this preliminary study was to define the limits of reuse of chemical protective gloves based on the breakthrough time (BTT). Different glove materials, including neoprene and nitrile synthetic rubber, were selected for this study. The permeation for these materials was measured in a closed loop system using a 2.5 cm permeation cell and a MIRAN infrared analyzer. Neat 99% toluene was used as the challenge chemical. BTT and steady-state permeation rates (SSPR) were determined for triplicate samples of each material. Following the exposure, the samples were thermally decontaminated for 16 hours at 100° C. BTT and SSPR were measured for the second time and the decontamination procedure was repeated. For neoprene challenged with toluene, the BTT increased slightly during the first three exposure/decontamination cycles with BTT of 116, 115, and 109 % compared to that of the new material, respectively, while SSPRs consistently decreased with SSPR of 82, 71, and 70 % compared to that of the new material. On the other hand, the nitrile material challenged with the toluene yielded BTT that is slightly decreased as the result of increasing the number of toluene exposure/decontamination cycles. The BBT of the new material was 24.3 min and decreased by 16% to 20.3 min after four exposure/decontamination cycles. SSPR were virtually unchanged after three exposure/decontamination cycles. Neoprene gloves have a red inner liner. Thermal decontamination affected the color of the inner surface of the neoprene glove material, causing it to become darker. However, no obvious change in nitrile could be detected. These results indicate that multiple reuses of some chemical protective gloves could be safe if effective decontamination methods are used.

136.

PERMEATION OF CAPTAN FORMULATION THROUGH NITRILE PROTECTIVE GLOVE MATERIAL. R. Phalen, S. S. Que Hee, University of California at Los Angeles, Los Angeles, CA

Wettable powders of the fungicide captan (CASRN #133-06-2) are applied in agriculture by spraying over fields, applying onto the soil, or by dipping roots to be planted into a concentrated solution. Potential for dermal contact exists with such applications, the manufacture of captan, and its formulating. However, there are no permeation data available. The aim of this study was to assess the permeation of a wettable-powder formulation (48.9% captan and 1.1% related derivatives) as it would be sprayed in agriculture. A popular disposable nitrile glove material, Safeskin Blue Nitrile of 0.116 ± 0.004 mm thickness, was evaluated. Testing involved using the I-PTC 600 permeation cell in accordance with the American Society for Testing Materials (ASTM) F739-96 method, "Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact". A worst-case aqueous concentration of 217 mg/mL of the 50% wettable powder was tested to maximize permeation. The collection medium was hexane. Samples were collected at 2, 4, and 8-hour intervals. Analysis was conducted using non-polar capillary column gas chromatography (GC) with electron capture detection (ECD) and mass spectrometry (MS). The GC/ECD least quantifiable limit was about 6 ng whereas that for GC/MS was approximately 30 ng at m/z 79. The collection medium had to be concentrated before an aliquot was injected. The calculated permeation rate by GC/ECD was about 600 pg/cm2/min after 8 hours, a very low rate.

137.

GLOVE PERMEATION AND DETERMINATION OF BENOMYL IN BENLATE 50% WP PESTICIDE FORMULATION BY GC-MS AND GC-EC. H. Zainal, S. Que Hee, University of California at Los Angeles, Los Angeles, CA

Benomyl is the active ingredient of the pesticide, Benlate 50% WP. Long-term human skin exposure to Benlate 50% WP causes skin irritation. Benomyl is a suspected carcinogen. The aim of this study was to investigate the protectiveness of gloves used by farm workers, pesticide sprayers, and formulators. A sensitive analytical technique was first developed to determine benomyl. A mass of 10 mg of benomyl was dissolved in 10 mL methanol. One mL of this solution was evaporated to dryness under a stream of nitrogen. A volume of 0.5 mL of acetonitrile was added, followed by 20 µL of diisopropyl ethyl amine and 20 µL of pentafluorobenzyl bromide. After vortexing and heating at 60°C for 16 hours, evaporation under nitrogen, 0.1 mL water was added. Extraction with isooctane (5x0.5 mL) followed by reducing the volume of the combined extracts to 0.5 mL. On gas chromatographic-mass spectrometric analysis, m/z values of 551, 492, 292, and 181 were observed at a retention time of 41 minutes. This confirmed the formation of di-pentafluorobenzyl carbendazim. Treatment with acetonitrile at 60°C caused the degradation of benomyl to carbendazim that was then derivatized. The base peak at m/z = 492 was used for selected ion quantitation. This resulted in an LQL of 6 ng and a linear range of 10-200 ng. In contrast gas chromatography-electron capture at the same chromatographic conditions resulted in an LQL of 2 pg and a linear range of 4-60 pg. Thus chromatography-electron capture was used as the method of choice. The permeation of benomyl through "SAFESKIN" nitrile glove material using ASTM typeI-PTC 600 permeation cell that employed isopropanol as collection fluid and a challenge solution of 1.2 mg/ mL suspension of benlate 50% WP in water was <100 pg /cm^2/min.

138.

EFFECTIVENESS OF FIVE COVERALLS AGAINST LIQUID JP-8 PENETRATION. R. Walton, U.S. Air Force, San Antonio, TX; D. Carpenter, KARTA, San Antonio, TX

The purpose of the research effort was to identify if any commercially available coveralls provided greater dermal protection against liquid JP-8 than the cotton coveralls currently worn by the USAF aircraft fuel cell workers.

We evaluated five different types of coveralls including the cotton, which served as the baseline. The evaluation criterion was based on three separate parameters: (1) Resistance to liquid JP-8 penetration, (2) Heat stress (3) Ergonomic/Comfort.

The coveralls ability to resist liquid JP-8 was evaluated both quantitatively and qualitatively. We obtained the quantitative data using a new dermal patch (activated charcoal cloth), which were placed inside and outside the coverall in the high contact areas. The qualitative data was based on a study participant questionnaire.

The heat stress associated with each coverall was also evaluated quantitatively and qualitatively. We obtained the quantitative data through environmental chamber testing and again the qualitative data through the questionnaire.

The ergonomic/comfort of each coverall was only evaluated through qualitative data. Again it was based on the study participant questionnaire.

The final evaluation criterion clearly indicated one coverall provided statistically significant increased dermal protection.

139.

SELECTION OF PROTECTIVE GLOVES. N. El-Ayouby, NIOSH, Pittsburgh, PA

Skin disorders resulting from hazardous exposures in the workplace account for 15% to 20% of all reported occupational diseases. Irritant and allergic contact dermatitis and burn injuries caused by chemicals account for about 50% of the skin disorder. A variety of protective gloves are available in the marketplace. However, the user must know the criteria for selecting the proper glove for protection against chemical, physical or biological hazards. The glove material must also not cause side effects to the workers, such as latex allergy.

To develop recommendations for selecting appropriate protective gloves, the author performed a critical review and synthesis of the scientific literature, national standards, pertinent federal regulations, and available manufacturer and other data regarding the performance of gloves against physical, chemical, and biological hazards. Using several industry examples, the author presents a systematic process for appropriate glove selection, reviews the regulations and standards pertaining to gloves, and provides information for establishing a training program for glove usage and maintenance.

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ABSTRACTS

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