C29 Counterfeit Drug Detection Using Multi-Spectral Imaging

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Learning Overview: The goal of this presentation is to: (1) provide instruction on multi-spectral imaging theory and measurement; (2) describe how multi-spectral imaging can be used to detect counterfeit drug products and packaging; and (3) provide case study examples of counterfeit drug detection using the Variable Magnification Lens (VML).

Impact on the Forensic Science Community: This presentation will impact the forensic science community by establishing multi-spectral imaging as an effective tool to help forensic teams identify counterfeit products or packaging in a fast, non-destructive manner.

Counterfeit pharmaceutical products are an increasing threat to patients and pose severe challenges to the pharmaceutical industry. The challenge for forensics teams searching for counterfeits is that the counterfeiters are becoming more sophisticated, making it increasingly difficult to distinguish authentic products from replicas. These teams need superior detection techniques. Multi-spectral imaging has been utilized in the field of satellite and airborne sensing for many years but is now available in a powerful benchtop laboratory analyzer. The system consists of a high-resolution camera that takes a series of images at wavelength bands ranging from ultraviolet to near-infrared light. Because a unique image is taken at each wavelength band, the images can be viewed individually or in combination. In addition, specific layers within the image can be isolated and compared. Multivariate analysis can then be utilized to identify differences between the spectra of each layer over the entire wavelength range.

The objective of this study was to utilize multi-spectral imaging to identify counterfeit pharmaceutical products. Three different tablet types consisting of both genuine and counterfeit samples were analyzed using multi-spectral imaging. A color image of the products did not reveal any differences, nor were differences detectable by the naked eye. However, by observing the entire spectra, it became clear that while distinguishable differences did not exist in the visual band, differences could be observed in the near-infrared region. Authentic and counterfeit samples were then compared using normalized Canonical Discriminant Analysis (nCDA) to identify the best way to differentiate between the samples. Once trained by nCDA with the correct combination of bands to use, the system was able to provide a spectral fingerprint to correctly identify genuine product from counterfeit in blind samples. Multi-spectral imaging was able to identify counterfeit tablets in blind samples with 100% accuracy and could even detect counterfeit tablets while still in the package, eliminating the need to remove the tablets for analysis. In addition, multi-spectral imaging was able to distinguish counterfeit packaging from authentic with full accuracy. Multi-spectral imaging was concluded to be an effective tool for forensics teams to identify counterfeit products in a fast, non-destructive, and versatile manner.

Counterfeit, Imaging, Fast