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AIR MONITORING APPLICATIONS USING XAD-2® AND SILICA GEL ADSORBENTS IN A TIME-SAVING SOLID PHASE EXTRACTION TUBE (ASSET&AUMA). I. DeGraff, S. Krout, J. Brown, Supelco, Inc., Bellefonte, PA

The air sampling solid extraction tube (ASSET) is an air sampling device in the form of a solid phase extraction (SPE) tube in which extraction is performed by gravity-feed elution rather than removal of the adsorbent followed by solvent desorption that is typical for glass tubes. This time-saving feature has been utilized in the development of two new applications: one for PAHs using XAD-2 (ASSET-43™) as the adsorbent, and one for nitrobenzene using silica gel (ASSET-52™).

Following NIOSH Method 5515, the ASSET-43 was evaluated for naphthalene and benzo(a)pyrene by GC/FID and comparisons were made with a standard glass tube containing the same amount of XAD-2. NIOSH Method 2005 was evaluated for nitrobenzene with the same comparisons made with a glass tube. Background levels, a recovery study over four concentration levels, and a storage stability study was performed for both tubes. Performance criteria were targeted at £10% difference to the glass tube equivalent. Results of the validation indicate that the performance of the ASSET is comparable to the corresponding glass sampling tube for both applications in all parameters investigated.

In addition, a round robin was conducted with several AIHA-accredited laboratories to assist in validation of the ASSET-43 and ASSET-52. The overall mean recovery of nitrobenzene in a set of six spiked tubes was 92%. The results from the PAH round robin yielded low recoveries, particularly for benzo(a)pyrene, for labs using high performance liquid chromatography (HPLC) rather than GC for the analysis.

The ASSET offers many advantages, including the convenience of a polypropylene tube and time-saving sample prep, while demonstrating equivalent performance to the traditional glass sorbent tube.

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THE PREPARATION OF PRE-SPIKED SORBENT TUBES FOR QUALITY CONTROL. M. Kern, L. Coyne, L. Guild, SKC, Inc., Pittsburgh, PA

Pre-spiked tubes are useful in quality assurance programs to assure the accuracy of results reported by laboratories. A technique has been developed to accurately spike a precise amount of an organic onto a sorbent tube. Varying loadings of trichloroethylene, toluene, and butyl acetate were spiked, individually, onto tubes containing 150 mg of a coconut-based charcoal and immediately glass-sealed to ensure minimal losses.

Tubes are packaged in groups of five, with four tubes spiked at one level and one left blank. All tubes are immediately refrigerated and have a shelf-life of six months.

Ten percent of each batch is analyzed to provide a nominal loading value of the test chemical. Every batch of spiked tubes had to pass three statistical tests prior to accepting the specific lot of tubes. The data demonstrate that all results are well within +/- 10% of the theoretical loading for trichloroethylene, toluene, and butyl acetate. Other analytes and mixtures are possible with this spiking technique.

These tubes are a useful tool for laboratory quality control programs and in field spiking.

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AEROSOL/VAPOR PARTITIONING OF MONOMERIC ISOCYANATES. H. Poovey, R. Rando, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA

The physical state of semivolatile toxicants has become an important topic of research in the industrial hygiene field. A toxicant's physical state will affect its site of deposition and uptake in the respiratory tract upon inhalation, in addition to influencing the techniques most appropriate for collection, analysis, and exposure control.

Isocyanates are commonly used in applications in which generation of an aerosol is part of the application process. This aerosol is actually a mixture of vapor and aerosol isocyanate. It is expected that the isocyanates would partition in a manner related to their vapor pressures. There is mounting evidence, however, that the monomeric isocyanates remain in the aerosol phase even when present at levels significantly below their saturated vapor pressure.

To further examine this phenomenon, three atmospheres were generated by nebulization in a laboratory-testing chamber and sampled with a denuder-based dichotomous sampler. These atmospheres consisted of three pre-polymer solutions: PMPPI, Desmodur N100 spiked with HDI, and a commercial coating, Rexthane (a TDI-based single component moisture cure coating).

The PMPPI atmosphere was generated at two levels with 8% of the MDI in the vapor phase at a total concentration of 694 µg/m3 and 41% in the vapor phase at 61 µg/m3. The Desmodur N100 atmosphere had 82% of HDI in the vapor phase at total concentration of 185 µg/m3. The Rexthane atmosphere showed 40% of 2,4-TDI and 63% of 2,6-TDI in the vapor phase at levels of 14 µg/m3 and 61 µg/m3 total TDI respectively.

