

<b>Title: Microwave Digestion of Airborne Particulate Matter Collected on Filters Using CEM MARS-5</b>		Copy No: <b>##</b>
SOP No.: 6.12/3.0/S	Effective Date: May 14, 2013	Location: <b>###</b>

QSM Approval: \_\_\_\_\_

## Microwave Digestion of Airborne Particulate Matter Collected on Filters using CEM MARS-5

### 1 INTRODUCTION and SCOPE

- 1.1 The Microwave Accelerated Reaction System, Model MARS® is designed for digesting a wide range of materials in chemistry laboratories. Its primary purpose is the rapid preparation of samples for analysis by atomic adsorption, inductively coupled plasma mass spectrometry or emission spectroscopy, and liquid or gas chromatography
- 1.2 This SOP provides procedures for the microwave assisted acid digestion of airborne particulate matter (PM) collected on filters using CEM MARS-5 microwave oven.
- 1.3 This SOP is applicable to the microwave assisted acid digestion of the PM samples using HNO<sub>3</sub> (near-total digestion), prior to analysis of trace elements by ICP-MS (method 6.11/\*.\*M).
- 1.4 The methodology is recommended for use only by, or under the supervision of analysts experienced in the use of CEM MARS Xpress system and trained in the proper operating techniques and safety procedures.

### 2 SAFETY

The microwaves generated from the magnetron in the CEM MARS unit can pass through some materials such as Teflon, but are readily absorbed by water and aqueous solutions such as acid used in the digestion or dissolution. Microwave digestion usually involves placing a sample in an acid solution and heating to high temperatures and pressures. These extreme conditions will dissolve most materials, but are potentially quite dangerous. Commercial equipment, however, features several inter-locked safety devices to provide unconditional, constant safety to the operators, including a highly sensitive vapor sensor, a pressure-sensitive rupture membrane and a high performance exhaust fan. Membrane rupture discs in each vessel are designed to break in the event of excessive pressure build-up. Safety features have been built into the system to detect liquid vapors and monitor pressure build-up to ensure that a sample will not unknowingly have any loss and that all the vessels are well closed. Exceeding the limits of temperature or pressure will cause the system to shut down by itself. As a minimum, the following safety procedures should be applied whenever digesting samples in CEM MARS-5.

- 2.1 Lab coats and safety goggles must be worn at all times.

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- 2.2 Before beginning the digestion procedure, check that the oven vent is adequately connected to the exhaust arm, the exhaust system is ON and is working, and that the fume hood and first aid kit are available.
- 2.3 The same quantity and type of reagents and sample must be used in each vessel to avoid uneven heating and rupture of the safety membranes.
- 2.4 All vessel components must be dry and free of particulate matter before use.
- 2.5 In the event of a leak or rupture of the safety membranes the system will sense the solution vapor and shut itself off. Allow 10 - 15 minutes for the oven to vent and the samples to cool down.
- 2.6 **For safety procedures while using the Microwave oven and handling concentrated acids and bases, consult Safe Working Procedures and Policies SWP-001/\*.\*.**

### 3 APPARATUS and SUPPLIES

- 3.1 The microwave oven Model CEM MARS 5 (CEM Corporation, Matthews, NC) consists of a 2450 MHz microwave power system with 0-1200 W output, a fluoropolymer-coated microwave cavity, a cavity exhaust fan and tubing to vent fumes, a 12 or 14-position alternating turntable, and a digital computer programmable for 100 programs consisting of up to 5 stages each. It requires the following accessories:
  - 100-mL XP-1500 Plus High Pressure Digestion Vessels capable of withstanding pressures up to 800 psi and temperature up to 240 °C.
  - 100-mL HP-500 Plus High Pressure Digestion Vessels capable of withstanding pressures up to 350 psi and temperature up to 210 °C.
  - 7-mL Teflon microvessels (MicroVessel™, CEM Corporation, Matthews, NC). Each large vessel (100 mL) can accommodate two 7-mL microvessels.
  - ESP-1500 Plus Pressure sensor and RTP-300 Plus Temperature sensor.
- 3.2 Millipore Super-Q system (SOP 19.04/\*.\* /S) and Barnstead NANOpure Diamond water purifying system.
- 3.3 Dilution tubes, grade A calibrated up to 50 mL.
- 3.4 Dilution (centrifuge) tubes, syringes and syringe filters.
- 3.5 Labconco Purifier Trace Metal Work Station.

