Decontamination of a Mustard Gas Simulant (CEES) by Metal Oxide Powders

Adam M. Rawlett, Joshua A. Orlicki, Eugene Napadensky
U.S. Army Research Laboratory
Aberdeen Proving Ground, MD

Eileen M. Kowalski
United States Military Academy
West Point, New York

ABSTRACT:

Thirteen different metal oxides were compared for their ability to decompose CEES, a simulant for sulfur mustard. Most metal oxides showed little to no decomposition of CEES. NanoActive™ Plus MgO and Al_2O_3 demonstrated the highest ability to degrade CEES. However, even these materials after 24 hours still contained 60-90% of the original CEES applied. These results are lower than some results obtained by other researchers under conditions unlikely to be found in the field. In this work, samples were maintained at ambient temperature and light, and no solvents were added to facilitate the reaction.

The realistic conditions may have contributed to the reproducibility challenges recurring throughout these studies. Since the liquid CEES was added to solid metal oxide powders, the CEES was unlikely to diffuse uniformly through the solid reactant. The extent of CEES decomposition would depend on the amount of contact between the CEES and the metal oxide powder.

Although the extent of mixing of the two components is difficult to change, some parameters of the assay can be modified. Using three- or five-point calibration curves and selected ion monitoring should yield more reproducible results for future studies with metal oxides and chemical agents or simulants.

KEYWORDS: metal oxide, 2-chloroethyl ethyl sulfide (CEES), decontamination, sulfur mustard, mustard gas, chemical agent, simulant.

CONTACT: Adam M. Rawlett, U.S. Army Research Laboratory, AMSRD-ARL-WM-MA, Aberdeen Proving Ground, MD, Tel: (410) 306-0695, Email: arawlett@arl.army.mil

Joshua A. Orlicki, U.S. Army Research Laboratory, AMSRD-ARL-WM-MA, Aberdeen Proving Ground, MD, Tel: (410) 306-0391, Email: jorlicki@arl.army.mil

Eugene Napadensky, U.S. Army Research Laboratory, AMSRD-ARL-WM-

MA, Aberdeen Proving Ground, MD, Tel: (410) 306-0682, Email: enapade@arl.army.mil

Eileen M. Kowalski, United States Military Academy, West Point, NY, Tel: (845) 938-3918, Email: eileen.kowalski@usma.edu