



Standard Test Method for Determination of Aerosol Monomeric and Oligomeric Hexamethylene Diisocyanate (HDI) in Air with (Methoxy- 2-phenyl-1) Piperazine (MOPIP) in the Workplace¹

This standard is issued under the fixed designation D6561; 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 determination of aerosol hexamethylene diisocyanate (HDI) in air samples collected from workplace and ambient atmospheres. The method described in this test method collects separate fractions. One fraction will be dominated by vapor, and the other fraction will be dominated by aerosol. It is not known at the present time whether this represents a perfect separation of vapor and aerosol, and in any case, there are not separate exposure standards for vapor and aerosol. Therefore, in comparing the results for isocyanate against a standard, results from the two fractions should be combined to give a single total value. The reason for splitting the sample into two fractions is to increase analytic sensitivity for the vapor fraction and also to give the hygienist or ventilation engineer some information concerning the likely state of the isocyanate species. The analyses of the two fractions are different, and are provided in separate, linked, standards to avoid confusion. This test method is principally used to determine short term exposure (15 min) of HDI in workplace environments for personal monitoring or in ambient air. The analysis of the vapor fraction is performed separately, as described in Test Method [D6562](#).

1.2 Differential air sampling is performed with a segregating device.² The aerosol fraction is collected on a polytetrafluoroethylene (PTFE) filter.

1.3 Immediately after sampling, the PTFE filter is transferred into a jar containing a (methoxy-2 phenyl-1) piperazine (MOPIP) solution in toluene.

1.4 The analysis of the aerosol fraction is performed by using a high performance liquid chromatograph (HPLC)

equipped with an ultraviolet (UV) detector. The range of application of the test method has been validated from 0.052 to 1.04 μg of monomeric HDI/mL, which corresponds, based on a 15 L air sample, to concentrations from 0.004 to 0.070 mg/m^3 of HDI. Those concentrations correspond to a range of aerosol phase concentrations from 0.5 ppb (V) to 10 ppb (V) and cover the established threshold limit value (TLV) value of 5 ppb (V).

1.5 The quantification limit for the monomeric HDI is 0.041 μg per mL, which corresponds to 0.003 mg/m^3 for a 15 L sampled air volume. This value is equivalent to ten times the standard deviation obtained from ten measurements carried out on a standard solution in contact with the PTFE filter whose concentration of 0.1 $\mu\text{g}/\text{mL}$ is close to the expected detection limit.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *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. See Section 9 for additional hazards.*

2. Referenced Documents

2.1 *ASTM Standards:*³

[D1193 Specification for Reagent Water](#)

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

[D1357 Practice for Planning the Sampling of the Ambient Atmosphere](#)

[D5337 Practice for Flow Rate Adjustment of Personal Sampling Pumps](#)

¹ This test method is under the jurisdiction of ASTM Committee [D22](#) on Air Quality and is the direct responsibility of Subcommittee [D22.04](#) on Workplace Air Quality.

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² The sampling device for isocyanates is covered by a patent held by Jacques Lesage et al, IRSST, 505 De Maisonneuve Blvd. West, Montreal, Quebec, Canada. If you are aware of an alternative to this patented item, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.