

Standard Operating Procedure for Coating and Extracting Annular Denuders with Sodium Carbonate

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 Purpose and Applicability	3
2.0 Safety Precautions	3
3.0 Equipment and Materials	3
4.0 Preparation of Sodium Carbonate Solution	4
5.0 Coating of IMPROVE Annular Denuders	4
6.0 Extraction of IMPROVE Annular Denuders	4
7.0 Coating of URG Annular Denuders	5
8.0 Extraction of URG Annular Denuders	5

1.0 Purpose and Applicability

This document outlines procedures for coating and extracting annular denuders with sodium carbonate for the collection and quantitation of gas phase acidic species in the ambient air. This SOP is applicable for coating and extracting aluminum annular denuders used with the IMPROVE sampler. Procedures are also outlined for coating and extracting the glass annular denuders used with the URG MASS 400 speciation sampler.

2.0 Safety Precautions

- 2.1 Always wear clean, dry neoprene gloves when handling any component involved in these procedures.
- 2.2 Always wear protective eyewear when conducting laboratory procedures specified in this SOP.
- 2.3 Read, understand, and follow the Material Safety Data Sheets (MSDS) for all chemicals involved in this procedure.
- 2.3 Always keep open chemical containers in properly operating fume hoods and wear adequate protective clothing according to the MSDS sheets for that chemical.
- 2.5 Always label secondary containers used in this procedure.
- 2.6 Disposal of waste materials should be in accordance with the appropriate MSDS.

3.0 Equipment and Materials

- 3.1 Chem Master neoprene gloves, medium. VWR Brand Cat. No. 32892-058
 - 3.2 Sodium Carbonate, reagent grade. 500 g. VWR Brand Cat. No. EM-SX0400-1
 - 3.3 Glycerol, reagent grade. 500 ml. VWR Brand Cat. No. EM-GX0185-5
 - 3.4 Methanol, reagent grade. 4 liter. VWR Brand Cat. No. VW4300-3
 - 3.5 1000 ml volumetric flask, Pyrex Class A, VWR Brand Cat. No. 29610-182
 - 3.6 PVC pipe, 1 1/4" x 28" (required for IMPROVE denuders only)
 - 3.7 1000 ml polyethylene storage bottles, VWR Brand Cat. No. 16155-050
 - 3.8 Distilled water, laboratory grade
 - 3.9 Source of nitrogen gas or clean air
 - 3.10 Storage bottles, high-density polyethylene, 60 ml capacity, VWR Brand Cat. No. 16058-043 (required for IMPROVE denuders only)
 - 3.11 Storage bottles, high-density polyethylene, 30 ml capacity, VWR Brand Cat. No. 16058-021 (required for URG denuders only)
 - 3.12 Graduated cylinder, 50 ml capacity, VWR Brand Cat. No. 24711-295
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4.0 Preparation of Sodium Carbonate Solution

- 4.1 Place 500 ml of DI water in a prelabeled, 1000 ml volumetric flask.
- 4.2 Add 10 g of sodium carbonate and 10 g of glycerol to the flask. Mix thoroughly.
- 4.3 Add methanol to the flask until the total volume reaches 1000 ml. Mix thoroughly.
- 4.4 Transfer the prepared coating solution to a prelabeled, 1000 ml polyethylene storage bottle.

5.0 Coating of IMPROVE Annular Denuders

- 5.1 Cap one end of the PVC pipe with a rubber stopper.
- 5.2 While holding the PVC pipe in the horizontal position, carefully slide a clean annular denuder into the PVC pipe.
- 5.3 While holding the PVC pipe in the vertical position, pour the coating solution into the pipe until the denuder is totally immersed.
- 5.4 After approximately 5 minutes, drain and discard the excess coating solution from the PVC pipe.
- 5.5 Remove the denuder from the PVC pipe. Shake the denuder to remove excess solution droplets and facilitate its subsequent drying.
- 5.6 To dry the coated denuder, connect the denuder to the glass drying manifold located in Bay 3 of RTI's Building 11. Plug any unused ports of the manifold and turn the connecting valve clockwise to activate the source of nitrogen gas. Following a one hour drying time, turn off the nitrogen source and remove the denuder from the drying column. Wrap the dry, coated denuder in aluminum foil and label the foil with the proper field sampling code.

Note: If a source of nitrogen is not readily available, clean air may be used to facilitate drying of the coated denuders. Alternatively, the denuders may be allowed to dry in an available fume hood.

6.0 Extraction of IMPROVE Annular Denuders

- 6.1 Cap one end of the PVC pipe with a rubber stopper.
 - 6.2 While holding the PVC pipe in the horizontal position, carefully slide a clean annular denuder into the PVC pipe.
 - 6.3 Add 50 ml of DI water to the denuder, cap the other end, then repeatedly invert the denuder (approximately 20 times) to ensure that all internal surfaces are thoroughly rinsed.
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- 6.4 Uncap one end of the denuder, and empty the solution into a prelabeled, 60 ml capacity bottle.
- 6.5 Store the bottle at temperatures below 5 C until the time of the solution's subsequent analysis by ion chromatography.
- 6.6 If the denuder is required for additional field use, repeat the coating procedure outlined in Section 5.0 of this SOP.

7.0 Coating of URG Annular Denuders

- 7.1 Cap one end of the URG denuder.
- 7.2 Add 20 ml of DI water to the denuder, cap the other end, then repeatedly invert the denuder (approximately 20 times) to ensure that all internal surfaces are thoroughly rinsed.
- 7.3 Uncap the denuder then empty and discard the excess solution.
- 7.4 Pour 20 ml of the previously prepared sodium carbonate coating solution (see Section 4.0 of this SOP) into the denuder and cap the denuder's other end.
- 7.5 Repeatedly invert the denuder (approximately 20 times) to ensure that all internal surfaces are properly coated.
- 7.6 Uncap one end of the denuder then empty and discard the excess solution.
- 7.7 To dry the coated denuder, connect the denuder to the glass drying manifold located in Bay 3 of RTI's Building 11. Plug any unused ports of the manifold and turn the connecting valve clockwise to activate the source of nitrogen gas. Following a one hour drying time, turn off the nitrogen source and remove the denuder from the drying column. Cap the end of the denuder and label it with its proper field sampling code.

Note: If a source of nitrogen is not readily available, clean air may be used to facilitate drying of the coated denuders. Alternatively, the denuders may be allowed to dry in an available fume hood.

8.0 Extraction of URG Annular Denuders

- 8.1 Cap one end of the URG denuder.
 - 8.2 Add 20 ml of DI water to the denuder, cap the other end, then repeatedly invert the denuder (approximately 20 times) to ensure that all internal surfaces are thoroughly rinsed.
 - 8.3 Uncap one end of the denuder, and empty the solution into a prelabeled, 30 ml capacity bottle.
 - 8.4 Store the bottle at temperatures below 5 C until the time of the solution's subsequent analysis by ion chromatography.
 - 8.5 If the denuder is required for additional field use, repeat the coating procedure outlined in Section 7.0 of this SOP.
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