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#### 4 REAGENTS and STANDARDS

- 4.1 Double deionized water (DDW, resistance > 18 MOhm cm) (See 3.2)
- 4.2 Concentrated (~70% w/v) HNO<sub>3</sub> (ACS grade, Fisher Scientific, Ottawa, Canada) purified prior to analysis using duoPUR Subboiling Distillation System (Milestone, Sorisole, BG, Italy) (SOP 6.15/\*.\*/\*S).
  - 4.2.1 **40% HNO<sub>3</sub><sup>1</sup> solution:** dilute 200 mL sub-boiled concentrated HNO<sub>3</sub> to 500 mL with DDW and store in Teflon bottles.
- 4.3 HPLC grade isopropanol (IP) (Fisher Scientific, Ottawa, Canada) is used directly as purchased
- 4.4 **Standard Reference Materials (SRM):** NIST 1648a Urban Particulate Matter (National Institute for Science and Technology, Gaithersburg, MD, USA)
- 4.5 **Spiking solution:** Intermediate multi-element control standard for near total analysis (**InMES-NT in 2% HNO<sub>3</sub>**). See Method 6.11/\*.\*/\*M for preparation and expiration time of this solution.

**NOTE:** Other commercial SRMs or standards with similar composition and concentration of analytes can be used.

#### 5 SAMPLE PREPARATION PROCEDURES

Two types of microwave digestion vessels (7-mL and 100-mL) are used. For airborne particulate matter collected on Teflon filters, the 7-mL microvessels are used as the digestion vessels and the 100-mL HP-500 Plus vessels serve as containers for the microvessels during the digestion. For PM samples collected on other types of filters (e.g., quartz or Whatman cellulose filters), the 100-mL HP-500 Plus or XP-1500 Plus vessels are used.

##### 5.1 *Digestion of samples collected on Teflon filters (in 7 mL microvessels)*<sup>2</sup>

One microwave digestion batch (27 microvessels) includes the SRM, Thermowell blank, Reagent blank, Method blank, spiked method blanks and samples (Appendix A).

- 5.1.1 Clean all vessels to be used for microwave digestion (SOP 6.13/\*.\*/\*S)
- 5.1.2 Get racks capable of holding 27 microvessels with numbers on them that correspond to the individual microvessels.

<sup>1</sup> Unless otherwise stated, acid concentrations are expressed in % (v/v). Handle concentrated acids with extreme care. **ACID IS ALWAYS ADDED TO WATER, NEVER THE REVERSE**

<sup>2</sup> Also refer to Appendix A, Flow chart A1

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- 5.1.3 Use cleaned plastic forceps to place the filter on a clean Teflon cutting board. Cut around the perimeter with a clean stainless steel cutter. After each use the cutter should be wiped with a clean lint free paper towel wetted with ethanol.
- 5.1.4 Transfer the filter into the appropriate microvessel (according to the schedule, Appendix A) and cap the microvessel. NOTE: the special cap with the hole in the center is used for the control vessel where the thermowell is located.
- 5.1.5 Move all vessels to the fume hood, pipette 50 µL of IP (to wet filters) and then add 2 mL of 40% HNO<sub>3</sub>. Let them stay for at least 30 min before digestion.

**5.2 Digestion of samples collected on other types of filters (in 100mL vessels)<sup>3</sup>**

One microwave digestion set includes the SRM, Thermowell blank, Reagent blank, Method blank, spiked method blanks and samples (Appendix B). In this case, 100-mL XP-1500 plus or HP-500 plus vessels can be used.

