D33 Development of Rapid Semi-Quantitative Colorimetric Test for Trinitrotoluene (TNT)

Aree Choodum, PhD, Prince of Songkla University, Department of Applied Science, Khohong, Hat Yai, Songkhla 90112, THAILAND; Niamh Nic Daeid, PhD, University of Strathclyde, Centre for Forensic Science, 204 George Street, Glasgow, G1 1XW, UNITED KINGDOM; Proespichaya Kanatharana, PhD, Prince of Songkla University, Department of Chemistry, Hat Yai, 90112, THAILAND; and Worawit Wongniramaikul, PhD, Prince of Songkla University, Faculty of Technology and Environment, Phuket Campus, Kathu, 83120, THAILAND*

After attending this presentation, attendees will understand the adaptation of a simple colorimetric chemical technique for the identification of TNT in power and extracted from soil samples to provide semi-quantitative information.

This presentation will impact the forensic science community by providing useful insight into the modification and development of an existing colorimetric test to facilitate the semi quantitative analysis in the field.

Explosive compounds are increasingly used around the world by terrorist groups and individuals; as a result, the rapid identification, detection, and quantification of explosives has become an important topic in forensic science and antiterrorist activities. Often explosives have also been used for military proposes, mining, and other industries. They can contaminate soil and water due to military activities (e.g., manufacturing, testing and training, demilitarization, open burning/open detonation, buried land mines, and industrial activities). This can cause significant environmental pollution and there is a need for a rapid, low-cost method for semi-quantitative or quantitative trace explosives detection for hazardous waste site characterization and land mine detection.

One important method for explosive detection involves the use of colorimetric techniques. This method could be used both off-site as the field test and as an on-site laboratory screen. Such techniques have the advantages of speed and low facilitating efficient sample analysis per unit time. This method has been used to analyze a large number of samples in mobile laboratory units as well as a number of commercial chemical kits have been developed; however, these can only produce qualitative analysis. Spectrophotometric detection has been reported for quantification of the product from colorimetric techniques; however, these require access to appropriate instruments. Therefore, there is a gap in current provision for field operators for a rapid, reliable, and low cost quantitative or semi-quantitative detection system for explosive trace and residue samples, both pre- and post-blast.

In this work, a rapid semi-quantitative colorimetric test for trinitrotoluene (TNT) was developed using digital image analysis. TNT was reacted with Nessler's reagent providing a purple colored product, which was recorded using digital images. The colored images were analyzed using a graphics editing software program to obtain analytical data in the form of Red Green Blue (RGB) values. The relationship between the individual RGB intensity and absorbance and the concentration of the target species were presented as calibration curves. A wide linear range and low detection limit was obtained in each case (1-50 mgL-1 for the color intensity and absorbance for red and blue as well as absorbance for green, and 1-25 mg L-1 for the color intensity of green, limit of detection of 0.73±0.01 mg L-1 to 1.75±0.07 mg L-1). The known concentration of TNT solution and TNT spiked in soil were tested for the accuracy of the method and satisfactory results were obtained. The results show great potential to continue the development for use as a semi-quantitative field test for TNT.

Colorimetric Test for TNT, Semi Quantitative, Digital Images

 ** Presenting Author*