	2427606	—

Before starting the test:

Analyze samples immediately. Do not preserve for later analysis.

Wash glassware with Chromic Acid Cleaning Solution¹ to remove trace contaminants.

Time and temperature are very important to this test. The sample should be 25 ± 1 °C and the times specified in the procedure steps must be followed precisely. A temperature-controlled water bath is recommended for best accuracy.

Obtain formaldehyde-free water by distilling water from alkaline permanganate (4 g sodium hydroxide¹, 2 g potassium permanganate per 500 mL of water). Discard the first 50–100 mL of distillate.

The Pour-thru cell cannot be used for this test.

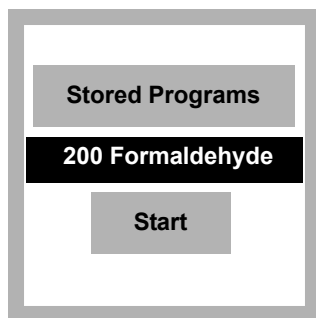
¹ See *Optional reagents and apparatus*.

Collect the following items:

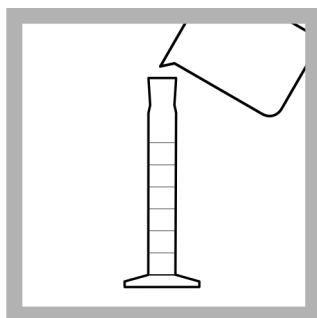
Description	Quantity
Developing Solution for LR Formaldehyde	5 mL
MBTH Powder Pillows	2
Cylinder, graduated mixing, 50-mL	2
Pipet, serological, 5-mL	1
Pipet Filler	1
Sample Cells (<i>Instrument-specific information</i>)	2

See *Consumables and replacement items* for reorder information.

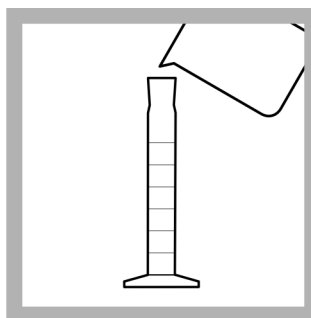
MBTH method for powder pillows



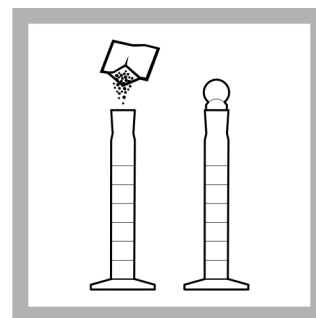
1. Select the test.
Insert an adapter if required (*Instrument-specific information*).
Refer to the user manual for orientation.



2. **Prepared Sample:**
Accurately measure 25 mL of sample in a 50-mL mixing cylinder.



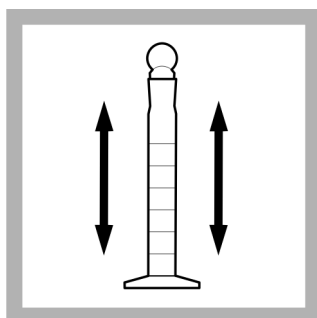
3. **Blank Preparation:**
Accurately measure 25 mL of formaldehyde-free water in a second 50-mL mixing cylinder.



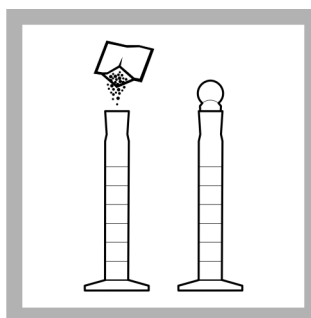
4. Add the contents of one MBTH powder pillow to the blank. Insert the cylinder stopper.



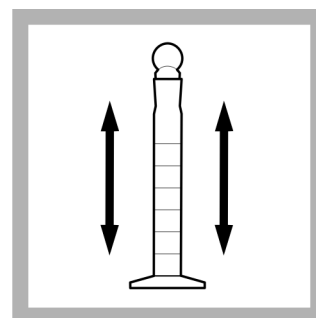
5. Start the instrument timer. A 17-minute reaction period will begin. Proceed with step 6 immediately after the timer starts.



