



Designation: D 5221 – 92

AMERICAN SOCIETY FOR TESTING AND MATERIALS

1916 Race St. Philadelphia, Pa 19103

Reprinted from the Annual Book of ASTM Standards. Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Test Method for Continuous Measurement of Formaldehyde in Air¹

This standard is issued under the fixed designation D 5221; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the continuous measurement of formaldehyde vapor in indoor or outdoor atmospheres.

1.2 This test method employs an automated wet-chemical colorimetric analyzer with a continuous signal output.

1.3 The commercial analyzer has been modified such that formaldehyde vapor is absorbed in acidified (HCl) pararosaniline with subsequent addition of dilute sodium sulfite. The resulting colored product has a strong absorption band in the visible region (530 to 600 nm).

1.4 This test method is applicable to concentrations of formaldehyde from 10 to 500 µg/m³. Detection limits are dependent on sample airflow rate (maximum 1.0 L/min).

1.5 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Specific precautionary statements are given in Note 1.*

2. Referenced Documents

2.1 ASTM Standards:

D 1193 Specification for Reagent Water²

D 1356 Terminology Relating to Atmospheric Sampling and Analysis²

D 1605 Practices for Sampling Atmospheres for Analysis of Gases and Vapors²

D 3249 Practice for General Ambient Air Analyzer Procedures²

D 3609 Practice for Calibration Techniques Using Permeation Tubes²

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology D 1356.

3.2 Descriptions of Terms Specific to This Standard:

3.2.1 *analyzer signal response*—the magnitude of the sample response recorded by the analyzer, minus the response recorded in the absence of the analyte (that is, baseline condition).

3.2.2 *liquid equivalent standard*—the concentration of a

dilute formaldehyde solution expressed in terms of its equivalent vapor concentration (in air, by volume) that would produce an identical signal response if measured by the analyzer.

4. Summary of Test Method

4.1 A modified commercial analyzer is used to continuously monitor concentrations of formaldehyde vapor in air. The analyzer incorporates the modified pararosaniline colorimetric procedure that is described in Ref (1).³

4.2 The complex chemistry of reactions involving pararosaniline and formaldehyde have been studied extensively during the 35 years since West and Gaeke published their procedure for the colorimetric determination of sulfur dioxide (2). Although there remains some disagreement concerning the mechanism involving the formation of the final product, it is generally agreed that the chromophore is an alkylsulfonic acid (1).

4.3 The analyzer consists of a portable unit that contains a small diaphragm pump, an analytical module, a colorimeter with glass flow cells, a peristaltic pump and tubing, and a 12-V rechargeable battery for optional DC power operation.

4.4 An acidified pararosaniline scrubber solution is pumped through the reference cell in the colorimeter and is then diluted 1+1 with a liquid flow stream containing water. The diluted solution then passes into an air scrubber coil, where formaldehyde is quantitatively absorbed from the air sample stream. After the liquid and air are separated, the sample solution is mixed 1+1 with a dilute aqueous Na₂SO₃ reagent. A series of time delay coils allow 16 min for color development of the chromophore. The absorbance of the sample solution is continuously measured as it passes through the sample cell, resulting in a 0- to 4.0-V output signal generated by the microprocessor. A schematic representation of the major components and the liquid flow scheme of the instrument is shown in Fig. 1.

4.5 The analyzer baseline is established by introducing a source of zero air at the sample inlet. The monitor is calibrated by introducing one or more liquid equivalent formaldehyde standard solutions into the reagent flow sequence while zero air is sampled. The baseline is then reestablished by replacing the liquid standard solution with water in the flow sequence.

4.6 Signal processing is performed manually by comparing the instrument response to calibration standards to its response to air samples at selected time intervals. Continuous automatic signal processing is also feasible, by using a

¹ This test method is under jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

Current edition approved Jan. 15, 1992. Published March 1992.

² Annual Book of ASTM Standards, Vol 11.03.

³ The boldface numbers in parentheses refer to the list of references at the end of the text.