Determining the Environmental Persistence of Ammonium Nitrate Fuel Oil (ANFO) using Gas Chromatography – Mass Spectrometry and Ion Chromatography with Conductivity Detection

John A. Tokarz, Joy M. Ginter, Timothy S. Allan, Lisa A. Walden, E. Alex Jestel, Kevin J. Shefcheck, Stanley A. Ostazeski

U.S. Army, Edgewood Chemical Biological Center (ECBC), Aberdeen Proving Ground, MD

Homemade explosives (HMEs) and improvised explosive devices (IEDs) are commonly used in terrorist attacks throughout the world. Identification and subsequent characterization of these explosive devices are a main priority to anti-terrorism efforts within the U.S. Army and other government agencies. Homemade explosive devices are made of inexpensive materials that are easy to acquire. In general a HME is composed of a fuel and an oxidizer, along with other components that improve handling properties and/or increase the heat of combustion. One combination that has become prevalent is ammonium nitrate fuel oil (ANFO) mixture. Environmental deterioration of ANFO is of interest to the US Army for protection of troops in the field. In this study we look at the persistence of ANFO on different material in different environmental conditions.

Figure 1. A-C. Environmental chamber light/dark set-up pictures. **D.** Light exposed sample (left) and dark sample (right). The light exposed sample shows some yellowing of the ANFO.

In this study, the first four weeks of an eight week study are presented. The study consisted of ANFO on metal or plastic coupons to simulate potential surfaces of interest. These ANFO-deposited coupons were placed under eight different environmental conditions (4 temperatures, 2 humidities). Half of the samples were exposed to light. The samples were collected at varying time points for analysis. Hexane-extracted samples were analyzed for fuel oil, while water-extracted samples were analyzed for ammonium and nitrate.

Through the first four weeks of this study fuel oil expectedly decreases in all samples, although at different rates at different temperature and humidity conditions. At a high temperature/low humidity, the fuel oil recovery decreases rapidly, while at high temperature/high humidity, the rate of fuel oil recovery decreases at a more moderate rate. Low humidity with lower temperatures exhibits similar data for the fuel oil to the data from the high temperature low humidity.

For more information, contact Kevin Shefcheck; Kevin.shefcheck@us.army.mil; 410-436-7055