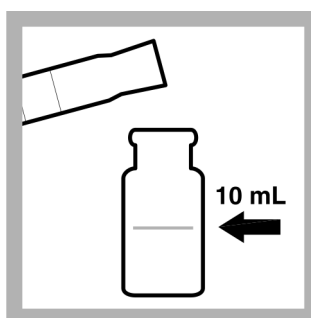
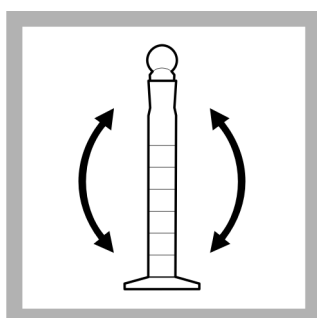
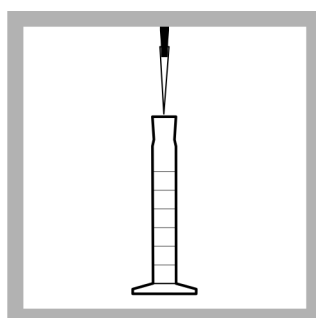
6. Immediately after the reaction period starts, shake the blank sample vigorously for 20 seconds. **Do not wait for the timer to expire.**



7. Add the contents of one MBTH powder pillow to the prepared sample when the timer shows **15:00**. Insert the cylinder stopper.



8. Shake vigorously for 20 seconds.



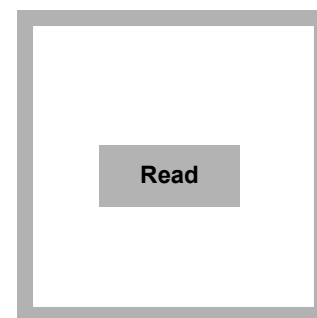
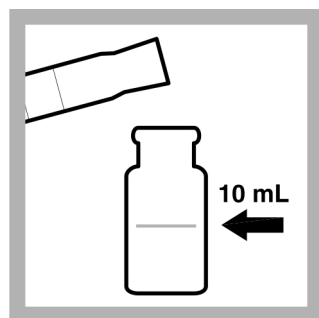
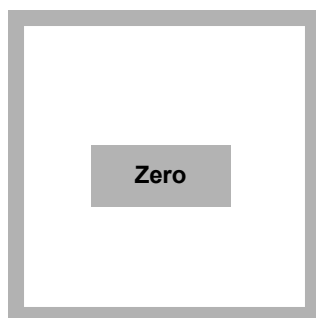
MBTH method for powder pillows (continued)

9. Add 2.5 mL of Developing Solution for Low Range Formaldehyde to the prepared sample when the timer shows **10:00**.

10. Insert the cylinder stopper and invert to mix.

11. Just before the timer shows **2:00**, pour at least 10 mL of the blank into the sample cell. Pour the solution slowly to avoid bubble formation on the cell walls. If bubbles form, swirl to dislodge them.

12. Immediately wipe the blank and insert it into the cell holder.



13. When the timer shows **2:00**, **ZERO** the instrument.

The display will show:

0 µg/L CH₂O

14. Pour at least 10 mL of the prepared sample into a sample cell.

15. Wipe the cell and insert it into the cell holder.

16. When the timer expires, **READ** the results in µg/L CH₂O.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level	Interfering substance	Interference level
Acetate	Greater than 1000 mg/L	Iron (Fe ³⁺)	Greater than 12 mg/L
Aldehydes (other)	Positive interference at all levels	Lead	Greater than 100 mg/L
Ammonium (as N)	Greater than 10 mg/L	Manganese	Greater than 500 mg/L
Aniline	Greater than 10 mg/L	Mercury	Greater than 70 mg/L
Bicarbonate	Greater than 1000 mg/L	Morpholine	Greater than 0.36 mg/L
Calcium	Greater than 3500 mg/L	Nitrate	Greater than 1000 mg/L
Carbonate	Greater than 500 mg/L	Nitrite	Greater than 8 mg/L
Chloride	Greater than 5000 mg/L	Phenol	Greater than 1050 mg/L
Copper	Greater than 1.6 mg/L	Phosphate	Greater than 200 mg/L
Cyclohexylamine	Greater than 250 mg/L	Silica	Greater than 40 mg/L
Ethanolamine	Greater than 33 mg/L	Sulfate	Greater than 10,000 mg/L
Ethylenediamine	Greater than 1.5 mg/L	Urea	Greater than 1000 mg/L
Glucose	Greater than 1000 mg/L	Zinc	Greater than 1000 mg/L
Glycine	Greater than 1000 mg/L		

