New ink sampling technique taking a bite of out time

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Researchers at the Midwest Forensics Resource Center at Iowa State University are building a library of ink profiles to help forensic scientists identify inks on fraudulent documents and other evidence. MFRC scientists will pair mass spectrometry with a new sampling technique called Direct Analysis in Real Time (DART) to reveal the chemical makeup of ink faster and in greater detail than ever before.

DART mass spectrometry analyzes ink by creating a stream of warm gas containing excited-state helium atoms or nitrogen molecules in the DART source. The gas stream is pointed at an ink sample, and the gas and excited-state species evaporate and ionize molecules from the sample. A mass spectrometer measures the production of ions to create mass spectrum data for each ink sample tested.

In contrast to other types of ink analysis, like liquid chromatography, which require cutting a small sample from a questioned document, DART mass spectrometry is able to test documents without physically or visually altering them. The questioned document is open to the environment, and all sizes of materials may be tested in their original form.

According to Roger Jones, U.S Department of Energy's Ames Laboratory associate chemist, "The great thing about the DART system is that it can sample the ink straight off the paper. You don't have to extract a sample first. Before DART, we had to cut a little bit of sample out and dissolve it in solvent for analysis. So, now we can look at the

document without visibly altering it, which is good for forensic science. We don't destroy the evidence."

Eliminating the sampling extraction process saves busy forensic scientists time. Jones said that benefit alone would have been enough to consider the DART method a success.

"We would have been satisfied with the mass spectra looking basically like the spectra obtained by the old extraction mass spectrometry methods, because the DART system still gets around damaging the sample and reduces the work involved in analysis," said Jones, "Time constraints are the major complaint of every forensic scientist. Their caseloads are so large that they just don't have the time to do traditional ink analysis."

But, on top of saving time and preserving evidence, the DART method also yields richer data about ink samples than previous sampling methods. Initial tests of the DART system indicate that the mass spectra reveal more components of the ink than conventional mass spectra. Using DART, forensic scientists may be able to differentiate between inks like never before.

Jones and John McClelland, Ames Laboratory senior physicist and DART project leader, plan a three-phase project. Currently in the first phase, they are experimenting to determine the best way to analyze inks and build the library.

The library of ink mass spectra will be produced in the second phase of the project. Researchers will use samples from the U.S. Secret Service International Ink Library to create a comprehensive, vetted, and computer searchable library of mass spectra of the more than 8,000 inks the Secret Service has compiled.

The third phase of the project will focus on creating computer software used to store and access the mass spectra library.

“Commercial mass spectrometry software available today is all based on the old style of mass spectrometry. We get a different type of data from DART. So, the assumptions used in existing software for searching and matching mass spectra do not work the best for DART,” said Jones.

Source: Ames Laboratory