B125 Identification of Household Chemicals Used in Small Bombs via Analysis of Residual Materials

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Attendees will obtain information on methodology for the identification of reactants used in a specific type of bottle bomb (also known as chemical or "MacGyver" bombs) by analysis of product residues that result from the mixing of certain household chemicals with commonly available liquids.

This presentation will impact the forensic community and/or humanity by providing forensic examiners with information and data useful in identifying chemical bombs made from household products containing halogenated organic compounds; the identification of an original reactant can be used to narrow the search for possible household chemical sources and thus provide an investigative lead. This presentation will also raise awareness of the increasing popularity of these types of bottle bombs and the availability of "recipes" for them on the Internet.

Bottle bombs have commonly been made by combining aluminum foil and either muriatic acid (hydrochloric acid) or lye (sodium hydroxide) drain cleaner and water in a plastic bottle, which is then tightly capped and shaken. The resultant build-up in gas pressure causes the bottle to violently burst, and may spray caustic or corrosive liquid. While these devices are often set off as a mere prank, they have been known to cause property damage and/or physical injury. Recently, a growing number of bottle bombs encountered at the New York City Police Laboratory have been not of the afore-mentioned type, but the combination of certain pool and toilet tank tablets with rubbing alcohol. A number of household chemicals contain certain halogenated organic compounds in sufficient concentration which, when mixed with water or other liquids will produce a large volume of gas upon decomposition. These products include pool and spa chlorinators and brominators, and automatic toilet tank cleaners.

The first step in this study was to identify products that contain the organic compounds used in these types of devices. This was done by searching stores, browsing online vendors, and looking through the National Institutes of Heath Household Products Database (http://householdproducts.nlm.nih.gov/).

In the second step, several pool and toilet chemicals containing such compounds as trichloroisocyanuric acid, sodium dichloroisocyanurate, dichloro-5,5-dimethylhydantoin, and bromochloro-5,5-dimethylhydantoin were mixed under controlled conditions with tap water, rubbing alcohol, and soda-pop. The third step was to take reagent quality compounds in the above list and react them with distilled water and solvent grade isopropyl and ethyl alcohols. The solid residues remaining from each were dried, and then analyzed using gas chromatography-mass spectrometry (GC-MS), Fourier Transform infrared spectroscopy (FTIR), dispersive Raman spectroscopy, and x-ray fluorescence (XRF) and x-ray diffraction (XRD). This multi-instrument approach allowed for several points of comparison between the chemical products of steps two and three and reagent grade standards.

It was found that the original solid reactant was easily identified based on characterization of the reaction product. All chromatograms, spectra, and diffraction patterns from the reactions and standards were retained as a reference for future casework.

Chemical Bombs, Household Products, Halogenated Organic Compounds

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