- 5.2.1 Clean all vessels to be used in microwave digestion (SOP 6.13/\*.\* /S).
- 5.2.2 Get racks capable of holding 14 standard vessels.
- 5.2.3 Using clean scissors cut the filters in small pieces; place each filter into the appropriate digestion vessels. Wipe the scissors with ethanol after each sample.
- 5.2.4 Move all vessels to a fume hood and add 10 mL of 40% HNO<sub>3</sub>. Place the covers without the vent fittings on and let them stay for at least 30 min before digestion.

**6 QUALITY CONTROL (QC) SAMPLES**

**6.1 Blanks**

- 6.1.1 **Reagent Blank** (ReagBlk) is used to monitor possible contamination from sample preparation and analysis procedures. To a clean digestion vial, add 50 µL of IP (if used for the samples) and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.
- 6.1.2 **Thermowell Blank** (ThwB) is used to insure the pressure and temperature control in a matrix similar to that of samples. Make sure that the modified cap with the hole in the center is used for this microvessel. To a clean digestion vial, add 50 µL of IP (if used for the samples) and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.

<sup>3</sup> Also refer to Appendix B Flow chart B1

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- 6.1.3 **Method Blank** (MethBlk) is used to monitor possible contamination from filter, sample preparation and analysis procedures. To a clean digestion vial containing a blank filter, add 50 µL of IP (if used for the samples) and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.
- 6.1.4 **Syringe Blank** (if applicable) is used to monitor possible contamination from syringe and syringe filter. It consists of a 4% or 10% HNO<sub>3</sub> solution prepared from the same digestion acid used for the samples, going through filtration via syringe filters.
- 6.1.5 **Vial Blank** (VialBlk) is used to monitor possible contamination from sample dilution tubes. It consists of a 4% or 10% HNO<sub>3</sub> solution prepared in the dilution tubes from the same digestion acid used for the samples.
- 6.1.6 **Digestion SRMs** are digested together with samples and used to control the digestion efficiency. Accurately weigh ~0.010 g or ~0.020 g of NIST 1648a PM in a clean 7-mL or 100-mL digestion vessel, respectively. Record the exact weight to four decimal places in the worksheet (Appendix A). Add the same amount of 40% HNO<sub>3</sub> that will be used for the samples
- 6.2 **Digestion spikes** are used to monitor possible contamination or loss of analytes during digestion, at two levels of concentration
  - 6.2.1 **Spike 1:** To a clean 7-mL or 100-mL digestion vessel containing a blank filter add 50 µL of IP (if used for the samples), 40 or 200 µL of the InMES-NT solution, respectively and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.
  - 6.2.2 **Spike 2:** To a clean 7-mL or 100-mL digestion vessel containing a blank filter add 50 µL of IP (if used for the samples), 80 or 400 µL of the InMES-NT solution, respectively and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.
  - 6.2.3 **MDL Spike:** To a clean 7-mL or 100-mL digestion vessel add 50 µL of IP (if used for the samples), 40 or 200 µL of the InMES-NT solution, respectively and the same amount of 40% HNO<sub>3</sub> that will be used for the samples.

## 7 MICROWAVE DIGESTION PROCEDURE

### 7.1 *Assembling the 7-mL digestion vials (microvessels)*

- 7.1.1 Cap each microvessel without tightening and let them stay for about 30 minutes to allow any gases that might have been formed to dissipate.
- 7.1.2 Using the 22 mm torque wrench and the holder bock, tighten all caps to 20 in lbs (2.3 N. m).
- 7.1.3 Assemble the standard vessels:

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- Insert only **one** safety membrane, **specified for HP-500 Plus**, in each vent fitting and tighten the fitting onto the relief port of the cover. **IMPORTANT NOTE:** The accidental insertion of more than one membrane or the wrong membrane can result in failure of the membrane to rupture under excessive pressure and would therefore defeat the safety feature.
- Place one Teflon spacer into the bottom of each liner and then pipette 7 mL de-ionized water into each liner.
- Place the liner into a Kevlar sleeve.
- Insert two microvessels into each liner according to the schedule (Appendix A), and place the cover on top of the liner. Place the brown load disk on the cover with the side with the circular depression facing upward.
- Insert the assembled vessel into the support module and place the support module onto the turntable.