Accuracy check

Required for accuracy check:

- Formaldehyde Voluette® Ampule Standard, 4000-mg/L CH₂O
- TenSette Pipet and Pipet Tips
- Flask, 100-mL volumetric Class A
- Mixing cylinders, 50-mL (3)

Standard additions method (sample spike)

1. After reading test results, leave the sample cell (unspiked sample) in the instrument.
2. Select standard additions from the instrument menu:

Instrument	Navigate to:
DR 5000	OPTIONS>MORE>STANDARD ADDITIONS
DR 2800	OPTIONS>MORE>STANDARD ADDITIONS
DR 2700	OPTIONS>MORE>STANDARD ADDITIONS
DR/2500	OPTIONS>STANDARD ADDITIONS
DR/2400	OPTIONS>STANDARD ADDITIONS

3. Default values for standard concentration, sample volume and spike volumes can be accepted or edited. After values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.
4. Open a Formaldehyde Voluette® Ampule Standard, 4000-mg/L CH₂O.
5. Use a TenSette® Pipet to add 0.2 mL of the standard to a 100-mL volumetric Class A flask. Dilute to volume with formaldehyde-free water and mix well. Prepare daily. This is an 8000-µg/L (8-mg/L) formaldehyde standard.
6. Prepare three sample spikes. Fill three 50-mL mixing cylinders* with 25 mL of sample. Use the TenSette Pipet to add 0.1 mL, 0.2 mL and 0.3 mL of 8000-µg/L standard, respectively, to each sample and mix thoroughly.
7. Analyze each sample spike as described in the procedure above, starting with the 0.1 mL sample spike. Accept each standard addition. Each addition should reflect approximately 100% recovery.
8. After completing the sequence, press **GRAPH** to view the best-fit line through the standard additions data points, accounting for the matrix interferences. Press **IDEAL LINE** to view the relationship between the sample spikes and the "Ideal Line" of 100% recovery

Standard solution method

Prepare a 320-µg/L Formaldehyde Standard Solution by pipetting 1.0 mL of the 8000-µg/L solution into a 50-mL mixing cylinder. Dilute to 25.0 mL with formaldehyde-free water. Run the test directly on this sample.

* See *Optional reagents and apparatus*.

Method performance

Program	Instrument	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
200	DR 5000	320 µg/L CH ₂ O	312–328 µg/L CH ₂ O	3 µg/L CH ₂ O
	DR 2800			
	DR 2700			
	DR/2500	300 µg/L CH ₂ O	285–315 µg/L CH ₂ O	
	DR/2400			

Summary of method

Formaldehyde reacts with MBTH (3-methyl-2-benzothiazoline hydrazone) and a developing solution to form a blue color in proportion to the formaldehyde concentration. Test results are measured at 630 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Formaldehyde Reagent Set (100 tests), includes:	—	—	2257700
Developing Solution for LR Formaldehyde	5 mL	500 mL	2257249
MBTH Powder Pillows	2	100/pkg	2257169

Required apparatus

Description	Quantity/Test	Unit	Catalog number
Cylinder, graduated mixing, 50-mL	2	each	189641
Pipet, serological, 5-mL	1	each	53237
Pipet Filler, safety bulb	1	each	1465100

Recommended standards

Description	Unit	Catalog number
Formaldehyde Standard Solution, 10-mL Voluette® Ampule, 4000-mg/L	16/pkg	2257310

Optional reagents and apparatus

Description	Unit	Catalog number
Chromic Acid Cleaning Solution	500 mL	123349
Potassium Permanganate	454 g	16801H
Sodium Hydroxide ACS	500 g	18734
Flask, volumetric, Class A, 100 mL	each	1457442
Pipet, TenSette, 0.1–1.0 mL	each	1970001
Pipet Tips, Tensette	50/pkg	2185696
Ampule Breaker	each	2196800
Wipes, disposable	280/pkg	2097000



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