



## Project Summary

# Stability of Polynuclear Aromatic Compounds Collected from Air on Quartz Fiber Filters and XAD-2 Resin

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The objective of this project was to investigate the stability of polynuclear aromatic hydrocarbons (PAH) collected from ambient air on quartz fiber filters and XAD-2 resin.

Eight EPA medium volume samplers were set up to collect ambient air for 24 hours at a 6.7 cfm flow rate. Quartz fiber filters and XAD-2 resin were used to collect particulate-bound and vapor-phase PAH. Prior to sampling, selected perdeuterated PAH in solution were spiked onto the XAD-2 resin. After collection, two of the filter and XAD-2 resin samples were extracted immediately, and the remaining filters and XAD-2 resin were extracted after 10, 20, and 30 day intervals. The storage temperature was approximately 70°F, and the samples were kept in the dark. Sample extracts were analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS).

The results indicated that the levels of perdeuterated and native PAHs on the XAD-2 resin were not adversely influenced by the storage time. The levels of most native PAH, except for cyclopenta[c,d]pyrene, adsorbed on the quartz fiber filters were also not influenced by the storage time. The levels of cyclopenta[c,d]pyrene found in the filters decreased from 1.28 ng/m<sup>3</sup> to 0.79 ng/m<sup>3</sup> after storage for 30 days.

*This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, to announce key*

*findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

Polynuclear aromatic hydrocarbons (PAH) have been extensively studied and have received increased attention in studies of air pollution in recent years because some of these compounds are highly carcinogenic or mutagenic. To understand the extent of human exposure to PAH, reliable sampling and analytical methodology must be established for monitoring the concentrations of these compounds in air. In general, the analytical methodology is well developed, but the sampling procedures can often reduce the validity of analytical results. Several studies have shown that the two- to four-ring PAH in air may be mainly in the vapor phase and are not retained by filters because of volatilization. Quartz fiber and glass fiber filters are typically used in sampling air particles. A wide variety of adsorbents such as XAD-2 resin and polyurethane foam (PUF) has been used to sample PAH vapors. However, the overall comparative effectiveness of the collection media and the degree to which quantification of the PAH is affected by sampling, handling and storage are not fully investigated. Recently, Battelle conducted a study to evaluate the stability of PAH collected on polyurethane foam (PUF) as a function

of storage conditions. As a follow-up study, the stability of PAH samples collected on quartz fiber filters and XAD-2 resin were evaluated in this program.

The objective of this project was to evaluate quartz fiber filters and XAD-2 resin for collection of particle-bound and vapor-phase PAH in air.

### Procedure

The stability study was performed to determine the stability of PAH adsorbed on quartz fiber filters and XAD-2 resin by examining the measured PAH concentrations as a function of storage time between collection and extraction. The sample extracts were analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS) to determine both native and spiked perdeuterated PAH.

### Results

The stability study was conducted to determine whether a significant loss of PAH captured by XAD-2 resin and quartz fiber filters occurred during the storage period. The samples were stored at room temperature (~70°F) in the dark for 0, 10, 20, and 30 days. Recoveries of the perdeuterated PAH for XAD-2 samples ranged from 71 percent for D<sub>12</sub>-benzo[a]pyrene to 103 percent for D<sub>8</sub>-naphthalene. Generally, good recoveries were obtained for all the spiked PAH. The storage time did not appear to have adverse effects on the recoveries of the spiked PAH.

The distribution of native PAH between the filters and XAD-2 resin agreed with the volatilities of the compounds, and the majority of the volatile PAH (<4 rings) were captured on the XAD-2 resin. The non-volatile PAH, such as BaP and coronene, were captured mainly on the quartz fiber filters. The storage time did not significantly affect the levels of the PAH adsorbed on the XAD-2 resin. In addition, the storage time did not appear to have adverse effects on the levels of most PAH captured on the quartz fiber filters, except for cyclopenta[c,d]pyrene. The levels of cyclopenta[c,d]pyrene decreased from 1.28 ng/m<sup>3</sup> (34.8 ng/mg of particles) to 0.79 ng/m<sup>3</sup> (17.8 ng/mg of particles) after 30 days storage.

### Conclusions and Recommendations

Generally, good recoveries for the spiked perdeuterated PAH were obtained for all XAD-2 samples. The recoveries of perdeuterated PAH did not de-

crease after storage for 30 days. However, results of a previous study showed that lower recoveries (1.2 to 0.6 percent) were obtained for D<sub>8</sub>-naphthalene from spiked PUF. The recoveries of D<sub>12</sub>-BaP were also decreased from 96 to 30 percent after 30 days storage. This finding demonstrated that XAD-2 resin has better retention efficiency for the volatile and reactive PAH than the PUF cartridge does.

The stabilities of native PAH adsorbed on XAD-2 resin and quartz fiber filters were investigated. The results showed that only cyclopenta[c,d]pyrene levels decreased significantly during storage. The loss of cyclopenta[c,d]pyrene was probably due to chemical reaction, because the five member ring is highly susceptible to oxidation. Therefore, if quartz fiber is used for air sampling, minimum sample handling and storage time is recommended to minimize the loss of some active PAH.

In this study, quartz fiber filters were used to collect air particulate matter. However, there are other types of filters that can be considered for collecting particles. Very few studies have been conducted to evaluate filter material for collection of particle-bound PAH. One research group has evaluated various candidate filter materials including glass fiber, quartz fiber, microglass fiber with Teflon binder, and Teflon membrane filters. Experiments were performed by spiking solutions of BaP onto filters to determine the recoveries. Spiking of BaP, however, does not represent the native adsorption process of BaP in ambient air sampling. Therefore, we recommend that a study be conducted to compare different types of filters such as quartz fiber, glass fiber, and Teflon-coated filters for collection of PAH from air. Several important characteristics such as flow rate and collection efficiency should be addressed. In addition, studies to determine the effects of storage time on PAH samples collected on different types of filters, such as glass fiber and Teflon-coated filters, are also recommended.

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*The complete report, entitled "Stability of Polynuclear Aromatic Compounds Collected from Air on Quartz Fiber Filters and XAD-2 Resin," (Order No. PB 86-223 054/AS; Cost: \$9.95, subject to change) will be available only from:*

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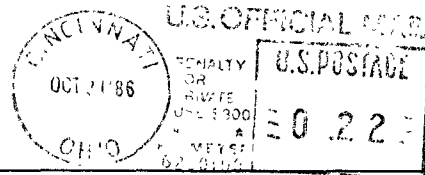
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