POSTER PS 502

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Air and Water Sampling

Papers 357–369

357.

A MULTIPLE FRAME-OF-REFERENCE SCHEME FOR ASSIGNING APPROPRIATE ROTAMETER CORRECTION FACTORS. M. Hoover, NIOSH, Morgantown, WV

Air sampling errors continue to occur when rotameters are used to monitor and control the sampling flow rate. Most errors can be traced to confusion over use of the rotameter equation and the ideal gas law to determine the flow rate associated with a given scale reading in relation to the calibrated flow rate for that scale reading. Most texts and tutorials refer to "actual" conditions and "calibration" conditions. Operators frequently assumed that "actual" conditions refer to the temperature and pressure at the sampling location, rather than inside the rotameter. Rotameters are typically located downstream of a filter or other sampling device, which results in a lower pressure than the ambient atmosphere from which the sample is being drawn. Depending on the pressure drop conditions (perhaps 1 psi for a filter and several psi for a cascade impactor) the errors can exceed the 5% level recommended for making a correction.

Confusion can be eliminated by defining and using a multiple-frame-of-reference scheme involving the following conditions of temperature and pressure: (1) calibration, (2) operation (inside the rotameter), and (3) ambient (typically the actual conditions where the worker is located and the sample is being taken), as well as two types of reference conditions, (4) normal or standard ambient (760 mm Hg and either 20 °C or 25° C), and (5) standard (760 mm Hg and either 0° C for chemists or 25° C for ventilation specialists). This system clarifies that the rotameter equation is only to be used for the correction between calibration and the operation, and that the ideal gas law is to be used for corrections among all other combinations of the frames of reference. An Excel spreadsheet with detailed examples and calculations has been developed to demonstrate and apply this approach.

358.

POSSIBILITIES TO MAKE ELECTROCHEMICAL SENSORS SPECIFIC.
W. May, E. Ligus, Draeger Safety Inc., Pittsburgh, PA

Measurements in the workplace are often complicated due to the presence of more than one hazard. Therefore the issue of specificity is a major challenge in the design of electrochemical sensors. However, there are a series of possibile solutions to cope with this problem. The most important options include the selection and com-position of the electrolyte, the geometry of the working electrodes, and the operating voltage.

One additional option is to utilize chemical filter layers. An example is the use of activated charcoal for the measurement of carbon monoxide in the presence of hydrocarbons. In order to provide a high level of convenience these filters should be firmly integrated into the sensor. This is important to avoid mistakes like calibrating without an external filter being attached during this procedure. Breakthrough measurements have shown that such integrated filters have a long operation period of 5,000 ppm x h. In the case of hydrogen sulfide, it means at least 500 hours at a level of the TLV of hydrogen sulfide.

359.

A SAMPLING AND ANALYSIS METHOD FOR TWO AMINO ALCOHOLS. A. Grote, NIOSH, Cincinnati, OH

During a recent NIOSH field survey, thermal desorption tubes were used to qualitatively determine any volatile organic compounds to which the workers were being exposed. Two major compounds in the samples were identified by gas chromatography-mass spectrometry as N,N-dimethylethanolamine (DMEA) and N,N-dimethylisopropanolamine (DMIPA). A short-term method development was conducted to quantify full-shift concentrations of these compounds, potentially at fairly high levels. A desorption study was conducted using various solid sorbents-silica gel, carbon molecular sieve, and XAD resins. Methanol was used as the desorbing solvent. Only the XAD resins gave desorption efficiencies above the NIOSH criteria of 75% at various levels. Further study showed only the XAD-7 sorbent efficiently trapped these particular amines. The gas chromatography-flame ionization (GC-FID) method used a dimethylpolysiloxane bonded phase capillary column. The limits of detection (LOD) and quantitation (LOQ) for both amines were approximately 4μg and 10μg per sample respectively. Calibration curves were linear over a range of 4 μg to 550 μg per sample. Additional studies were conducted to check the storage stability of spiked samples, showing that samples were stable for at least three weeks when stored cold (- 4 C). The method was successfully used in a field study for the analysis of over 200 personal samples. The method will be published in the next supplement of the NIOSH Manual of Analytical Methods (NMAM).

360.

EFFECT OF SAMPLING VOLUME ON THE BREAKTHROUGH OF CHARCOAL TUBE DURING VINYL CHLORIDE MONOMER SAMPLING. J. Roh, J. Yoon, N. Lim, C. Kim, Yonsei University College of Medicine, Seoul, Republic of Korea

The main factors of breakthrough are known to sampling time, flow rate, concentration of the sample, temperature, humidity, and the physical characteristics of the solid sorbent tube. However, no study has been reported the effect of temperature and sampling volume on the breakthrough of a charcoal tube during vinyl chloride monomer (VCM) sampling. The objective of this study is to suggest the optimal sampling condition during VCM sampling based on National Institute for Occupational Safety and Health (NIOSH) method.

