



Standard Test Method for Determination of Residual Acetaldehyde in Polyethylene Terephthalate Bottle Polymer Using an Automated Static Head-Space Sampling Device and a Capillary GC with a Flame Ionization Detector¹

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1. Scope

1.1 This test method covers a gas chromatographic procedure for the determination of the ppm residual acetaldehyde (AA) present in poly(ethylene terephthalate) (PET) homopolymers and co-polymers which are used in the manufacture of beverage bottles. This includes sample types of both amorphous and solid-stated pellet and preform samples.

1.2 *This standard does not purport to address all of the safety concerns, 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.*

2. Referenced Documents

2.1 ASTM Standards:

D 4509 Test Method for Determining the 24-Hour Gas (Air) Space Acetaldehyde Content of Freshly Blown PET Bottles²

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method³

3. Terminology

3.1 The terms employed in this test method are commonly used in normal laboratory practice and require no special comment.

4. Summary of Test Method

4.1 A specified size (800 to 1000 μm) of granulated sample is weighed into a 20-mL head-space vial, sealed, and then heated at 150°C for 60 min. After heating, the gas above the

sealed sample of PET polymer is injected onto a capillary GC column. The acetaldehyde is separated, and the ppm of acetaldehyde is calculated.

5. Significance and Use

5.1 This test method is of particular use as a quality control tool for a molding or synthesis operation. Acetaldehyde is a volatile degradation product generated during melt processing of PET. Thus, it becomes trapped in the sidewalls of a molded article and desorbs slowly into the contents packaged therein. In some foods and beverages AA can impart an off-taste that is undesirable, thus, it is important to know its concentration in PET articles that are to be used in food contact applications.

5.2 The desorption conditions of 150 C for 60 min are such that no measurable AA is generated by the sample during the desorption process.

6. Sources of Error

6.1 A bias is known to exist if the ratio of sample mass (mg) to head-space vial volume (mL) exceeds a value of ten.

6.2 Acetaldehyde is very volatile and must be handled carefully to avoid sample loss during the calibration procedure. Storing the standard vials in a refrigerator is a must to minimize the error due to volatility.

6.3 Failure to achieve a tight seal on the head-space vial will result in the loss of acetaldehyde during storage and desorption, producing a false low value.

6.4 Failure to grind the sample to the appropriate particle size may lead to a false low value for residual AA due to the increased path length for desorption.

6.5 Samples submitted for 'residual AA measurement' should be stored in a freezer until they are tested. Failure to do so can result in lower than expected results.

6.6 Excessive grinding of samples can cause residual AA contained therein to be desorbed. Extensive excessive grinding can lead to actual melting of the polymer and AA generation. Samples which have been chilled in liquid nitrogen properly

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² *Annual Book of ASTM Standards*, Vol 08.03.

³ *Annual Book of ASTM Standards*, Vol 14.02.