## E5 Differentiating the Thickness of Black Plastic Bags Used in Bomb or Weapon Wrappings: A New Palm-Sized Digital Micrometer Approach

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**Learning Overview:** After attending this presentation, attendees will have learned how to differentiate black plastic bags by thickness using a new palm-sized digital micrometer. Black plastic bags are often used to wrap a bomb (e.g., the Madrid Bombing Incident) or a weapon (e.g., in many murder cases). While the Gas Chromatography/Mass Spectrometry (GC/MS) has been used to differentiate the elemental components of plastic bags, the method requires complicated techniques, longer times for sample preparation, advanced examination skills, and is destructive testing. Therefore, for a more practical application in the field for a preliminary source identification, a quick, in-field, and non-destructive device is much needed.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by providing a cutting-edge method of measuring the thickness of plastic bags in a quick, in-field, and non-destructive manner. Attendees will learn how the method may assist in investigating bomb- or weapon-related cases as a supplementary ability and competence.

Due to the chemical complexity of plastics, it is still a challenge to compare an unknown sample from a scene to a known sample for a source identification. Therefore, for a more practical application in the field, a quick, in-field, and nondestructive device is much needed for preliminary source identification. A physical approach may provide a new solution to the examination of trace evidence. A new type of palm-sized digital micrometer (different from a traditional micrometer screw gauge) is able to measure the thickness of collected samples ($n$=10) at a micro-level (μm=$1\times10^{-6}$m) and can reach up to one place after the decimal point of the μm unit.

This study employs a semi-experimental design: (1) ten black plastic bags were purchased as samples ($n$=10) from various stores; (2) each sample was cut into a 3mm square (similar to tiny pieces of black plastic from a bomb scene); (3) the micrometer was used to measure the thickness on three different spots on each sample; (4) the three results (per sample) were recorded and averaged to represent the thickness of that particular plastic sample; (5) the same process was repeated for another set of ten samples; (6) the final means of each thickness was compared between two sets; (7) correlations (the final means of each plastic sample) between two sets were identified; and (8) if the means between two sets were quite close to each other, it may suggest that the micrometer can be used to differentiate different types of black plastic bags as a quick, in-field, and non-destructive method.

This presentation will demonstrate the whole process of measuring the two types of black plastic bag samples for the attendees to watch via the Zoom connection with the following focuses: (1) the new palm-size digital micrometer for potential field and lab work (without mentioning the brand and the manufacturing); (2) the black plastic sample (3mm by 3mm); (3) the measuring action (about 50 seconds per piece); and (4) the two sets of the means from the two samples.

In conclusion, this novel method using a palm-sized digital micrometer may suggest a new tool to: (1) differentiate various types of black plastics by one of the physical properties of black plastic bags, namely the thickness; (2) help identify a possible source of a known sample (if available); and (3) make a final decision among exclusion, inclusion, identification, or inconclusive to promote accuracy, precision, and specificity in the forensic sciences.

**Micro-Measurement, Plastics, Thickness**