7.1.4 Assemble the control vessel, Figure 1.

- Insert the open end of the thermowell into the locking ferrule nut and slide it through the temperature port of the HP control cover. Tighten the locking ferrule nut to finger tight.
- Slide the ferrule nut onto the thermowell that has been assembled into the HP control cover.
- Install a safety membrane into the vent fitting and tighten the fitting onto the relief port of the control cover
- Insert the tip of the thermowell into the control micro-vessel and slide it until it is just above the bottom of the vessel. Slide the locking nut onto the cap threads and tighten in hand tight.
- Place one Teflon spacer into the bottom of the liner and then pipette 7 mL deionized water in.
- Place the liner into a Kevlar sleeve.
- Insert the assembled control micro-vessel into the liner and place the brown load disk with the hole in the center onto the cover, with the side with the circular depression facing upward.
- Insert the assembled control vessel into the support module and place the support module onto the turntable.

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**Figure 1.** Control MicroVessel™ (7 mL) assembly inserted inside an HP-500 Plus control vessel.



- 7.1.5 Attach the pressure probe to the control vessel.
- 7.1.6 Using the torque wrench, tighten all the module screws to 5 ft lbs (6.9 N m).
- 7.1.7 Slide the EST-300 Plus temperature probe into the control vessel through the support screw until it “bottoms out” in the thermowell.
- 7.1.8 Put the turntable and all attached modules into the microwave oven properly. For more details refer to *MARS Operation Manual and Instructions for Use of 3 and 7 mL Teflon Vessels*

**7.2 Assembling the 100-mL digestion vials (standard vessels)**

- 7.2.1 After adding the HNO<sub>3</sub>, let samples stay in the fume hood for at least half an hour before digestion.
- 7.2.2 Insert only **one** safety membrane in each vent fitting and tighten the fitting onto the relief port of the cover. **Make sure to use the membranes that are appropriate for the vessel.** Place the cover on the top of each vessel liner, and on top of it, put the brown disk with the side with the circular depression facing upward.
- 7.2.3 Insert the liner into a clean, dry Kevlar sleeve.
- 7.2.4 Insert the assembled standard vessel into support module and place support module onto the turntable.
- 7.2.5 Assemble the control vessel.
  - Insert the open end of the thermowell into the locking ferrule nut and slide it through the temperature port of the control cover. Tighten the locking ferrule nut to finger tight.

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- Place the vessel cover on the top of the vessel liner, insert it into the liner and place the brown load disk with hole on the cover with the side with the circular depression facing upward.
  - Insert the assembled control vessel into the support module and place the support module onto the turntable.
- 7.2.6 Attach the pressure probe to the control vessel.
- 7.2.7 Using the torque wrench, tighten all the module screws to 5 ft lbs (6.9 N m).
- 7.2.8 Slide the EST-300 Plus temperature probe into the control vessel through the support screw until it “bottoms out” in the thermowell.
- 7.2.9 Put the turntable and all attached modules into the microwave oven properly. For more details refer to *MARS Operation Manual* and *HP-500 Plus, XP-1500 Plus & OMNI Vessel Accessory Sets & Autovent Options, Instructions for Use*
- 7.3 Operation of the MARS 5 with the *Marslink software*
- 7.3.1 Make sure that CEM MARS-5 and the computer are on. If they are not, turn both on. Turn the turntable plate until the control vessel is located at the left rear corner of the oven by pressing circle on the microwave keypad.
- 7.3.2 Connect temperature probe at plug in ceiling of the oven and pressure probe to the left-side wall plug (the temperature reading has to be around 25 ° C and pressure less than 50 psi).
- 7.3.3 If a new probe is used, set temperature probe according to the instructions that come with the probe by entering the correct GF number that is available on information sheet of the probe.
- 7.3.4 Press circle on the CEM MARS-5 keypad to rotate the turntable plate and make sure that the temperature probe and pressure probe connections have enough slack during the turning.
- 7.3.5 Click *Start* >> *Programs* >> *Marslink* >> *Marslink* to open the program. Once it is open click *Sample* >> *New Sample* and fill in sample type, for example, Teflon filter; click on *Change Method File* to select appropriate microwave digestion program to be used (Appendix C).
- 7.3.6 Click on *Enter Sample Data* to input the sample information.
- 7.3.7 Click on *Save Sample Profile*.
- 7.3.8 Click *Run Sample and save Data file*. File can be saved as xx(month) xx(day) xx(year) y(number)\_description.
- 7.3.9 After designating the file name, another screen will pop up. Click on the *Start/Pause* button once to start microwave digestion.