To evaluate adequate sampling volume for VCM without breakthrough, volume of 1, 2, 3, 4, and 5 L each from VCM of 1, 5, 10, 15, and 20ppm at flow rate of 0.05 L/min were sampled in 22°C and 40°C. At 22°C, in the case of 1, 5, 10, and 15ppm, VCM was adsorbed completely in first section of charcoal tube regardless of sampling volume. But in 20ppm, detection rates are 99.56% in first section and 0.44% in second section. At 40°C of 1ppm, VCM was adsorbed completely in first section. In 10, 15, and 20ppm, detection rates of second, third, and fourth sections were decreased significantly by reduction of sampling volume. In determination of breakthrough based on NIOSH method, no breakthrough was occurred in 20ppm at 22°C. At 40°C, breakthrough was occurred in 10, 15, and 20ppm when sampling volume was 5L. Although no breakthrough was occurred when sampling volume was 3L.

Finally, in environment of temperature around 22°C, breakthrough may not occurred up to 20ppm during sampling for VCM. During sampling for VCM in environment of temperature around 40°C, no breakthrough occurred in 1-5ppm and 10-20ppm when sampling volume is 5L and 3L respectively. This result suggests that the sampling volume should be considered when VCM sampling under hot conditions (>22°C) by the NIOSH method No. 1007.

361.

IMPROVING DESORPTION EFFICIENCY OF ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE COLLECTED ON CHARCOAL TUBE. H. Kim, Y. Roh, The Catholic University of Korea, Seoul, Republic of Korea; K. Kim, Korea Industrial Health Association, Seoul, Republic of Korea.

Desorption efficiencies of ethylene glycol monomethyl ether estate (EGMEA) by traditional desorbents, collected on coconut shell charcoal tubes and analyzed by gas chromatography using a flame ionization detector, have been shown to be very unstable. The ranges of desorption efficiencies with carbon disulfide (CS_2) that specified in the NIOSH analytical method No. 1451 (1994) were consistently low with 71.0-90.1% (mean =77.7%). Using a methylene chloride (MC)/methanol (MeOH) mixture (95/5 v/v) that specified in the OSHA method No. 79 (1990), the desorption efficiencies ranged 101.3-138.9% (mean=116.5%). The problems of unstable desorption efficiency for EGMEA stem from either lack of desorbing

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ABSTRACTS

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2002 Abstract Index by Session Topic

PF 101 Agricultural Health and Safety

Papers 1–6

1.

RELATIONSHIPS BETWEEN WORK EXPOSURE AND RESPIRATORY OUTCOMES IN POULTRY WORKERS.

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A pilot study was conducted on 74 poultry barn workers in Western Canada during the winters of 1998–2000. General respiratory health, current, chronic and work related respiratory symptoms; general work duties, and work-site factors were ascertained, pre-exposure, by questionnaire. Personal airborne exposure levels and changes in symptoms and lung function were measured across the work-shift for all workers. Workers were classified according to the type of poultry operation (floor based, n=53; cage based, n=13) in which they worked. There was no significant difference in daily hours spent in the barn between those who worked with caged poultry (5.41±2.35 hours) and those who worked with floor-based poultry (4.42±2.48 hours). Age of birds was 47.10±58.36 days for floor based versus 155.91±63.01 days for cage based facilities. There were no significant differences in personal environmental measurements between cage-based and floor-based facilities (ammonia 13.22±13.70 ppm, 17.34±16.35 ppm; total dust 5.74±4.85mg/m^3, 10.01 ±8.84 mg/m^3; endotoxin 6046±6089 EU/m^3, 5457±5934 EU/m^3 respectively). There were no significant differences in across work-shift change in pulmonary function indices between workers from cage and floor-based operations. For the entire sample total dust dose (work hours/day x total dust) significantly correlated with across-shift change in FEV$_1$, whereas endotoxin dose and ammonia dose did not. Stocking density was significantly correlated with average ammonia (ppm, p=0.002) and ammonia dose (ppm x work hours/day; p=0.004) in floor based operations and with total dust (particles/ml, p=0.002) in cage based populations. Stocking density was also significantly correlated with chronic cough (p=0.003) and across work-shift cough (p=0.05) and chest tightness (p=0.06) for workers from floor based operations; and with phlegm when working (p=0.018) and chest tightness across the work-shift (p=0.004) for workers from cage based operations. Type of poultry production operation and therefore type of work exposures appear to significantly impact symptoms experienced by workers exposed to these atmospheres.

2.

DUST GENERATION SYSTEM FOR AGRICULTURAL SOIL DUST. K. Lee, R. Domingo-Neumann, R. Southard, UC Davis, Davis, CA

Agricultural workers are prone to exposure to mixed dust of inorganic and organic compounds. Diverse working conditions and operations in agriculture make direct measurements of the mixed dust exposure difficult. This study was conducted to develop a new dust generation system to determine possible exposure potency indicators of soil samples. The dust generator consists of a blower, a rotating chamber and a settling chamber. The rotating chamber has inner baffles to provide sufficient agitation of the samples while the chamber is rotating. A blower provides air into the rotating chamber, and the suspended dust is moved to the settling chamber through a perforated pipe. A small fan inside the settling chamber helps maintain suspension of the dust. Various size fractions of dust are sampled on filters suspended in the chamber via outlet ports and attached pumps. Air pressure is released through a filter plate mounted on the wall of the settling chamber. Various operating conditions were evaluated: air intake from blower, speed of rotation, soil mass and sampling time. To evaluate the characteristics of dust from the system, we collected dust samples from agricultural fields while the soil was prepared for