# Chemometric Identification Of Chemical Agents Via Electrochemical Methods Coupled With Classification Algorithms

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## BACKGROUND

Conventional methods for chemical analysis require that the sample be isolated and transported to the laboratory, and entail some risk of contamination during sample transport. Analytical techniques requiring expensive instrumentation and trained personnel are then applied to the samples (e.g., electrochemical analysis, gas / liquid chromatography, ion mobility, mass spectrometry, scanning electron microscopy, Raman spectroscopy, fluorescence spectroscopy, UV/VIS spectroscopy, and IR spectroscopy), and statistical data processing performed to assess the presence of the analyte(s) of interest. These techniques are limited in their ability to identify and classify groups of samples that could be associated with varying levels of exposure to said analyte(s). Moreover, such techniques are not amenable to field-deployment, thereby precluding applications requiring real-time, quasi-real-time, or on-the-spot/scene assessment.

## TECHNOLOGY DESCRIPTION

University researchers have developed a novel method and system that identify chemical agents using a combination of electrochemical detection and advanced signal processing algorithms. The invention distinguishes itself from other chemometric technologies in that it combines electrochemical methods (e.g., voltammetry, amperometry, potentiometry, coulometry, conductometry, and impedometry) with pattern-recognition algorithms (e.g. Principal Component Analysis, Linear Discriminant Analysis, Support Vector Machines) to transduce the chemical information to the electrical domain. It has been reduced to practice for the classification of residues originating from the handling and discharge of a firearm and to implicate culpability under such scenarios. A handheld unit integrating the electrochemical analyzer and embedded signal processing algorithms is currently under development. The approach, demonstrated for firearm forensics, can be extended to diverse other applications requiring differentiation among groups possessing variable chemical signatures (e.g., healthcare, environmental, agricultural, cosmetics).

## RELATED MATERIALS

- Electrochemical Detection of Gunshot Residue for Forensic Analysis: A Review. Electroanalysis, Volume 25, Issue 6, pages 1341–1358, June 2013 - 04/22/2013
- Rapid Field Identification of Subjects Involved in Firearm-Related Crimes Based on Electroanalysis Coupled with Advanced Chemometric Data Treatment, Anal. Chem., 2012, 84 (23), pp 10306–10314 - 11/03/2012
- Swipe and Scan: Integration of sampling and analysis of gunshot metal residues at screen-printed electrodes, Electrochemistry Communications, Volume 23, September 2012, Pages 52–55 - 09/01/2012

## RELATED CASES

2013-324 Solid-State Finger Sensor for Integrated Sampling and Detection

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| United States Of America | Issued Patent | 10,520,459 | 12/31/2019 | 2013-060 |
| United States Of America | Issued Patent | 9,678,032 | 06/13/2017 | 2013-060 |

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## OTHER INFORMATION

**CATEGORIZED AS**

- **Sensors & Instrumentation**
  - Analytical
  - Environmental Sensors

**RELATED CASES**

2013-060-0

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