SKC

Operating Instructions

863 Valley View Road, Eighty Four, PA 15330 USA
Tel: 724-941-9701 Fax: 724-941-1369 e-mail: skctech@skcinc.com

Passive Sampler for Inorganic Mercury
Catalog No. 520 Series

Introduction

The 520 Series Passive Sampler for Inorganic Mercury is a lightweight, reusable personal sampler designed to be worn in the breathing zone of individuals who are potentially exposed to inorganic mercury vapor.

The sampler is comprised of a reusable housing and a replaceable sorbent capsule. The sample enters the sampler by positive controlled diffusion. The sorbent is analyzed by flameless atomic absorption. The sampler housing can be cleaned and reused with a new sorbent capsule. Validation of the SKC 520 Series Passive Sampler for Inorganic Mercury is based on OSHA ID-140.

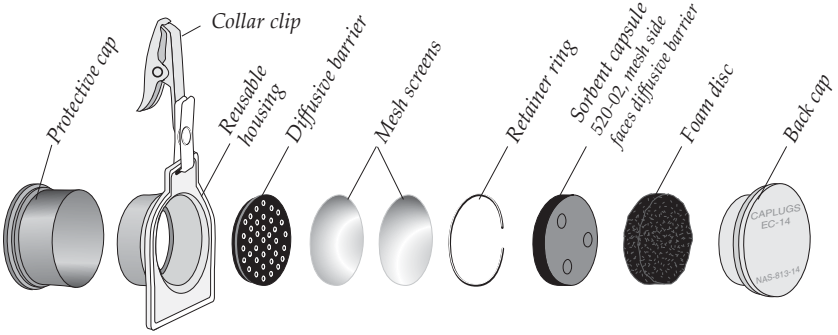

Figure 1. Complete Assembly of Passive Sampler for Inorganic Mercury

Specifications*

Sorbent:	Anasorb® C300 (SKC proprietary sorbent; equivalent to Hydrar® and Carulite®)
Background:	0.02 µg/200 mg section
Limit of Detection:	0.01 µg†
Limit of Quantitation:	0.04 µg†
Capacity:	> 30 µg mercury per capsule
Breakthrough Volume:	> 1500 liters of air
Overall Co-efficient of Variation:	6.1%

** Specifications are based on a study conducted by the Health and Safety Executive (HSE) in the U.K. as an update to Method MDHS 16.*

† Limits may vary with analysis and instrumentation.

***Note:** For sampling low levels of mercury, use a sorbent tube.*

Preparing the Sampler

For Sampling

1. Remove the back cap from the housing with a screwdriver or a coin.
2. Remove a sorbent capsule from the plastic vial, and place it in the housing with the mesh side facing the diffusive barrier.

Keep the plastic vial with remaining sorbent capsules in a safe place free from mercury contamination.

3. Ensure the back cap contains a foam disk. Press the back cap onto the housing.
4. Record I.D., date, and start time on a provided I.D. label (included with replacement sorbent capsules), and place it on the sampler's back cap. Note any other pertinent sampling information.
5. Using the clip, attach to clothing of individual near breathing zone or place in desired location for area sampling.
6. To begin sampling, remove protective cap. Retain the cap in a safe place free from contamination. Recommended sampling time is four to eight hours.
7. When sampling period is complete, replace protective cap and record finish time on I.D. label. Note any other pertinent sampling information.

Avoid excessive agitation of the sampler.

For Analysis

1. As soon as possible after sampling, take the sampler to a clean area. Remove sorbent capsule by pulling off the back cap. Remove foam disk from back cap and dispose properly.
2. Place the sorbent capsule in the provided ziploc bag. Remove the I.D. label from the sampler's back cap and adhere to the ziploc bag.
3. Mail or transport the sorbent capsule and at least one field blank to a qualified laboratory for analysis. The sorbent should be analyzed within 30 days of sampling.

Store sample away from sources of contamination.

For Cleaning

1. Unsnap and remove the collar clip. Clean with soap or detergent and water.
2. Disassemble the sampler and place all parts (except foam disk, sorbent capsule, and collar clip) in a container. Wash in a dilute solution of nitric acid (approximately 15%) in distilled water.
3. Rinse parts three times in separate rinses of distilled water.
4. Dry as quickly as possible.
5. Re-assemble sampler housing for storage, without the sorbent capsule or foam disk (*see Figure 1*).
6. Store in a clean area where the sampler will not become contaminated with mercury until ready to use again.

