THREAT AGENT DEFEAT MODELING AND TESTING USING WMD SIMULANTS

Development of a Skin Dosing Method using Methyl Salicylate

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Human exposure assessments of military protective ensembles against vapor intrusion generally employ methyl salicylate (MeS), a sulfur mustard simulant. Currently, the MeS dose reaching the skin's surface is estimated using passive sampling. No method exists to quantify total mass of MeS penetrating through the skin while accounting for evaporation. We aimed to develop such a method that can also be used to interpret human biomonitoring data. To ensure consistent skin exposure, we investigated porous vehicles including textiles and filter papers with various physical and chemical characteristics. These vehicles allow for reproducible dosing via gas-phase transfer of MeS to the skin, which resembles exposure through clothing in field conditions. Vehicles were evaluated based on extraction efficiency, chemical potential, reproducibility, and practical considerations for dosing. A flow-through chamber placed over the exposure site was used to collect evaporated MeS on a sorbent tube. The Millipore Durapore membrane filter, a hydrophilic polyvinylidene fluoride (PVDF) material, was identified as the best among the investigated vehicles. Extraction of the dosing vehicle and gas-capture sorbent tube resulted in 95% mass closure. When this method was applied to human subjects, up to 44% of the MeS dose was absorbed into the skin. The total mass absorbed was quantified by accounting for mass evaporated and remaining on the vehicle. Labeled salicyluric acid (13C6-SU) urine concentrations indicated sufficient skin absorption for biological monitoring. This dosing method allows quantification of the absorbed MeS mass and will aid in quantifying MeS dose during protective clothing testing using biomonitoring.

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