

device. Flow rates between 1 and 5 liters/minute had negligible effect on the operation of the rotating impactor.

One major application for the selectable cut point impactor is the determination of aerodynamic particle size distribution using the device upstream of an aerosol concentration sensor such as a light scattering photometer.

### 169. VALIDATION OF A COMBINATION MCE FILTER/GLASS IMPACTION PLATE SAMPLING MEDIA.

D. Anna, D. Nye, Millersville University, Millersville, PA.

As a precursor to a project with a goal to utilize optical and polarized light microscopy to characterize and identify atmospheric particulate matter, a standard 37 mm filter was modified for collection of total dust samples by combining a glass impaction plate and a mixed cellulose ester (MCE) filter. The 20 mm diameter glass plate was lightly greased with silicone impaction grease and adhered to the center of the 37 mm MCE filter. Filters were desiccated and weighed prior to sampling. The validation study was conducted using side-by-side sampling in an aerosol generation chamber. ISO coarse dust (formerly known as Arizona Road Dust) was used as the contaminant. Low ( $5 \text{ mg/m}^3$ ) concentration levels of particulate contaminate were generated and sampled. Each side-by-side series of sample cassettes included both standard MCE filters and the MCE/glass impaction combination samples series of samples collected for analysis.

Gravimetric analysis of the samples demonstrated that both sample media collected total dust samples efficiently and effectively with little to no variability between the media types. The MCE/glass impaction media allowed further sample analysis using microscopy. The shape, size and surface morphology of particles were noted and digital images of the particles were recorded. Several parameters of the various component particles, such as refractive index, birefringence, color, transparency, and solubility, were determined in order to aid in particle identification. The open- and closed-face samples provided similar results for the gravimetric analysis, but the closed-face samples yielded a very high particulate concentration on the glass portion of the MCE/glass impaction media, which complicated the microscopic analysis.

## Podium 124. Biological Monitoring—Dermal Exposure

Papers 170–177

### 170. DEVELOPMENT OF A HAND WIPE METHOD FOR PAHS USING CORN OIL AND MODIFIED NIOSH METHOD 5506.

M. Boeniger, C. Neumeister, A. Booth-Jones, NIOSH, Cincinnati, OH.

Polyaromatic hydrocarbon (PAH) compounds are present in a variety of petrochemical mixtures to which workers are potentially exposed. We identified a need for an efficient and sensitive sampling method for determining PAHs on the skin and other surfaces. One approach that has previously been used applied food grade corn oil to the skin, removing oil and any PAHs on the skin by sorption with a Whatman filter paper and liquid chromatographic analysis. We have optimized NIOSH Method 5506 for analysis of pyrene and benzo[a]pyrene in corn oil, using maximum fluorescence excitation and emission frequencies of 328/394 nm and 365/410 nm, respectively. These are two predominant PAHs used in gasoline engine oil (UGE0) that we have measured at concentrations up to 0.1% w/v, thus representing a potential hazard to automotive repair technicians. Using the optimized conditions for detection of pyrene and benzo[a]pyrene, the lower limit of detection and limit of quantification (LOD/LOQ) was determined to be approximately 0.6 ng/2 ng per 100  $\mu\text{L}$  and 3 ng/10 ng per 100  $\mu\text{L}$ , respectively. Next, a number of possible wiping materials were evaluated for background contamination and recovery efficiencies including Whatman filter paper, paper towels, cotton gauze, and a highly absorbent non-woven polyester fabric (Tex-wipes). There were no background levels of PAHs in any of these media and recovery was acceptable for each. We then applied known amounts of UGEO that were characterized for pyrene and BaP onto volunteers hands and asked them to wipe them with the polyester wipes (3 concentrations) or Whatman filter paper (1 concentration) with three consecutive wipes that were analyzed individually to determine relative and absolute analyte recovery. Most of the applied UGEO was recovered in the first wipe, but combining up to three consecutive wipes will increase quantification of PAHs residing on the skin.

### 171. DEVELOPMENT OF A TAPE-STRIPPING METHOD TO QUANTIFY DERMAL EXPOSURE TO HEXAMETHYLENE DIISOCYANATE DURING SPRAY PAINTING.

C. Trent, L. Nylander-French, L. Ball, A. Gold, H. Koc, The University of North Carolina at Chapel Hill, Chapel Hill, NC.

Hexamethylene diisocyanate (HDI) is a commonly used diisocyanate in the surface

coating industry. The focus of research has mainly considered the inhalation hazards associated with the use of HDI due to its well-documented ability to cause respiratory sensitization and occupational asthma. Inhalation exposure, however, may account for only part of the total body dose resulting from occupational exposures. Recent animal studies have suggested a link between dermal exposure to diisocyanates and respiratory sensitization, but dermal exposure assessment methods and techniques for these compounds have been slow to emerge. An analytical method using liquid chromatography-ion trap mass spectrometry with electrospray ionization (LC-ESI-MS) was developed to detect and quantify dermal exposure to HDI. NIOSH Method 5521:

“Isocyanates, Monomeric”, originally developed for air sampling, was modified for use with our non-invasive dermal tape-stripping technique. The tape-stripping technique includes an application of an adhesive tape strip (2.5 cm  $\times$  4.0 cm) onto the skin and removal after 2-min adhesion time. The tape strip removes an outer layer of stratum corneum onto which HDI-containing paint has either deposited or penetrated. Each tape strip is placed in a 20-ml vial containing 15 ml of a toluene/1-(2-methoxyphenyl) piperazine solution and derivatized to HDI urea (HDIU). The presence of HDIU is detected by monitoring the spectra and retention time for its protonated molecular ion at 553.7 m/z. Octamethylene diisocyanate urea (ODIU) derivative (1000 pmol spike) is used as an internal standard, and detected using the protonated molecular ion at 581.7 m/z. A standard curve is developed with pure HDIU and spiked with 1000 pmol of the internal standard using a mol/mol range of 0.01 to 1.0. Evaluation of the method included tests on storage stability and extraction efficiency. All samples were run in triplicate providing reproducibility within 10%. Supported by NIEHS P30-ES10126.

### 172. STABILITY OF FORMALDEHYDE-INDUCED DNA ADDUCT BIOMARKERS USING HPLC/UV.

W. Zhong, S. Que Hee, University of California at Los Angeles, Los Angeles, CA.

Occupational formaldehyde (FA) exposure causes nasal cancer in animals and in some human cohorts. Formaldehyde-induced DNA adducts can be used as biological monitoring markers for FA exposure if the adducts are stable. The purpose of this study was to investigate the stability of FA-induced DNA adducts at different temperatures and storage time conditions. After 0.1 mmol deoxyadenosine (dA) and deoxyguanosine (dG) were separately exposed to 5 mmol FA at 60°C for 4 hours, the N<sup>6</sup>-hydroxymethyldeoxyadenosine (N<sup>6</sup>-dA) and N<sup>2</sup>-hydroxymethyldeoxy-guanosine (N<sup>2</sup>-dG) were separated from their normal deoxynucleosides using a C18 column and eluting with an aqueous solution using a 5–15% methanol gradient for 15 min and 2%–8%

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