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- 7.3.10 Record in the Digestion Logbook the date of the digestion, type of samples being digested and other information as required in the book.
- 7.3.11 After initiating microwave digestion, make sure that everyone in the lab is aware that they should stay away from the instrument. The operator should check the status of the microwave digestion from time to time.

## 8 SAMPLE TREATMENT AFTER DIGESTION

- 8.1 After microwave digestion, allow the samples to cool down and the pressure within the digestion vessels to dissipate (about 10 to 15 minutes) inside the oven.
- 8.2 Disconnect temperature and pressure probes and remove the turntable from the microwave oven. Place the turntable with vessels into the fume hood and open all venting fittings.
- 8.3 Detach all modules and place the digestion vessels in the proper numbered positions in the rack.
- 8.4 Transfer the digested samples into labeled 50-mL sample preparation tubes inside the fume hood. Rinse the digestion vessels and the caps at least 3 times each with appropriate amounts of DDW. Finally, dilute the samples with DDW to a final volume of 20 or 40 mL for digestion with microvessels or standard vessels, respectively.
- 8.5 Store digested samples in fridge until analysis (up to three months) (SOP 2.6/\*.\*/\*S).

## 9 APPLICABLE DOCUMENTS

- SWP-001/\*.\*/\*: "Safe Working Procedures and Policies"
- SOP 19.02/\*.\*/\*S "Volumetric Measurement, Micropipettes and Bottle-Top Dispensers"
- SOP 19.04/\*.\*/\*S "AAQS Water Purification System"
- SOP 2.6/\*.\*/\*S "Laboratory Refrigerators and Freezers"
- SOP 6.01/\*.\*/\*S "Sample Management"
- SOP 6.13/\*.\*/\*S: "Lab Cleaning in ICP-MS laboratories"
- SOP 6.11/\*.\*/\*S "General Operations, Safety and Housekeeping Practices in the ICP-MS Laboratory"
- SOP 6.15/\*.\*/\*S "Acid Purification Using MILESTONE duoPUR "Subboiling" Distillation System"
- Method 6.11/\*.\*/\*M "Determination of Near-Total Trace Elements in Airborne Particulate Matter by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS)"

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## 10 REVISIONS

**September 2005:** Authors: Heidi Chen and Xiangjun Liao. New document

**April 2007:** Reviewers: Valbona Celso, Irina Okonskaia

Section 4.3.2 is removed; Section 5.1.5.1: Definitions of blanks are changed and the vial blank is added; Section 5.1.5.3 and 5.1.5.4: Teflon filter spikes are changed; Section 5.1.10: Some details on the procedure for assembling of the control vessel are added; Section 5.1.16 The expression “ The temperature reading should be around 25°C and pressure less than 50 psi” is added; Sections 5.1.24 and 5.2.8: preparation of Vial Blank is added; Section 5.2: “Digestion of samples collected on Quartz filters (in 100 mL vessels)” is changed to “Digestion of samples collected on other types of filters (in 100 mL vessels)”; Section 5.2.2: The definitions of blanks and the spikes are changed; vial blank is added; Section 5.2.6 is changed to include more details on procedure for the assembling of the control vessel