- *Always use a sorbent capsule within a few days of removing it from the plastic vial and placing it in the housing; the protective cap does not provide a hermetic seal.*
- *When inserting a replacement sorbent capsule, ensure that the two mesh disks are in place within the housing. These disks must be kept in place at all times to ensure reproducible sampling rates under all environmental conditions.*
- *Do not store any parts of the sampler in areas where they may become contaminated with mercury.*
- *Store the exposed sorbent capsule in the provided ziploc bag after the sampling period.*
- *Always clean the housing before reusing to guard against accidental carry-over from previous sampling.*

- *Always replace the used foam disk in the back cap with a clean disk after cleaning the housing.*
- *This sampler only samples elemental mercury (Hg) in the vapor phase and does not sample organic mercury compounds or particulate matter.*
- *Take precautions when sampling for mercuric chloride. It can collect on the face of the badge and interfere with sampling.*

Interferences During Sampling

Ambient Temperature

The sampling rate will vary with ambient temperature changes which affect the diffusion co-efficient. This effect is small but may be significant if sampling at unusually high or low temperatures. The diffusion coefficient (D) is a function of the absolute temperature (T) by the relation $D \propto T^{1.5}$. This factor is taken into account in the calculation used in the OSHA method (*see page 4*).

Wind Velocity

The sampling rate will remain substantially constant over a range of wind velocity from 25 to 750 ft/min. In very still air conditions (below 25 ft/min), the sampling rate will drop by up to 30%. If very high wind velocities (in excess of 750 ft/min) are expected, passive samplers should not be used.

Ambient Pressure Changes

The sampling rate varies with ambient pressure changes which affect the diffusion co-efficient. The diffusion coefficient is inversely proportional to the ambient pressure. This factor is taken into account in the calculation used in the OSHA method (*see page 4*).

Presence of Other Gases

The sampling of mercury on the sorbent has been shown to be unaffected by the presence of other gases, including chlorine. Note, however, that complex interactions in the atmosphere may reduce the total free elemental mercury present to be sampled.

Analysis

Consult OSHA Method ID 140 and MDHS 16 for detailed analytical procedures.

Preparation of Samples

Open the sorbent capsule and carefully pour the sorbent into a 50-ml volumetric flask. Add 5 ml of concentrated nitric acid followed by 5 ml of concentrated hydrochloric acid. Allow to stand for approximately 30 minutes or until the sorbent is fully dissolved. Stir gently if necessary. Add approximately 15 ml of distilled water to bring total liquid quantity up to 25 ml.

When Anasorb C300 is dissolved, a milky suspension results. This is an insoluble residue and must be removed by filtration or centrifugation before analysis.

Take aliquots from this solution and analyze at 253.7 nm by cold vapor atomic absorption.

Prepare several "blanks" by dissolving fresh, unexposed capsules of the same lot number as the test specimen. These "blank" values represent the background level of mercury in the sorbent and should be subtracted from all readings.

Mercury Desorption

The basic mechanism of desorption consists of adding an excess of stannous chloride to the aliquot of sample solution. This causes the mercury to be released as elemental mercury which is swept into the analyzer by an air or nitrogen stream.

Calibration
The complete analytical system can be calibrated by injecting aliquots from standard solutions (either from liquid or sorbent solution standards or both). It is recommended that three different concentrations be checked to insure linearity of the equipment over the likely range.

It is further recommended that standards and blank values be interspersed between samples to check for any variations in response. Take particular care to avoid buildup of mercury on the internal surfaces of the equipment; this will cause an increase in readings. A buildup of mercury can be detected by a gradual apparent increase in the blank values during use. If this occurs, run several aliquots of mercury-free solutions through the equipment until the analyzer indication drops to zero. Retest the "blank" solution as an additional precaution before proceeding.

Report all results as nanograms or micrograms of mercury on the capsule by direct comparison with the known standards. Relate the aliquot size to the total 25 ml of liquid solution.

Consult OSHA Method ID 140 and MDHS 16 for detailed analytical procedures.

Interpretation of Results
The lab result will indicate the total mass of mercury which was collected on the sorbent capsule in either nanograms (10^{-9} gram) or micrograms (10^{-6} gram). The airborne concentration of mercury is determined as follows:

1. Convert reported mass of mercury into micrograms (10^{-6} gram).
2. Convert sampling period into minutes.
3. Sample Volume (L) =
   Sampling Period (mins) x Sampling Rate (L/min) x Temperature/Pressure Correction Factor

   Where:
   Sampling rate = 0.020 L/min at 20 C and 760 torr
   Temperature/Pressure Correction Factor = $(T_1/T_2)^{1.5} \times (P_2/P_1)$
   T_1 = Sampling Site Temperature (K)
   T_2 = 293 K
   P_1 = Sampling Site Pressure (torr)
   P_2 = 760 torr
4. Mercury $mg/m^3 = \dfrac{\text{Mercury Mass } (\mu g) - \text{Mercury Blank } (\mu g)}{\text{Sample Volume (L)}}$

Note: *This is the calculation of mercury concentration as given in OSHA Method ID-140 (Revised June 1991), page 16.*

Ordering Information

Replacement Sorbent Capsules contain Anasorb C300* and include replacement foams and resealable bags ..... Cat. No. 520-02A/10
Cat. No. 520-02C/30

Reusable Capsule Holder ..... Cat. No. 520-03

* *Anasorb C300 is equivalent to Hydrar and Carulite*

SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to http://www.skcinc.com/warranty.asp.