



A97 A Proposed Mechanism for the Trichloro Triazine Trione/Isopropanol Reaction with Regards to Its Use in the Construction of Chemical Reaction Bombs

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After attending this presentation, attendees will have a better understanding of the mechanism involved in the reaction between trichloro triazine trione based chlorine tablets and isopropyl alcohol with regards to their use in the construction of chemical reaction bombs.

This presentation will impact the forensic science community by providing data related to the analysis and detection of residues from chlorine tablet/isopropyl alcohol based chemical reaction bombs.

Also known as pop bombs and bottle bombs, chemical reaction bombs are not all that new to the forensic laboratory. These devices and their remnants have been encountered for numerous years. Within recent memory however, the number of submissions involving these devices has been steadily on the rise. Reasons for this may be attributable to the presence of numerous recipes on the internet with available video documentation on their construction, the overall ease of construction, and the fact that they can be manufactured with materials that are either on hand already or can be obtained at just about any local store.

At first glance, such devices would appear to be relatively harmless. Since they consist of nothing more than either a single compound or a mixture that can produce large volumes of gas and a sealable container (typically a soda bottle), one might be led to believe that these devices are nothing more than a simple nuisance. To the contrary, these devices can present a significant danger to anyone in their immediate vicinity when they explode. The forces involved can have surprising effects and the substances that are either used in their construction or evolved during the reactions that take place can be highly acidic, strongly basic, or toxic. Combine these features with an inherent unpredictability and it should become obvious why such devices should be treated as dangerous.

Some of the more common components of these devices include dry ice, which acts simply through sublimation, hydrochloric acid and aluminum foil, which produces large volumes of hydrogen gas, and sodium hydroxide and aluminum foil, which also produces large volumes of hydrogen gas. Another popular mixture that is often encountered is the addition of isopropyl alcohol to pool chlorine tablets, the primary ingredient of which is trichloro triazine trione (also known as symclosene and trichloro isocyanuric acid). When mixed together, these two compounds rapidly react in an exothermic fashion to produce a large volume of gaseous product. If confined in a vessel such as a soda bottle, pressure will build rapidly until the confinement capacity is reached at which point the vessel will rupture with forceful consequence.

The goal of this research was to attempt to elucidate the mechanism involved in the exothermic chemical reaction between trichloro triazine trione and isopropyl alcohol. By mapping out this mechanism it is thought that a better understanding of the types of by-products produced could be obtained. If armed with such knowledge it might be possible to devise better methods for the detection and identification of the residues involved. Preliminary research indicated that an oxidation reaction was taking place in which the isopropyl alcohol was being converted to acetone. In order to test this hypothesis, carefully controlled quantities of reactants were mixed together and the reactions that took place were carefully monitored. The reaction products were then characterized using a combination of gas chromatography/mass spectrometry, scanning electron microscopy-energy dispersive spectrometry, Fourier transform infrared analysis, and X-ray diffraction. Based on the results obtained using these analytical techniques and observations of the reactions themselves, a possible reaction mechanism was thus constructed.

This presentation will discuss the methods that were employed to achieve this goal and the results that were obtained. In addition to the information pertaining to the mechanism, a brief discussion on the products obtained and their analysis will also be provided.

Chemical Reaction Bomb (CRB), Chlorine Tablet/Isopropyl Alcohol, Reaction Mechanism