**November 2010:** Reviewers: Valbona Celso, Irina Okonskaia

Section 3.1: formatting is changed; Section 5.1.3: “After each use the cutter should be wiped with a clean lint free paper towel wetted with ethanol.” is added; Sections 5.1.5.4 and 5.2.2.3: spiking amounts for preparation of Spike 2 are changed to 100 µL and 200 µL, respectively; Sections 5.1.6, 5.1.24, 5.2.4 and 5.2.8: for operations described therein, the Labcono Purifier Trace Metal Work Station is changed to fume hood.

**May 2013:** Reviewer: Valbona Celso

Sections 1.1 and 1.3 are added; Section 2.6 is added; Sections 3.2 and 3.3 are added; Section 4.1; description of water purification systems is removed and reference to section 3.2 is added; Section 4.2.1: a footnote is added; Section 4.3 is added; Section 4.3.2 is deleted and 4.5 is added; Section 5 (Sample Digestion Procedures) is split in four sections: **Section 5** describes sample preparation procedures for each type of digestion vials; **Section 6** describes the preparation of QC samples for each type of digestion, in a non-tabular form; **Section 7** describes the procedures for assembling of vessels and for operation of the microwave oven; **Section 8** describes the steps after the microwave digestion; Applicable documents: SOP 19.04/\*.\*S is added; Appendix A: Flow Chart A1 is added; Appendix B is changed to Appendix C and a footnote is added; Appendix C is changed to Appendix B and Flow Chart B1 is added

## 11 REFERENCES

MARS Operation Manual, Rev. 0, June 2004, CEM Corporation, NC, USA

HP-500 Plus, XP-1500 Plus & OMNI Vessel Accessory Sets & Autovent Options, Instructions for Use, Rev. 6, December 2001, CEM Corporation, NC, USA

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Instructions for Use of 3 and 7 mL Teflon Vessels, Rev. 10-18-89, CEM Corporation, NC, USA

Instructions for use of SP-1164: modification of 3 mL and 7 mL Teflon vessel for temperature control with the HP and XP Plus Control Vessel in a MARS System, CEM Corporation, NC, USA

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**Approved By:** Ewa Dabek

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**Appendix A**

**Table A1.** Proposed worksheet for digestion of PM samples collected on Teflon filters

Sample ID	Batch name	Micro vessels	Macro vessels	Check	Notes	ICP-MS ID
	TMBx-1	1	2_top			
	TMBx-1	2	2_bottom			
	TMBx-1	3	3_top			
	TMBx-1	4	3_bottom			
	TMBx-1	5	4_top			
	TMBx-1	6	4_bottom			
	TMBx-1	7	5_top			
	TMBx-1	8	5_bottom			
	TMBx-1	9	6_top			
	TMBx-1	10	6_bottom			
	TMBx-1	11	7_top			
	TMBx-1	12	7_bottom			
	TMBx-1	13	8_top			
	TMBx-1	14	8_bottom			
	TMBx-1	15	9_top			
	TMBx-1	16	9_bottom			
	TMBx-1	17	10_top			
	TMBx-1	18	10_bottom			
	TMBx-1	19	11_top			
	TMBx-1	20	11_bottom			
	TMBx-1	21	12_top			
	TMBx-1	22	12_bottom			
Reagblk-1	TMBx-1	22	13_top			ReagB-1
Methblk-1	TMBx-1	23	13_bottom			MethB-1
Spike 1	TMBx-1	24	14_top			Spk1-1/Spk1-2
SRM-1	TMBx-1	26	14_bottom			SRM-1
Thermowell-1	TMBx-1	27	1			

