D33 Infrared Analysis of Human Remains

Diane K. Williams, PhD, Federal Bureau of Investigation, 2501 Investigation Parkway, Quantico, VA 22135*

After attending this presentation, the attendee will gain a better understanding of how infrared spectrometers may be used to detect human remains.

The presentation will impact the forensic community by providing an additional tool for the detection and location of human remains.

Human skin has been shown to possess reflectivity in the short- wave infrared (SWIR) region of the electromagnetic spectrum. As a result, a research study was designed to investigate the reflectivity of human skin in the (SWIR) region of the spectrum using a hand-held infrared spectrometer. The goal of the study was to use the infrared spectrometer to collect reflectivity data from the skin of a wide range of humans and from tree canopy to assess the feasibility of using a portable SWIR system to recover human remains. Prior to the collection of the skin reflectivity data, preliminary measurements were made on fabrics to determine instrument reproducibility. The results from the preliminary measurements suggest that the instrument is reproducible since the signal variation was less than five percent.

The reflectivity data was collected from the skin, hair, and bones of human remains in the short-wave region of the electromagnetic spectrum to determine the characteristic reflected wavelengths from each type of sample. The data was collected from the human remains housed at the Anthropological Research Facility at the University of Tennessee at Knoxville. The remains were in various stages of decomposition (ranging from one to four years), and all of the measurements were made in situ over a period of several days in order to account for variations in weather. Spectra was collected from both male and female remains. Multiple sample measurements were obtained in order to determine the mean and standard deviation of each sample type. Additionally, radiance measurements were taken from the ground through tree canopy to determine the amount of reflectivity that might be detected from a remote imaging camera. Finally, reflectivity data was collected from foliage and other environmental debris to determine wavelengths of possible interferences. The data was analyzed for consistency and principal component analysis of the data is continuing.

The initial analysis of the data revealed that there are unique and characteristic wavelengths in the SWIR region of the electromagnetic spectrum that will distinguish human skin from tree canopy. Additionally, the data analysis revealed that the spectra collected from human hair are reproducible and are not dependent on variables such as the sex of the individual or hair color. The complete data set will be discussed in the context of the spectral differences between human remains and tree canopy and the ways in which these differences may be used to aid in the search for human remains. Additionally, the relevance of the data with regard to the types of possible environmental conditions and/or interferences will be discussed. For example, a variety of tree leaves were analyzed to determine the effect of species on the analytical signal in the SWIR region. An initial review of the data suggests that the technique shows promise for using a SWIR system for detecting human remains. Future research will focus on the determination of the key spectral parameters that will be useful for further field testing using a remote system for detection.

Human Remains, Infrared Spectra, Remote Sensing

Copyright 2009 by the AAFS. Unless stated otherwise, noncommercial *photocopying* of editorial published in this periodical is permitted by AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained by AAFS. ** Presenting Author*