Designation: D8332 – 20

Standard Practice for Collection of Water Samples with High, Medium, or Low Suspended Solids for Identification and Quantification of Microplastic Particles and Fibers[1]

This standard is issued under the fixed designation D8332; 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 practice provides for the collection of water samples with high, medium, or low suspended solids to determine the presence, count, polymer type, and physical characteristics of microplastic particles and fibers. This collection practice has been validated for the collection of samples from drinking water, surface waters, wastewater influent and effluent (secondary and tertiary), and marine waters. This practice is not limited to these particular water matrices; however, the applicability of this practice to other aqueous matrices must be demonstrated.

1.2 Water samples are passed through filters or sieves of adequate mesh size to enable capture of the smallest desired particle size. For waters with high or medium suspended solids content, a series of sieves with increasingly smaller mesh size should be used to prevent clogging and allow for the collection of desired particle size fractions.

1.3 Subsequent sample preparation followed by analysis utilizing either Pyrolysis gas chromatography/mass spectrometry (Py-GC/MS), IR spectroscopy, or Raman spectroscopy may be used to identify the quantity (mass or number count) and composition (polymer type) of microplastic particles/fibers. The spectroscopic methods can provide a count of the number of particles and fibers present in a sample, and Py-GC/MS can provide the mass present in a sample. When desired, microplastic particle/fiber size, shape and surface characteristics can be ascertained with appropriate instruments such as a scanning electron microscope (SEM).

1.4 *Units*—The values stated in SI units are to be regarded as the standard except where standard U.S. equipment is specified in imperial units, for example, inches and gallons. No other units of measurement are included in this standard.

1.5 *Standard Practice*—This practice offers a set of instructions for performing one or more specific operations. This practice cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This practice is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this practice be applied without consideration of a project's many unique aspects.

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

D1193 Specification for Reagent Water

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this standard, refer to Terminology D883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *effluent, n*—any stage of treated wastewater.

3.2.2 *influent, n*—raw sewage entering a wastewater treatment facility.

3.2.3 *microplastic, n*—any solid, synthetic organic polymeric material to which chemical additives or other substances may have been added, which are particles <5 mm in their

[1] This practice 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.

Current edition approved July 15, 2020. Published August 2020. DOI: 10.1520/D8332-20.

[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.

largest dimension, and fibers no longer than 15 mm in length with an aspect ratio of at least 30:1 and <500 µm in its smallest dimension.

3.2.4 *surface waters, n*—a water body with its surface in contact with the ambient atmosphere, examples which include lakes, rivers, and streams.

3.2.5 *suspended solids, n*—refers to all matter which remain in suspension in water media and that are removed by a 0.45 µm filter.

4. Summary of Practice

4.1 This practice is suitable for sampling of most water qualities from low to high suspended solids content dependent upon project goals. It consists of processing water samples through filters or sieves of adequate mesh size to enable capture of the smallest desired particle or fiber size. For waters with high to medium suspended solids content, a series of sieves with increasingly smaller mesh size should be used to prevent clogging and allow for the collection of desired particle/fiber size fractions.

4.2 All particulates less than 5 mm in the largest dimension and fibers less than 15 mm in length should be retained for preparation and analysis.

4.3 Water flowing through the sieves must be metered to record the total volume, to enable calculations of "numbers of particles/fibers per unit volume" or "mass per unit volume." The flow rate of water with high suspended solids across the sieves must be observed and appropriately regulated to avoid blinding (obstruction) of the sieve perforations. Flow volume must be throttled-back and recorded when blinding occurs.

4.4 Wastewater influent (high suspended solids) sampling should include 24 consecutive hours of flow collection to ensure capture of peak diurnal flow concentrations.

5. Significance and Use

5.1 When significant quantities of inorganic or organic material are present in water samples (high suspended solids), microplastic particles/fibers can be masked and the ability to conduct reliable identification and quantification analyses of the plastic particles/fibers can be impeded.

5.2 In order to quantify the occurrence of microplastic particles/fibers in wastewater influent (high suspended solids), the sampling procedure must be able to reliably collect samples at a constant flow over the desired 24-hour interval to reflect changes in diurnal flow. For wastewater influent the capture flow rate should be no less than 1 GPM over the 24-hour interval (approximately 1440 gal or 5450 L total) to minimize the problem with heterogeneity of the suspended solids and to reduce the standard error (the larger the sample size, the smaller the standard error).

5.3 In order to quantify the occurrence of microplastic particles/fibers in all other water samples with a lower content of inorganic or organic material present addressed by this practice (low to medium suspended solids), a minimum volume of 1500 L (approximately 400 gal) should be filtered through the appropriate filters or sieves to minimize potential issues with heterogeneity of suspended solids and to reduce the standard error (the larger the sample size, the smaller the standard error).

5.4 Microplastic particles/fibers retained on the sieves are suitable for characterization in terms of size, shape, quantity, and composition (polymer type), dependent upon the chosen analytical method.