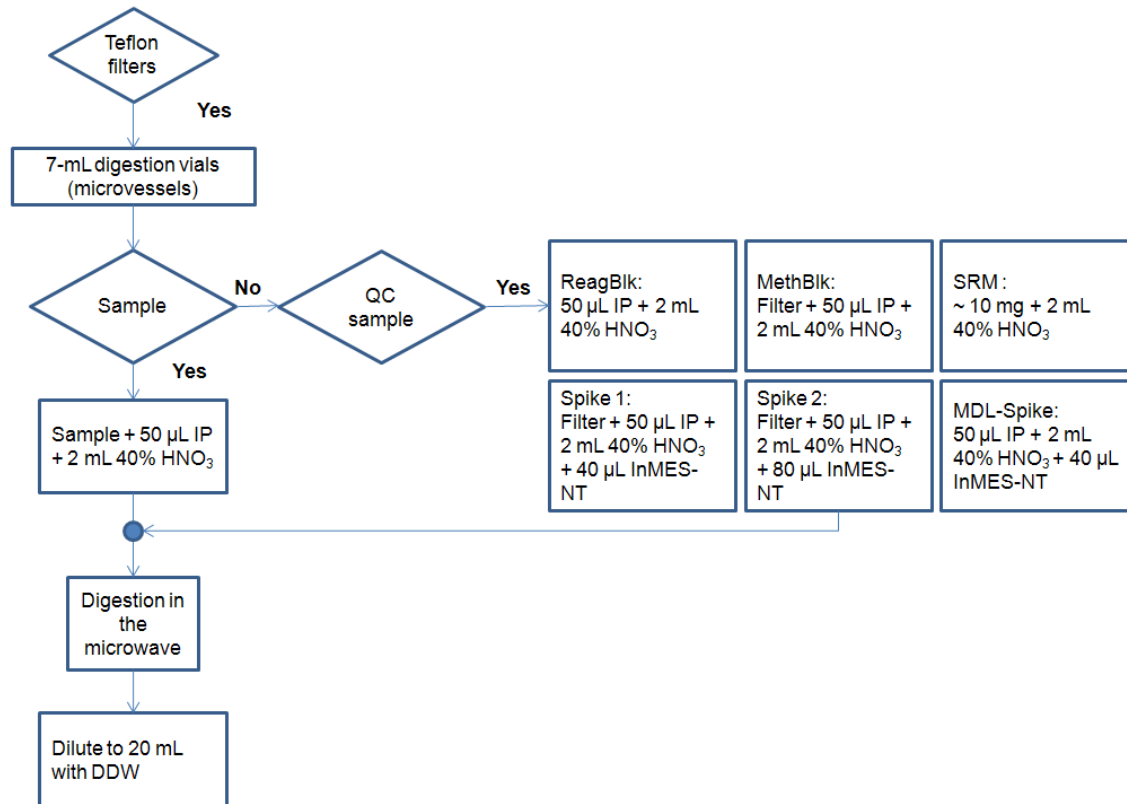
SRM-1 = \_\_\_\_\_

Digestion date: \_\_\_\_\_

Analyst: \_\_\_\_\_

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**Flow Chart A1.** Digestion of PM samples and QCs using the 7-mL microvessels



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**Appendix B**

**Table B1.** Proposed worksheet for digestion of PM samples collected on other types of filter media.

Vessel No.	Sample ID	Batch Name	Check	ICP-MS ID
1	Thermowell			
2	Method blank			MetBlk
3	Reagent blank			ReagBlk
4	Spike-1			Spk-1
5	Spike-2			Spk-2
6	SRM			SRM
7				
8				
9				
10				
11				
12				
13				
14				

