Automatic Semi-continuous Field-Deployable Thermal/Optical OCEC Carbon Aerosol Analyzer

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Introduction

Why Organic and Elemental Carbon Measurements?
- Climate effects
- Tracer for Sources
- Health effects
- Visibility

Semi-continuous Field Instrument Specifications, Features and Data

Field version better suited for continuous monitoring at one location over a period of time
OCEC Field Instrument

Basic functions
- Automatically samples and analyzes carbon in a semi-continuous method
- Accurate thermal/optical OCEC sampler
- Semi-continuous operation with minimal operator input
- Field deployable to an enclosed site
- Pre-set sample collection time (certain hours of the day) or pre-set collection cycle times (repeated time cycle)
- Sample collection variance from 30 minutes to 4 hours. One or two hour cycles are typical
Basic Functions (continued)

- Sunset Laboratory transmittance based OCEC parameters or user defined (NIOSH 5040, IMPROVE, EPA STN, or any user entered parameter)
- Measure EC by optical measurement and also thermal measurement
- Fast analysis protocol to maximize sample collection time
- Sensitive and smooth detector system
Features

- Time resolution as small as 30 minutes (recommended under unusually high levels)
- Minimum quantifiable levels of 0.4ugC/m^3 for OC and EC
- Sensitive NDIR detector measures carbon after it evolves from the filter and is oxidized to CO2.
- Computer operated flow controllers for all gases to allow for efficient use of gases
Features (continued)

- Minute by minute optical EC measurements (OptEC)
- Minimal maintenance
- Portable computer allows for easy operation and data storage
- Laser enables pyrolysis correction and compatibility with accepted OCEC method 5040 (NIOSH, National Institute of Safety and Health)
Semi-Continuous OCEC Instrument Diagram
Current Production Model
Model 4 Rack-Mount OCEC
Gas Inputs and other connections

- Sample Inlet
- Serial Cable to computer
- Support Gases
- NDIR Serial Cable
- Remote SSR Pump Control
- Remote TC
- Vacuum Line to Ballast Tank
Inlet Requirements

- Pre-Cleaned Metal Tubing Only (Copper or SS)
- Cyclone for size selection
- Denuder for removal of Organic Vapors
COMMON MAINTENANCE ITEMS

1. Gases – 6 months to 2 years
2. Filters – Usually changed weekly, though may need to be more often or can be less often
3. Heating coils – need to be replaced when they burn out. 1-2 Years
OC and EC – Suburban Area
Two Hour Samples
Minute Optical EC – Suburban Area

Minute Optical EC, ug C/cubic meter

Micrograms EC per cubic meter

Date and Time Ranges:
  - 0:00 to 12:00
OC/EC - Busy EU Intersection March 2006

- OptOC (ugC/M3)
- OptEC (ugC/M3)
- PM2_5 AKC

Weekend
Nightly OCEC Events in Portland

OC, EC ug/cub m   EC/TC raio Portland, Oregon

Wednesday Thursday Friday Saturday Sunday Monday
Primary OC Correlation with CO

![Graph showing correlation between Primary OC and CO over time]

- Primary OC (ug/m³)
- CO (ppm)

- Graph Legend:
  - Blue: Primary OC
  - Pink: CO

- Data Points:
  - 11/1/05 to 11/12/05
  - 0:00 to 5:00

- Note: Graph illustrates the correlation between Primary OC and CO over the specified period.
Forest Fire Event in Columbia Gorge

Bonneville Dam/Columbia Gorge - Forest Fire Event

Date and Time

8/29/2006 0:00 8/30/2006 0:00 8/31/2006 0:00 9/1/2006 0:00 9/2/2006 0:00 9/3/2006 0:00 9/4/2006 0:00 9/5/2006 0:00 9/6/2006 0:00
Optical EC and Aethelometer® BC

Three Day BC vs. OptEC
(5 min BC vs. 1 hr. OptEC)
Optical EC vs. Aethelometer® BC

BC vs OptEC (Hourly average)

\[ y = 1.1877x + 0.0147 \]

\[ R^2 = 0.9526 \]
Applications

- Ambient air quality and environmental exposure measurements
- Indoor air exposure assessment monitoring
- Long term environmental research such as studying the effects of regulatory changes implemented
- Workplace assessments
- Natural/man-made disaster effects over temporary periods such as extreme weather patterns, seasonal temperature inversions, or large fires