

54. Evaluation of Permea-Tech Pads as a New Technology for Detection of Chemical Breakthrough in Personal Protective Equipment (PPE)

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The degree of protection provided by gloves as personal protective equipment (PPE) depends on their ability to resist permeation of different types of chemicals. Permea-Tech Pads (PTP) are a new technology intended for field detection of glove barrier permeation by chemicals. The PTP employs micro-encapsulated color indicators that respond to a wide range of chemical contaminants such as aromatic and aliphatic amines, acids/bases, and various solvents. The pads are attached to the workers hand before donning the gloves, the color indicator response to chemicals if contamination occurs. This application allow the workers on site to identify gloves that provide less protection and exclude them from use as PPE in their tasks.

We evaluated PTP to determine if the pads can enhance worker protection through early detection of chemical permeation. We evaluated three types of PTP using two types of gloves and three common industrial chemicals. Chemical permeation breakthrough time and time to steady state permeation were determined by using infrared analysis with a closed-loop vapor collection system. The Edmont 34–100 PVC glove (mean sample thickness of $0.16 \text{ mm} \pm 0.11 \text{ mm}$) was mounted on the 2.5 cm AMK permeation cell and triethylamine (an aliphatic amine) was used as the challenge chemical. The mean breakthrough time was 2.3 minutes, with a minimum detection limit of 0.3 ppm. The visual color change of the PTP occurred simultaneously with the breakthrough as recorded by the infrared analyzer. The Edmont 37–137 nitrile glove (mean sample thickness of $0.42 \text{ mm} \pm 0.2$) was mounted on the 2-inch ASTM cell and aniline (an aromatic amine) was used as the challenge chemical. The mean breakthrough time was 12.5 minutes, with a concentration of 7 ppm, as determined by the infrared analyzer. The aromatic amine PTP color indicator also changed color at the breakthrough time. The Edmont 37–137 nitrile glove (mean sample thickness of $0.42 \text{ mm} \pm 0.2$) was mounted on the 2-inch ASTM cell and methanol (a solvent) was used as the challenge chemical. The mean breakthrough time was 53.7 ± 4.8 minutes at a concentration of 15 ppm. The PTP color indicator did not change color even at steady state permeation. The PTP indicators for the aliphatic amine and the aromatic amine both adequately detected permeation. However, no color change for the PTP was observed at the methanol breakthrough time or when steady state permeation of the methanol was reached.

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