



Designation: D8401 – 24

Standard Test Method for Identification of Polymer Type and Quantity of Microplastic Particles and Fibers in Waters with High to Low Suspended Solids Using Pyrolysis-Gas Chromatography/Mass Spectrometry¹

This standard is issued under the fixed designation D8401; 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 In this pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) test method, an analytical protocol validated specifically for the analysis of water with high to low suspended solids is described. This test method will standardize the identification and simultaneous quantitation of organic polymer particles and fibers in water. It has been designed for and applies to all microplastic particles and fibers, and is intended for use with treated drinking water, surface waters, wastewater influent and effluent (secondary and tertiary), and marine waters. This test method is not limited to these particular water matrices; however, the applicability of this test method to other aqueous matrices shall be demonstrated.

1.2 Microgram quantities of a sample containing microplastics are pyrolyzed (Py) at 600 °C. The pyrolyzates are separated on an analytical column (GC) and detected using a 70-eV electron impact mass spectrometer (MS). Polymers often have similar pyrograms, making it difficult to differentiate the pyrolyzates for a given polymer from those of the composite sample. In this test method, ion ratios at predetermined retention times to facilitate the identification of each polymer present in a sample containing microplastics are compared.

1.3 This test method is to be used in conjunction with Practices D8332, D8333, and D8402. These ASTM International standards enable the collection and preparation of water samples with high, medium, or low suspended solids for the identification and quantification of microplastic particles and fibers without compromising the integrity of the microplastics. This test method is applicable to microplastic fibers and particles, including sizes defined as a nanoparticle; this is a natural extension of this test method because Py-GC/MS technology responds to the total mass of the sample independent of individual particle sizes. The uniformity of particle size

influences the reproducibility of the pyrogram and samples with microplastics should be reduced to a fine powder with the final particle size diameter on the order of less than 0.2 mm.

1.4 It is the responsibility of the user to ensure the validity of this test method for untested matrices.

1.5 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- D883 Terminology Relating to Plastics
- D1129 Terminology Relating to Water
- D1193 Specification for Reagent Water
- D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
- D8332 Practice for Collection of Water Samples with High, Medium, or Low Suspended Solids for Identification and Quantification of Microplastic Particles and Fibers
- D8333 Practice for Preparation of Water Samples with High, Medium, or Low Suspended Solids for Identification and Quantification of Microplastic Particles and Fibers Using

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.06 on Methods for Analysis for Organic Substances in Water.

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² 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.