The data indicate that all of the isocyanates partition between the vapor and aerosol phases at levels different from that which would be predicted by saturated vapor pressure alone.

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DETERMINATION OF THE SUBMICROMETER FRACTION OF BERYLLIUM AEROSOL. M. Berakis, M. McCawley, NIOSH, Morgantown, WV; M. Kent, Brush Wellman Inc., Elmore, OH

Controversy currently surrounds the choice of both the correct exposure limit for beryllium and the means of measuring that limit. Recent evidence has indicated that there might be a link between the number concentration of beryllium particulate and disease. Because number concentration is strongly influenced by smaller particle sizes, a determination of the size distribution of the processes that generates the aerosol was undertaken. This investigation was done to establish the relative quantity of material throughout the size range of interest for human inhalation and to connect that information with published epidemiologic data.

To span the size range of interest it was necessary to use several instruments with overlapping ranges and various means of collecting and sizing the particles. At the smallest size an electrical mobility analyzer coupled with a condensation nuclei counter was used for particle counting. The lower limit of this instrument was 0.01 µm and the upper limit was 0.40 µm. Overlapping this was a low-pressure impactor with a range of 10 µm down to 0.08 µm. The impactor allowed determination of the particle mass as well as beryllium content of the collected material. Personal impactors were also used to compare area samples collected with the two previous instruments with personal measurements made on workers.

Samples were taken involving processes that generated sizes, including fumes and coarse particles. The processes involved various chemical forms of beryllium both as a ceramic and alloy. Those processes established as most hazardous for disease had the highest submicrometer fraction of material. Particle count was subsequently highest in those areas as well.

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CONTENT VARIATION OF TOTAL CHROMIUM AND HEXAVALENT CHROMIUM IN FLUX-CORED ARC WELDING. C. Yoon, N. Paik, K. Ha, S. Choi, S. Kim, School of Public Health, Seoul National University, Seoul, Republic of Korea; J. Kim, H. Chae, Korea Institute of Industrial Technology, Chonnan, Republic of Korea; D. Park, Korea National Open University, Seoul, Republic of Korea

The practice of welding stainless steel is known to produce various valance states of chromium. Carbon dioxide (CO2) flux-cored arc welding on stainless was performed in a fume collection chamber. The content of total chromium and hexavalent chromium in fumes, the content of hexavalent chromium in total chromium, and the solubility of hexavalent chromium were investigated. The content of total chromium in fumes increases from 2%-3% to 7%-9% as a function of input energy, but for hexavalent chromium less than 1.2% in fumes. The solubility of hexavalent chromium is similar to shielded metal arc welding fumes, but the content of hexavalent chromium is similar to metal inert gas-welding fumes.

These characteristics are relevant to flux of wires and CO2 shielding gas.

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SURFACE SAMPLING TO ESTIMATE AIR CONCENTRATIONS. J. Jankovic, W. Underwood, Oak Ridge National Laboratory, Oak Ridge, TN; E. Coates, Purdue University, West Lafayette, IN

Suspended surface dust does not constitute the full amount of the material on a surface. Dust particle characteristics, collecting surface properties, suspension energy, and other factors affect the amount of aerosol that can be generated. Surface wiping typically collects more surface dust than can be aerosolized. The ambient air concentrations resulting from the resuspension of surface dust is predicted from a "surface-like" sampling system. The resuspendable surface concentration per unit area can also be determined from the same sampler. A collection device such as a mixed cellulose ester filter in a cassette is inserted into the sampler box and the sampling pump is actuated. Discharge air from the sample pump enters the sampler box through a flagellating nozzle that suspends some portion of the surface debris, which is collected on the filter for subsequent analysis.

Aerosolized chalk dust was allowed to settle in an empty room used as a dust chamber. Surface resuspension samples were collected and weighed and a sampler concentration was calculated. The chalk dust was then resuspended using a leaf blower and the resulting ambient concentration measured. Assuming equal energy, sampler concentration is related to ambient concentration by the simple ratio of sampler and room surface-volume dimensions (k factor). The experimental "k" determined by dividing ambient air concentration by the sampler concentration was not different than the measured "k"

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