

# CARBON BLACK

5000

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

**METHOD:** 5000, Issue 2

**EVALUATION:** FULL

**Issue 1:** 15 May 1989

**Issue 2:** 15 August 1994

**OSHA :** 3.5 mg/m<sup>3</sup>  
**NIOSH:** 3.5 mg/m<sup>3</sup> (in presence of PAHs: carcinogen/PAHs to 0.1 mg/m<sup>3</sup>, cyclohexane extractable fraction)  
**ACGIH:** 3.5 mg/m<sup>3</sup>

**PROPERTIES:** solid; may contain polynuclear aromatic hydrocarbons (PAH)

**SYNONYMS:** acetylene black; amorphous carbon; furnace black; lamp black

SAMPLING		MEASUREMENT	
<b>SAMPLER:</b>	FILTER (tared 5-µm PVC membrane)	<b>TECHNIQUE:</b>	GRAVIMETRIC (FILTER WEIGHT)
<b>FLOW RATE:</b>	1 to 2 L/min	<b>ANALYTE:</b>	airborne particulate material
<b>VOL-MIN:</b>	30 L @ 3.5 mg/m <sup>3</sup>	<b>BALANCE:</b>	0.001 mg sensitivity; use same balance before and after sample collection
<b>-MAX:</b>	570 L	<b>CALIBRATION:</b>	National Institute of Standards and Technology, Class S-1.1 weights or ASTM Class 1 weights
<b>SHIPMENT:</b>	routine	<b>RANGE:</b>	0.1 to 2 mg per sample
<b>SAMPLE STABILITY:</b>	indefinitely	<b>ESTIMATED LOD:</b>	0.03 mg per sample
<b>BLANKS:</b>	2 to 10 field blanks per set	<b>PRECISION (<math>\hat{S}_p</math>):</b>	0.025 @ 3.5 mg/m <sup>3</sup> [1, 2]
ACCURACY			
<b>RANGE STUDIED:</b>	2 to 8 mg/m <sup>3</sup> (100-L samples)		
<b>BIAS:</b>	0.01%		
<b>OVERALL PRECISION (<math>\hat{S}_{rT}</math>):</b>	0.056 [1]		
<b>ACCURACY:</b>	± 11.0%		

**APPLICABILITY:** The working range is 0.5 to 10 mg/m<sup>3</sup> for a 200-L air sample. This method is not applicable for the determination of "cyclohexane-solubles" [3]. This analysis is simple but the method is nonspecific. Information on any other particulate materials present should be assessed. The method may be extended to higher air concentrations (e.g., nuisance dust levels) by collecting a smaller sample volume [4].

**INTERFERENCES:** The presence of any other particulate material in the air being sampled will be a positive interference since this is a gravimetric method.

**OTHER METHODS:** This is Method S262 [5] in a revised format. It is similar, except for collecting device, to the method described in the carbon black criteria document [3].

#### **EQUIPMENT:**

1. Sampler: 37-mm, 5- $\mu$ m pore size PVC filter and stainless steel support screen in 37-mm, cassette filter holder (preferably, conductive).
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. Po-210; replace nine months after production date.
5. Forceps (preferably nylon).
6. Environmental chamber or room for balance (e.g.  $20 \pm 1$  °C and  $50 \pm 5\%$  RH).

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**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].

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#### **PREPARATION OF FILTERS BEFORE SAMPLING:**

1. Equilibrate the filters in an environmentally controlled weighing area or chamber for at least 2 h.  
NOTE: An environmentally controlled chamber is desirable, but not required.
2. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
3. Weigh the filters in an environmentally controlled area or chamber. Record the filter tare weights,  $W_1$ , (mg).
  - a. Zero the balance before each weighing.
  - b. Handle the filter with forceps. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
4. Assemble the filters in the filter cassettes and close firmly so that leakage around the filter 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 mark with the same number as the backup pad.

#### **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 30 to 570 L. Do not exceed a filter loading of approximately 2 mg total dust. Take two to four replicate samples for each batch of field samples for quality assurance on the sampling procedures.

#### **SAMPLE PREPARATION:**

7. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
8. Remove the top and bottom plugs from the filter cassette. Equilibrate for at least 2 h in the balance room.
9. Remove the cassette band, pry open the cassette, and remove the filter gently to avoid loss of dust.  
NOTE: If the filter adheres to underside of cassette top, gently lift using the dull side of scalpel blade. Take care not to tear the filter.

**CALIBRATION AND QUALITY CONTROL:**

10. Zero the microbalance before all weighings. Use the same microbalance for weighing filters 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. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [6] or in the field [7]. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. Calculate precision from these replicates and record  $\bar{S}_r$  on control charts. Take corrective action when the precision is out of control [6].

**MEASUREMENT:**

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

**CALCULATIONS:**

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

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

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

**EVALUATION OF METHOD:**

Method S262 [5] was issued on January 30, 1976, and validated over the range 1.9 to 7.7  $\text{mg}/\text{m}^3$  for a 200-L sample and over the range 7.8 to 28  $\text{mg}/\text{m}^3$  for a 100-L sample using Vulcan XC72 (0.03- $\mu\text{m}$  particle size; Cabot Corp.) in a Wright Dust Feeder [1]. Overall precision,  $\hat{S}_{rT}$ , was 0.056. Collection efficiency was between 99 and 100%.

**REFERENCES:**

- [1] Documentation of the NIOSH Validation Tests, S262 and S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).
- [2] Unpublished data from Non-textile Cotton Study, NIOSH/DRDS/EIB.
- [3] NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Carbon Black, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-204, 80-88 (1978).
- [4] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).

- [5] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S262, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [6] Bowman, J.D., D.L. Bartley, G.M. Breuer, L.J. Doemeny, D.J. Murdock. Accuracy Criteria Recommendation for the Certification of Gravimetric Coal Mine Dust Personal Samplers. U.S. Department of Health and Human Services, NTIS Pub. No. 85-222446 (1984).
- [7] Breslin, J.A., S.J. Page, R.A. Jankowski. Precision of Personal Sampling of Respirable Dust in Coal Mines, U.S. Bureau of Mines Reports of Investigations #8740 (1983).

**METHOD REVISED BY:**

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