

LITERATURE CORNER

USE OF SEP-PAK[®] CARTRIDGES FOR GAS SAMPLING

The application of SEP-PAK[®] cartridges for the preparation of samples in solution are numerous, as indicated by the extensive listings of literature reports in the Waters SEP-PAK[®] Bibliographies (1,2). A less known use of these versatile cartridges is for the trapping of trace components of gaseous samples such as polluted air.

A recent publication (3) details the use of C₁₈ SEP-PAK[®] cartridges for the analysis of C₁-C₄ alkyl amines from natural air samples collected in various agricultural settings. These odorous amine pollutants have received considerable attention in air quality studies. While they can be conveniently analyzed by gas chromatography using a specially treated porous polymer packing such as PORAPAK[®] Q packings, the storage and analysis of the samples is troublesome due to the adsorption of the amines on solid surfaces. Such problems were found to be eliminated by the use of SEP-PAK[®] cartridges for sample collection and handling.

In preparation for sample collection, each C₁₈ SEP-PAK[®] cartridge was washed with 4-5 ml of methanol, followed by 3-4 ml of a 0.3% (v/v) solution of phosphoric acid in methanol. Cartridges were then dried under vacuum in a nitrogen stream (Figure 1A) followed by passage of nitrogen directly through the cartridges (Figure 1B). The dried cartridges were capped with glass stoppers, sealed into vials and stored in the dark at 3-5 degrees Centigrade until needed.

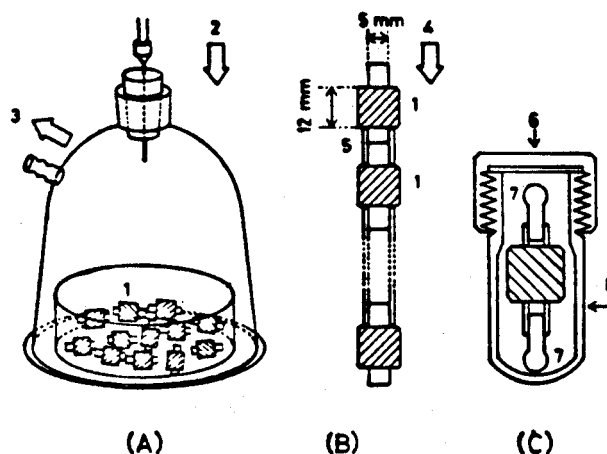


Figure 1. Sep-PAK C₁₈ (SP) cartridges: (A) drying step 1, (B) drying step 2, (C) storage and transportation; (1) SP cartridge, (2) nitrogen 20-30 mL/min, (3) water aspirator, (4) nitrogen 80-100 mL/min, (5) silicone tube, (6) PTFE-sealed cap, (7) glass plug, (8) glass tube.

Sampling consisted of drawing air through a single cartridge at a well-defined flow rate for a specified period of time. Adsorbed materials were removed by passing 1.5 ml of methanol through the cartridge, followed by injection of a small aliquot into the gas chromatograph. The capacity of the cartridges was found to be quite adequate for this analysis. When two SEP-PAK^R cartridges were connected in series (4), no amines were ever found to be present on the second cartridge in line. Recovery was 87-94% with a 3.8-5.5% relative standard deviation.

Figure 2 shows a typical chromatogram (GC) for the complete separation of all eleven isomers of the C₁-C₄ alkyl amines. In Figure 3, chromatograms for air samples collected near polluted sources are presented.

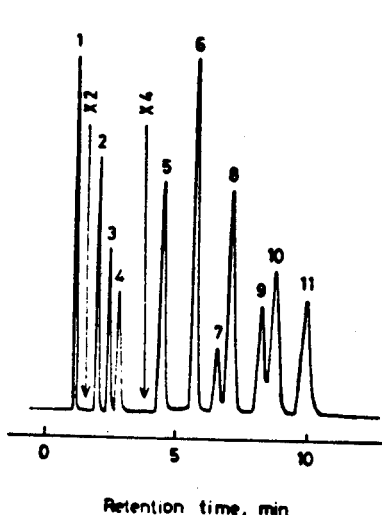


Figure 2. Typical gas chromatogram of the C₁-C₄ aliphatic amines. Amounts of the amines, 6 ng: (1) methylamine, (2) dimethylamine, (3) ethylamine, (4) trimethylamine, (5) isopropylamine, (6) *n*-propylamine, (7) *tert*-butylamine, (8) diethylamine, (9) *sec*-butylamine, (10) *iso*-butylamine, (11) *n*-butylamine.

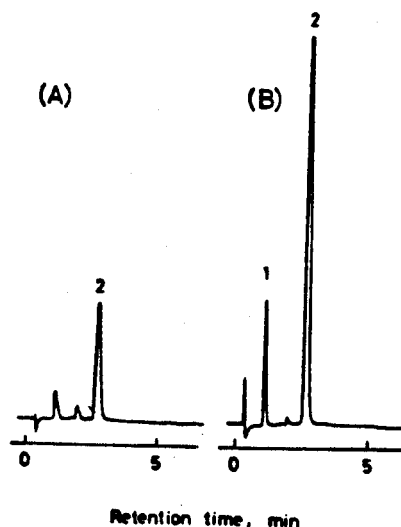


Figure 3. Gas chromatograms of amines from polluted sources: (A) air in a cowshed, (2) trimethylamine (0.22 ng) 0.80 ppb; (B) air around a fermentation system of poultry wastes, (1) methylamine (0.073 ng) 0.97 ppb, (2) trimethylamine (0.83 ng) 5.85 ppb.

This application indicates the creative uses which some of our customers find for WatersTM products, and points specifically to a new area of application for SEP-PAK^R cartridges. If you are aware of additional examples of the use of SEP-PAK^R cartridges for gas sampling, the author would be very interested to receive this information.

- 1) SEP-PAK^R Cartridge Applications Bibliography, Volume 1, Waters #N81.
- 2) SEP-PAK^R Cartridge Applications Bibliography, Volume 2, Waters #B57.
- 3) K. Kuwata, E. Akiyama, Y. Yamakazi, Y. Kuge, and Y. Kiso, Anal. Chem., **55**, 2199 (1983).
- 4) A convenient device for joining SEP-PAK^R cartridges in series is available from Millipore. It is a male/male Leur hub, part number XX1102503.