**SRM** = \_\_\_\_\_

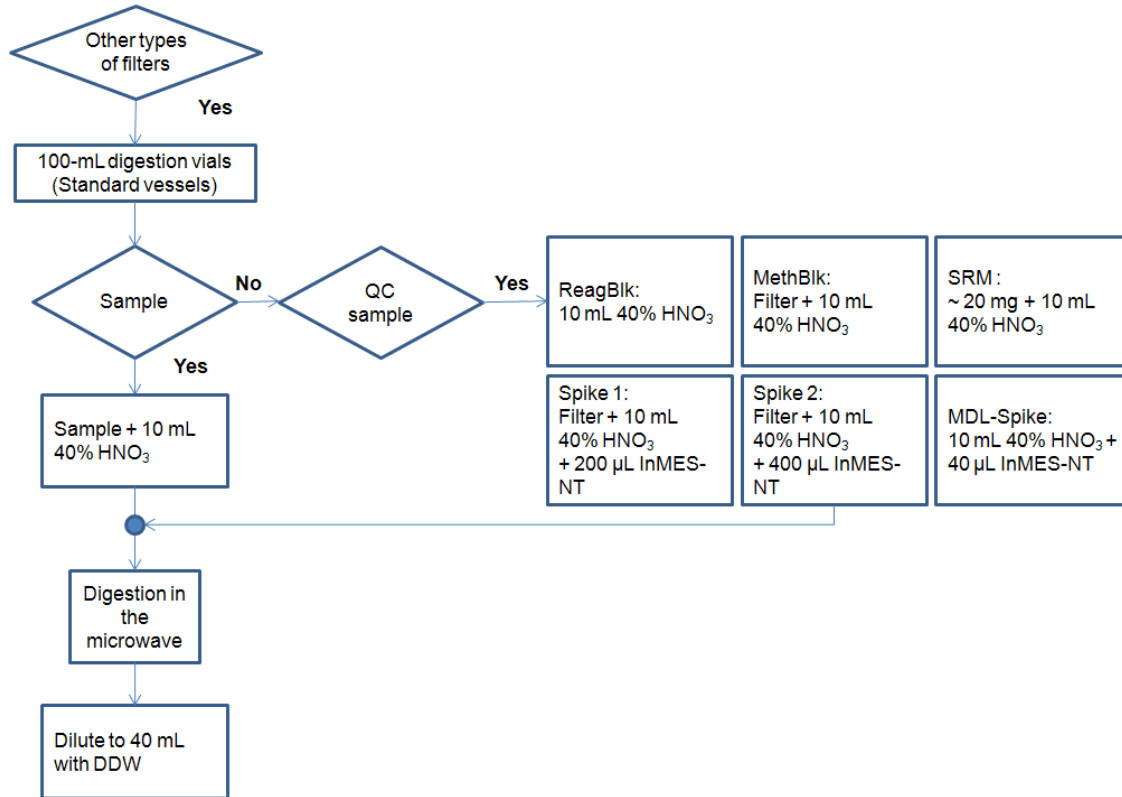
**Digestion date:** \_\_\_\_\_

**Analyst:** \_\_\_\_\_

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**Flow Chart B1.** Digestion of PM samples and QCs using the 100-mL standard vessels.



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**Appendix C: Microwave digestion programs <sup>(a)</sup>**

Program	Step	Power	Ramp time	Pressure	Temperature	Dwell time
Teflon.PGM <sup>(b)</sup>	1	600 W (100%)	5 min	70 psi	165°C	6 min
	2	1200 W (100%)	5 min	100 psi	175°C	15 min
Quartz.PGM <sup>(c)</sup>	1	1200 W (100%)	15 min	150 psi	175°C	2.5 min
	2	1200 W (100%)	3 min	200 psi	185°C	10 min

<sup>(a)</sup> The ramping steps, times and temperatures can be changed for unknown sample matrices. Slower ramping helps in preventing the venting of vials, especially for samples with high organic matter content. However, the temperature and holding time of the final step should be kept as shown in this table.

<sup>(b)</sup> “Teflon.PGM” program is used to digest samples collected on Teflon filters.

<sup>(c)</sup> “Quartz.PGM” program is used to digest samples collected on quartz and other types of filters.

