

Rotating Drum Impactors

COLLECTION OF SIZE SEGRAGATED AEROSOL SAMPLES WITH MULTISTAGE ROTATING DRUM IMPACTORS FOR ANALYSES BY SXRF

1. PURPOSE AND APPLICABILITY

This research protocol (RP) contains the protocol for collecting size-segregated aerosol particle samples with the Rotating Drum Impactor (RDI) for analysis by synchrotron XRF. Research Protocols are subject to change. Every addition to this RP will be added as an Appendix during this study.

2. DEFINITIONS OF TERMS

RDI: Rotating Drum Impactor

S-XRF: Synchrotron X-ray Fluorescence

3 EQUIPMENT

- 8-Stage RDI
- Rain shield
- Sampling pump
- Critical Orifice with recording pressure monitor
- Data Logger or Computer with ADC
- Dry gas meter

ACCESSORIES

1. Set of substrate loaded drums
2. Plastic drum containers
3. Clipboard with paper (permanent record) data collection form

OTHER MATERIALS

None

4. Collection Schedule

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Intensives (8-stage RDI):	24-hr drum sample daily, rotation speed is set to 1 revolution/day.
Routine sampling (8-stage RDI):	24-hr drum sample collected once every 3 days, rotation speed set to 1 revolution/day .

5. PROCEDURES

5.1 Loading Drums for sampling

Load drums in the laboratory clean bench facility

Use disposal, powder-free gloves and install a clean plastic-coated paper workstation mat on the bench top before proceeding

Drums, preloaded with clean substrates, will be received from the UC Davis Delta Group. Clean Substrate loaded drums are simply installed into the RDI body by opening each drum cover and slipping the drum onto the shaft, and then reinstalling the cover. The drum may be rotated, gently, by hand, to align the drum with the alignment pin on the rotating shaft.

Do not touch the coated substrate area of the drum while installing.

After sample collection, the drum is removed, and placed in the original storage container for temporary storage in the field laboratory refrigerator.

5.2 Collecting a sample

1. Start computer data acquisition program.
2.
 - a) Disconnect drum impactor housing from pressure sensor/sampling line
 - b) install plastic inlet plug
 - c) move unit into field laboratory.
 - d) Wipe outside of drum impactor housing with moist or dry towel to remove dust
 - e) Place drum impactor housing in field laboratory clean bench for drum loading
3. Inspect drum impactor slits for debris and remove as necessary (see Cleaning Procedures in Maintenance section, below).
4. Install substrate loaded drums.
 - a) record id numbers for each drum
 - b) ADVANCE THE RDI drive by an angle equivalent to 5 minutes of sampling to

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- provide for a field sampling blank.
5. Install drum impactor body on field laboratory roof
 6. Perform leak test (install plastic plug on inlet
 - a) switch on pump with plastic inlet plug in-place, observe gas meter flow rate for 30s.
 - b) record results. If gas meter flow rate does not indicate zero after 30 s, then diagnose problem and fix before initiating sample.
 7. Record gas meter volume (start volume), results of leak test, date, time of day, RDI configuration. Record also confirmation that field blank rotation was performed.
 8. Start pump
 9. Observe pressure drop, terminate sample if not in limits:
 10. Observe data acquisition is occurring
 11. Type data into electronic sampling data form and file paper copy of the permanent data acquisition form (not a paper copy of the electronic version).

4.2 Flow Calibrations

The flow is controlled by a critical orifice whose pressure is monitored continuously with a recording absolute pressure gauge.

1. The critical orifice flow system is calibrated prior to beginning field measurements by measuring the flow rate achieved with a bubble meter calibration instrument installed at the inlet of the system. Actual flow rate is measured as a function of the differential pressure between the ambient atmosphere and the flow downstream of the critical orifice to establish limits of proper application.
2. Flow checks against the bubble meter system should be performed weekly while operating at the field sites.
3. The dry gas meter is, likewise, to be subjected to weekly flow checks. Should the flow rate check reveal a difference of more than 5%, then a complete calibration is to be performed.

5. INSTRUMENT MAINTENANCE

1. The impactor housing should be inspected weekly and cleaned with a lint-free cloth wetted with ethyl alcohol.
2. Impactor slits should be cleaned weekly with a "QueTip" swab wetted with ethyl alcohol.

6. HEALTH AND SAFTY WARNING

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1. Ethyl alcohol used is not potable. Ingestion could cause blindness or death.
2. Removal and installation of the RDI will require climbing onto the roof platform.
 - a Take care not to fall, or to
 - b drop tools that might injure persons standing below

7. DATA QUALITY ASSURANCE

1. Written sampling records should be filed in a file cabinet on site. Files are to be transferred to the University of Maryland for storage in the UMCP file cabinet for a period of 5 years beyond the project period. Written sampling records will be scanned and their electronic copies will be stored in the project master data base.
2. Backup copies of Electronic files of all raw data shall written to redundant CDROM (or DVD ROM). One copy may be stored on site. The second copy shall be transferred to the Baltimore Supersite Storage Computer within 48 hours.
2. The 5-min average flow rate and 5 min std deviation of the flow rate, time, date, and sampler location (site) shall be recorded as well as total sample flow rate derived from the dry gas meter. The appropriate data quality flag (NARSTO convention) shall accompany each 5 minute average flow rate. (This will permit analysis of periods on the substrate for which flow rate or other compromising conditions have not occurred.).
3. The precision of the flow rate will be expressed in terms of one relative standard deviation (RSD) derived from 10 s orifice pressure interrogations. The reported accuracy of the sample volume shall be reported as the difference between the flow rate determined from continuously monitoring (pressure) and the dry gas meter readings, after any corrections of the latter inspired by weekly calibrations.

8. DATA QUALITY OBJECTIVES

1. A sample segment (equivalent to 1 hour) shall be deemed properly collected if a) the flow rate precision is $<5\%$ (RSD) during the segment, b) the dry-gas meter or pressure transducer calibration is found to be valid for the sampling period or segment, c) the flow rate lies within 10% of the prescribed rate, and d) absent any conditions or events leading to evident contamination (e.g., sample dropped on floor).
2. Our target frequency for successful sample collection is $\geq 80\%$.

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9. STATISTICAL CONTROL

A the flow rate standard deviation and deviation between dry gas and pressure sensor flow rates will be plotted on a statistical control chart to permit rapid detection of data degrading trends.