## A182 Detection of Molecular Markers for the Identification of Gunshot Residues by Solid Phase Micro Extraction - Gas Chromatography/Nitrogen Phosphorous Detector (SPME-GC/NPD)

*Jorn Chi Chung Yu, PhD*, Sam Houston State University, College of Criminal Justice, Box 2525, Huntsville, TX 77341; and Brittney C. Gonzalez, Sam Houston State University, 1003 Bowers Boulevard, Huntsville, TX 77340*

After attending this presentation, attendees will have the opportunity to discuss our new method for the detection of trace amounts of methyl centralite and ethyl centralite from the GSR collection kit with a novel extraction scheme of using solid phase micro extraction. The ease of adaptation of this technique to forensic labs from other chemistry-focused areas will be shown. Discussion of similar efforts towards advances in science being applied to forensics will be encouraged.

This presentation will impact the forensic community by exploring the many compounds that are specific to gun powder primers and stabilizers. For the purposes of uniqueness, methyl centralite and ethyl centralite were reported as highly significant to GSR. These two stabilizers are commonly used in virtually all ammunitions and are not typically found in normal environments. Detection of trace amount of methyl centralite and ethyl centralite has been a challenging task. Our investigation of a novel extraction technique has created an alternative way to detect significant molecules form GSR related samples. The new method will have a great impact on the determination of molecular marks for those GSR related samples that couldn't be easily determined by conventional analytical procedures.

The confirmative detection of gunshot residues (GSR) relies on the use of scanning electron microscope - X-ray energy dispersive spectrum (SEM-EDX) to identify micrometer-sized particles that have the characteristics similar to known GSR-particles. This widely accepted method can determine the morphology, as well as the inorganic chemical composition, of the GSR-like particles. Collection of these micrometer- sized particles from samples is commonly achieved by using a standard GSR collection kit, which is a carbon double-sided tape sticking on an aluminum disc. To reduce false positive and false negative results for the detection of GSR, identification of organic components in GSR is a feasible way to provide a second layer of information. The idea in this work was to develop a complementary analytical method to pick up signature organic molecules collected on the GSR collection kit.

Methyl centralite (MC) and ethyl centralite (EC) are two important molecular markers for a positive identification of GSR, even though not all ammunitions contain these two compounds as stabilizers. The presence of these two molecules from the sample would highly suggest the presence of GSR. A sensitive extraction scheme to extract MC and EC from the samples collected by standard GSR collection kits has successfully been developed. The extraction was achieved using a solid phase micro extraction (SPME) technique. The SPME fiber was exposed to the head space in a 20-mL vial that contained the sample. The vial was also dipped in an oil bath maintained at 80 degrees Celsius during extraction. With the increase of extraction time, there was no impact on the extraction of MC. However, extraction of EC was increased when extraction time was increased. After extraction, the extracts were then desorbed in a GC injection port at 280°Celsius for 5 mins and splitlessly injected to a gas chromatography (GC) coupled to a nitrogen phosphorus detector (NPD) for analysis. Twenty ng of EC and MC spiked onto a GSR collection kit were readily detected under the optimal condition. No interference peaks were overlapped with EC peak at retention time of 16.7 mins. Unfortunately, one interference peak slightly overlapped with MC at retention time 15.8 mins.

This new extraction scheme can be easily applied to the extraction of MC and EC from different GSR collection methods, such as cotton swabs. Further research will also focus on designing an efficient extraction camber specialized for the extraction. The detection of sub nano grams of MC and EC from the sample may be possible in the near future.

**Solid Phase Micro Extraction, Gunshot Residues, Trace Evidence**

 ** Presenting Author*