G90 Evaluation of a New Approach for Estimating the Postmortem Interval Based on the Direct Skin Surface Analysis Using FTIR Spectroscopy

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The goal of this presentation is to determine with accurate methods the Postmortem Interval (PMI).

This presentation will impact the forensic science community by facing one of the main issues in forensic sciences, the estimation of time since death (postmortem interval). Most methods currently employed have considerable inaccuracy. To be able to determine PMI is one challenge that can change a forensic investigation, and give answers, that until now were not properly supported in court.

The estimation of postmortem interval is a main issue in forensic sciences. Most methods currently employed have considerable inaccuracy.

Most of these methods are based on medical knowledge. With this work we intend to solve a forensic problem with the help of other areas of science not usually involved in medical studies.

The interaction of infrared (IR) electromagnetic radiation with the matter is a widely established technique to probe the chemical composition of materials.

The IR spectrum is divided into three zones; near- (14000-4000 cm- 1), mid- (4000-400 cm-1) and far-infrared (400-10 cm-1). The mid- infrared (MIR) region is used to analyze the fundamental vibrations of molecules and is strongly absorbed so materials have to be analyzed as thin films or in small path length cells (e.g., milk analysis).

Near-infrared (NIR) spectroscopy is based on molecular overtone and combination vibrations, which are forbidden by the selection rules of quantum mechanics. This means that NIR can penetrate much further into materials than MIR. This makes NIR very useful in probing bulk material with little or no sample preparation.

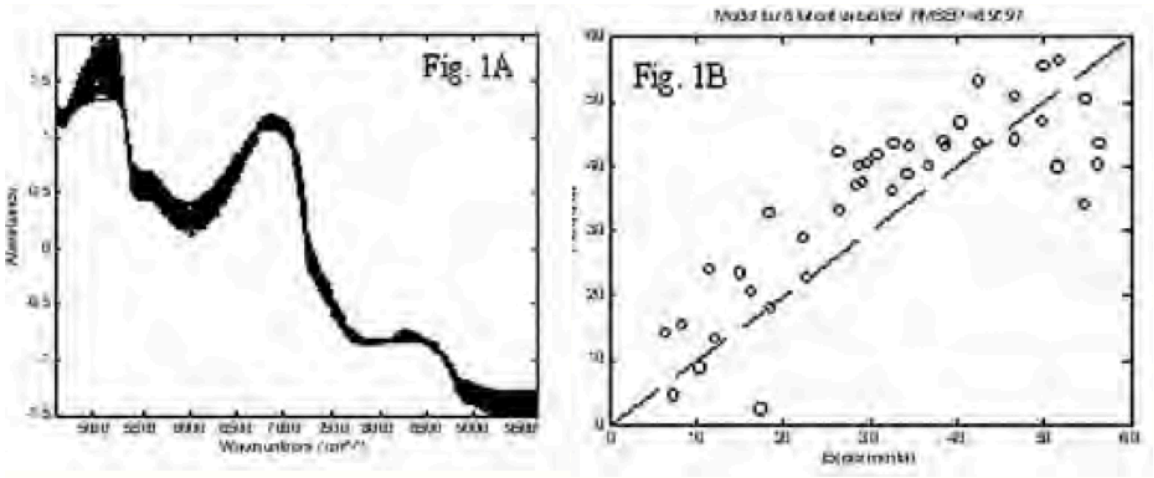
Because NIR probes the overtone and combination bands the spectra are usually very complex. Individual bands can not be assigned to specific features as with MIR. This means multiple wavelength (multivariate) calibration techniques are used to extract structural information. The design of powerful software packages, such as PLSplus/IQ, allows users with minimal chemometric experience the opportunity to generate and maintain their own calibration models without relying on general models from a third party that are not specific to their materials.

The increased processing power of computers has allowed the introduction of Fourier Transform (FT) infrared analyzers. Prior to this technology instruments either had to either use filters to look at the absorption of specific wavelengths or use diffraction gratings to scan through the wavelengths and measure the changing absorptions. FT technology uses interferometers that allow all the information at all wavelengths to be collected simultaneously. This means much more information can be collected in a shorter time.

Fourier transform near-infrared (FT-NIR) spectroscopy is an analytical technique that has gained great popularity in recent years. It is an effective tool for investigating chemical changes at molecular level and its major strengths include fast and easy equipment operation, good accuracy and precision, and the potential to perform nondestructive analyses. In its reflectance mode, FT-NIR spectroscopy is widely used to study, for example, the human skin and other tissues. And in the last few years, using fiber-optic technology, the direct real-time in situ analysis became possible.

The utilization of FT-NIIR spectroscopy is being studied here to directly test the human skin in order to, in combination with chemometric data analysis (PCA – principal component analysis; PLS – partial least-squares models), look for possible surface chemical changes occurring after death that may correlate with PMI. Studies performed to date (20 cases) showed promising results. Figure 1A shows typical spectra obtained from six corpses in the 48 hours postmortem period and Figure 1B shows the correlation between the predicted PMI *versus* the known (real) time since dead.

 ** Presenting Author*



This study shows the usefulness of coupled with chemometric data analysis for estimating PMI, and the importance of the interaction between different areas of knowledge.

Postmortem Interval, FTIR Spectroscopy, Accuracy

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