

Evaluation of propylene glycol methyl ether as a potential challenge agent for leak detection of liquid and headspace from closed system drug transfer devices using Fourier Transform Infrared Spectroscopy

Introductory Information

Measurement of vapors from solutions containing propylene glycol methyl ether (PGME) released inside a closed chamber were evaluated. Data used to quantify limits of detection, limits of quantification, bias, precision, and accuracy of Fourier Transform Infrared Spectroscopy (FTIR) measurements of vapors from 2.5 M PGME solutions are presented. The effects of ethanol as a component of the PGME solution were also evaluated. Liquid drops of PGME solutions and headspace vapors above PGME solutions were released to simulate leaks from Closed System Drug-Transfer Devices (CSTD)s. Using a calibration apparatus, an instrumental LOD of 0.25 ppmv and a LOQ of 0.8 ppmv were determined for PGME vapor. A LOD of 1.1 μ L and a LOQ of 3.5 μ L was determined for liquid aliquots of 2.5 M PGME solution released in the NIOSH chamber. Accurate quantitation of liquid leaks required complete evaporation of droplets. With the upper end of the usable quantitation range limited by slow evaporation of relatively large droplets and the lower end defined by the method LOQ, the method has a narrow quantitative range for liquid droplets. Displacement of 45 mL of vial headspace containing PGME vapor is the largest amount expected when using the draft NIOSH testing protocol. Release of an unfiltered 45 mL headspace aliquot within the NIOSH chamber was calculated to produce a concentration of 0.8 ppmv based on the Henry's constant, which is right at the instrumental LOQ. Therefore, the sensitivity of the method was not adequate to determine leaks of PGME vapor from a headspace release through an air filtering CSTD when using the draft NIOSH testing protocols with an FTIR analyzer.

Methods Collection

Calibration of FTIR Gas Analyzer

- A Gasmet DX4040 FTIR Gas Analyzer controlled by Calcmeter software from Gasmet Technologies Oy (Vantaa, Finland) was calibrated using a modified Adsorbent Tube Injector System (ATIS) from Supelco.
- Ethanol and 1-methoxypropan-2-ol (PGME) were from the Sigma-Aldrich Co (Saint Louis, MO) were delivered via Gas-tight syringes from Hamilton Company (Reno, NV) metered by syringe pumps from Cole-Parmer (Vernon Hills, IL). A Bios DryCal Defender flowmeter from Mesa Labs (Lakewood, CO) was used to measure the output flowrate.

Releases of Liquid and Vapors from PGME solutions in the NIOSH chamber

- Experiments were done in a glove chamber consisting of a modified Secador® Techni-dome® 360 Large Vacuum Desiccator from Bel-Art Products (Pequannock, NJ).
- Chemicals in the chamber air were measured using a Gasmet DX4040 FTIR Gas Analyzer, connected so the exhaust recirculated back into the chamber.
- Chemical aliquots were dispensed using handheld syringes which either dispensed liquid or were used to displace headspace from a vial.

Citations – Publication based on the dataset.

Westbrook E.G., Doepke A., Streicher R.P., Evaluation of Propylene Glycol Methyl Ether as a Potential Challenge Agent for Leak Detection of Liquid and Headspace from Closed System Drug Transfer Devices using Fourier Transform Infrared Spectroscopy. Analytical Methods. DOI: 10.1039/d2ay01128j.

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