6. Equipment, Reagents, and Materials

6.1 References to *purity of water* – unless otherwise indicated – shall be understood to mean reagent water as defined by Type IV of Specification D1193.

6.2 A *5-gal metal container* to hold the assembled sieve stack with either (*1*) a spigot valve at the bottom and non-plastic spacers to raise the sieves above the bottom surface, or (*2*) a series of 20 at ⅜ in. holes drilled through the bottom, allowing the processed water to flow through unimpeded.

6.3 *Stainless steel tubing* for use in conveying the flow of sample water from the pump (non-pressurized system) or sampling tap/spigot (pressurized system) to the sieve stack.

6.4 Several *4 in. glass petri dishes*.

6.5 *High Suspended Solids Water Samples — Wastewater Influent (*Fig. 1*):*

6.5.1 *Stainless steel submersible pump* capable of delivering approximately 1.0 gal per minute when pulling 24-hour diurnal wastewater influent samples from a non-pressurized system.

6.5.2 A series of *8 in. diameter stainless steel stacked sieves* with the suggested following mesh sizes: 20 µm, 50 µm, 150 µm, 300 µm, 500 µm, 1000 µm, and 5000 µm.

6.5.3 *Flow control valve* (or in-line flow meter if water quality conditions permit) capable of achieving a nominal flowrate of 1.0 gal per minute, accurate enough to measure an approximate filtered volume within ±5 %, or ±72 gal out of 1440 gal (approximately 5450 L) total per 24 hours.

6.5.4 *Digital outdoor timer*.

6.6 *Low to Medium Suspended Solids Water Samples — Surface Water and Secondary-Treated Wastewater Effluent (*Fig. 1 *or* Fig. 2*):*

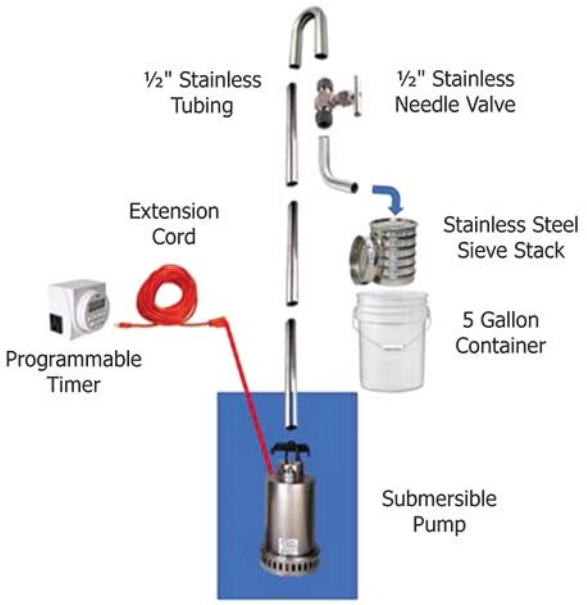
6.6.1 *Stainless steel submersible pump* capable of pulling samples from a non-pressurized system or ambient surface water as needed, to enable delivery of 1500 L (approximately 400 gal). With a pressurized system/line, a sampling tap or spigot is required to pull the sample.

6.6.2 *Flow control valve* or in-line flow meter accurate enough to measure an approximate filtered volume within ±5 % for 1500 L.

6.6.3 A series of *stacked stainless-steel sieves* with the suggested following mesh sizes: 20 µm, 150 µm, 500 µm, and 5000 µm.

6.7 *Low to Very Low Suspended Solids Water Samples — Drinking Water and Tertiary-Treated Wastewater Effluent (*Fig. 1 *or* Fig. 2*):*

6.7.1 *Stainless steel submersible pump* capable of pulling samples from a non-pressurized system as needed, to enable



1) Pump capable of providing 20' of head and up to 3 gpm flow
2) Stainless steel transfer tubing
3) Adjustable valve for flow control
4) Programmable timer (for 24-hour diurnal flow)
5) 8" dia Sieve Stack (minimum – 20 µm)
6) Container for sieves with drainage

FIG. 1 Water Sampling Apparatus for Non-Pressurized Systems

FIG. 2 Water Sampling Apparatus for Pressurized Systems

delivery of 1500 L (approximately 400 gal). With a pressurized system/line, a sampling tap or spigot is required to pull the sample.

6.7.2 *Flow control valve* or in-line flow meter accurate enough to measure an approximate filtered volume within ±5 % for 1500 L.

6.7.3 Two *stainless steel sieves* with the suggested mesh sizes of 20 µm and 300 µm.

7. Procedure

7.1 *High Suspended Solids Water Samples — Wastewater Influent:*

7.1.1 To facilitate processing of wastewater influent and to help minimize cross-contamination, sieves should be placed inside a 5-gal metal container with either (*1*) a spigot valve at the bottom and non-plastic spacers to raise the sieves above the