CARBON BLACK 5100

C MW: 12.01 CAS: 1333-86-4 RTECS: FF5800000

METHOD: 5100, Issue 1 **EVALUATION: FULL** **Issue 1: 30 April 2015**

OSHA: 3.5 mg/m³[1]
NIOSH: 3.5 mg/m³ (in presence of PAHs: carcinogen/PAHs to 0.1 mg/m³, cyclohexane extractable fraction) [2]
For other OELs and guidelines: See references [3,4]

PROPERTIES: Solid; may contain polynuclear aromatic hydrocarbons (PAHs)

SYNONYMS: Acetylene black; amorphous carbon; furnace black; lamp black

SAMPLING

SAMPLER: INTERNAL CAPSULE, (tared 37-mm, 2- to 5-µm PVC filter melded to PVC housing) in 37-mm 2-piece cassette

FLOW RATE: 1 to 2 L/min

VOL-MIN: 75 L @ 3.5 mg/m³
-MAX: 1400 L @ 3.5 mg/m³

SHIPMENT: Routine

SAMPLE STABILITY: 28 days minimum

BLANKS: Minimum of 2 field blanks per batch

ACCURACY

RANGE STUDIED: 0.1 to 4 mg/sample

BIAS: 0.058 [5]

OVERALL PRECISION ($\hat{S}_{rT}$): 0.059 [5]

ACCURACY: ± 15.5%

MEASUREMENT

TECHNIQUE: GRAVIMETRIC (INTERNAL CAPSULE WEIGHT)

ANALYTE: Carbon black

BALANCE: 0.001 mg sensitivity; use same balance before and after sample collection

CALIBRATION: National Institute of Standards and Technology (NIST), Class S-1.1 weights or ASTM Class 1 weights

RANGE: 0.25 to 5 mg per sample

ESTIMATED LOD: 0.075 mg per sample

PRECISION ($\overline{S}_r$): 0.031 at 2 mg per sample [5]

APPLICABILITY: The working range is 1.5 to 25 mg/m³ for a 200-L air sample. This method is not applicable for the determination of "cyclohexane-solubles" [3]. The method is nonspecific; information on any other particulate materials that may be present should be assessed.

INTERFERENCES: Moisture and static electricity can affect gravimetric measurements. Humidity control and minimization of static effects are addressed in this procedure. The presence of co-sampled airborne particulate material is a positive interference since this is a gravimetric method.

OTHER METHODS: This method is preferred over Method 5000, Issue 2 [6], and is similar to Method 0501 for particulates not otherwise regulated [8]. OSHA method PV2121 describes a similar procedure (but for respirable sampling) using an alternative sampler design [9].

EQUIPMENT:

1. Sampler: Internal capsule, 37-mm PVC, 2- to 5-µm pore size membrane or equivalent hydrophobic filter attached to PVC housing and supporting pad in 37-mm 2-piece cassette filter holder
   NOTE: The cassettes should be fabricated so as to ensure complete sealing of the internal capsule after sample collection.
2. Personal sampling pump, 1 to 2 L/min, with flexible connecting tubing
3. Microbalance capable of weighing to ±0.001 mg
4. Static neutralizer; e.g. ^{210}Po; replace no more than nine months after production date
5. Tool for handling internal capsules, e.g., forceps (preferably plastic)
6. Environmental chamber or room for balance (e.g. 20 ± 1 °C and 50 ± 5% RH)

SPECIAL PRECAUTIONS: Carbon black containing polynuclear aromatic hydrocarbons (cyclohexane - extractable materials) in excess of 0.1% (w/w) should be treated as a suspect carcinogen [3].

PREPARATION OF FILTER CAPSULES BEFORE SAMPLING:

1. Equilibrate the PVC filter capsules in an environmentally controlled weighing area or chamber for at least 24 h.
   NOTE: An environmentally controlled chamber is desirable, but not required.
2. Place backup pads in filter cassette bottom sections.
3. Weigh the filter capsules in an environmentally controlled area or chamber. Record the capsule tare weight, W_1 (mg).
   a. Zero the balance before each weighing.
   b. Handle the filter capsule with forceps. Pass the capsule over an antistatic radiation source. Repeat this step if the capsule does not release easily from the forceps or if it attracts balance pan. Static electricity can cause erroneous weight readings.
4. Assemble the filter capsules in the filter cassettes and close firmly so that leakage around the internal capsule will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry, and label the cassette with indelible ink.

SAMPLING:

5. Calibrate each personal sampling pump with a representative sampler in line.
6. Sample at 1 to 2 L/min for a total sample volume of 75 to 1400 L. Do not exceed a filter capsule loading of approximately 5 mg total dust. Take two to four replicate samples for each batch of field samples for quality assurance on the sampling procedure.

SAMPLE PREPARATION:

7. Wipe dust from the external surface of the filter cassette with a moist paper towelette to minimize contamination. Discard the towelette.
8. Remove the top and bottom plugs from the filter cassette. Equilibrate for at least 24 h in the balance room.
9. Using forceps, open the cassette and remove the internal capsule gently to avoid loss of dust or damage to the capsule.

CALIBRATION AND QUALITY CONTROL:

10. Zero the microbalance before all weighings. Use the same microbalance for weighing filter capsules before and after sample collection. Calibrate the balance with National Institute of Standards and Technology Class S-1.1 or ASTM Class 1 weights.
11. Process laboratory blanks, spiked QC samples and field blanks at a minimum frequency of 1 per 20 field samples. Internal capsules used for QC samples should come from the same lot. Spiked QC samples, loaded with 0.25 to 4 mg of material per internal capsule, should be prepared using weight-stable material such as Arizona Road Dust [10].

MEASUREMENT:

12. Weigh each capsule, including field blanks. Record the post-sampling weight, W_2 (mg). Record anything remarkable about a capsule (e.g., overloading, leakage, wet, torn, etc.).

CALCULATIONS:

13. Calculate the concentration, C (mg/m^3), of carbon black in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) - (B_2 - B_1)}{V} 10^3 \quad , \text{mg/m}^3$$

where: W_1 = tare weight of capsule before sampling (mg)
W_2 = post-sampling weight of sample-containing capsule (mg)
B_1 = mean tare weight of blank capsules (mg)
B_2 = mean post-sampling weight of blank capsules (mg)

EVALUATION OF METHOD:

Lab testing was carried out using blank internal capsules and with capsules spiked with 0.1 – 4 mg of NIST SRM 1648 (Urban Particulate Matter) and Arizona Road Dust (Air Cleaner Test Dust) [5]. Precision and accuracy data are given on page 5100-1. Weight stability over 28 days was verified for both blanks and spiked capsules [5]. Independent laboratory testing on blanks and field samples have verified long-term weight stability as well as sampling and analysis uncertainty estimates [5].

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