A192 Nanomanipulation-Coupled to Nanospray Mass Spectrometry Applied to Document and Ink Analysis

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The goal of this presentation is to address the usage of nanomanipulation-coupled with nanospray mass spectrometry as applied to the extraction of small volume ink samples from questioned documents. Utilization of this technique is of special importance in maintaining the integrity of century old documents.

This presentation will impact the forensic science community by providing a non-destructive approach to analyzing ink samples from questioned documents with small sample volumes.

This technique will provide a non-destructive approach to the analysis of ink samples from questioned documents. The key advantage of using the nanomanipulation technique is that the process does not leave any destructive tracks on the surface of the document, which enables the analyst to retain the document in the original form.

Ink analyses are important aspects in the investigation of questioned documents. Ink analyses provide information on the type of ink used and give an estimate of the time frame in which the document was generated. Nanomanipulation-coupled with nanospray mass spectrometry can be advantageous in the field of questioned document examination where dealing with extremely small sample volumes is typical.

The advent of nanospray ionization has allowed the forensic science community to use extremely small sample volumes for trace analyses. Nanomanipulation-coupled with nanospray mass spectrometry is known to be an ideal approach for analyzing samples with increased sensitivity and resolution. The application of the nanomanipulator allows extraction of very small volumes (nanoliter to picoliter) of the ink sample from the questioned documents using a nanospray capillary.

The advantage of using the nanomanipulator is that one can use a microscope to visually determine the extraction of the ink sample from the document in question. The nanomanipulator is coupled with a Nikon AZ 100 microscope with 2X objective lens and has total optical zoom of 16X. A nanopositioner controls capillary placement and it can be electronically moved in the x, y, and z direction using a joystick. Piezoelectric motors control the nanopositioner which are capable of translational resolution that is beyond the optical limit of 200 nm in both courses of fine mode, allowing for discrete placement of the nanospray capillary in relation to the document surface. A PE200b four-channel pressure injector is used to supply up to 60 psi of injection pressure and 24 inches of mercury of fill vacuum to the nanospray capillary. Once the extraction has taken place, the nanospray tip can be taken directly from the nanomanipulator to the ionization source of the mass spectrometer for analysis.

To demonstrate this technique, a nanospray capillary is filled with an appropriate solvent and mounted on a nanopositioner. The capillary is then maneuvered very close to the surface of the document where the extraction is to be made. A very small drop of water can be placed on the surface of the ink using a gel loader pipette tip. The water drop is then

allowed to sit for a predetermined amount of time to allow the ink to diffuse into the water. The dissolved ink is then collected into the nanospray capillary and analyzed by nanospray mass spectrometry.

This novel technique will impact the forensic science community by providing a non-destructive approach to analyzing ink samples from questioned documents with small sample volumes. This will be an improvement from past analytical methods such as HPLC and TLC where higher sample volumes were required along with more preparation time. This approach will provide a more direct and efficient way to do ink analysis.

Ink Analysis, Non-Destructive, Nanomanipulation

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