Analysis of Poisoned Food by Capillary Electrophoresis

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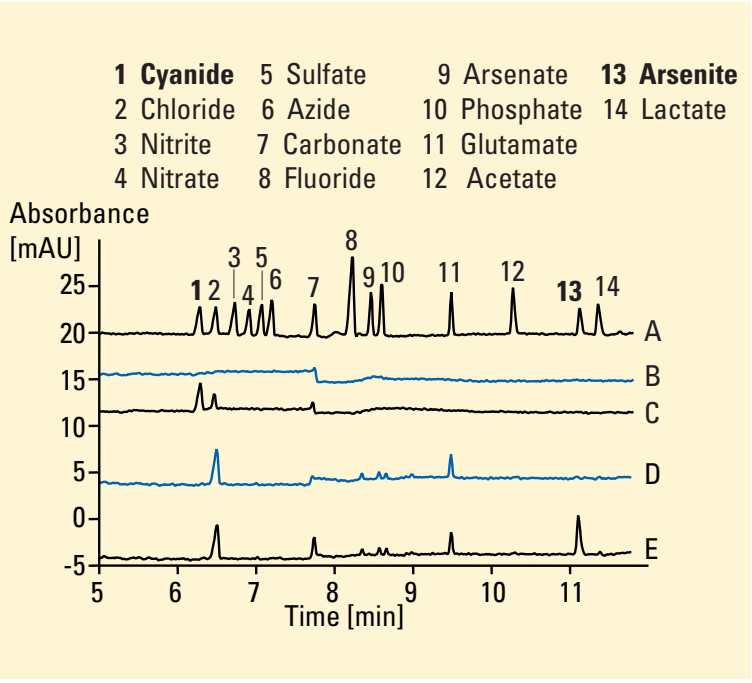
Food

Abstract

In cases of poisoning, analytical tools are needed to determine the identity of the toxins quickly and accurately. This enables healthcare professionals to administer appropriate treatment as quickly as possible and helps police to find those responsible. A rapid determination of anionic toxins in adulterated foods and beverages is possible using capillary electrophoresis (CE) with indirect UV detection. Cyanide, arsenite, arsenate, selenate, azide and other anions can be detected within 15 minutes, requiring only minimal sample preparation.



Conditions

Injection
6 s @ 50 mbar

Capillary
fused silica capillary
total length 112.5 cm
effective length 104 cm
internal diameter 50 µm

Buffer
Agilent Basic Anion Buffer

Voltage
-30 kV

Temperature
30 °C

Detection
signal 350/20 nm
reference 275/10 nm

Figure 1
Analysis of cyanide and arsenite in food.
A = anion standard (50 ppm each), B= Oolong tea (1:100 diluted with H_2O), C= Oolong tea as in B, spiked with 100 ppm NaCN, D=curry (1:100 diluted with H_2O, filtered through 0.22 µm filter), E=curry as in D, spiked with 100 ppm $NaAsO_2$

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Experimental

Anion analysis was performed using the Agilent Capillary Electrophoresis system equipped with diode-array detection and computer control via Agilent ChemStation. The analysis is based on the Agilent Forensic Anion Analysis Kit (part number 5064-8208).

Prior to first use, a new capillary was flushed with run buffer for 15 minutes (at 1 bar). Between the analyses the capillary was flushed 2 minutes from the OutHome vial into waste, then 2 minutes from the InHome vial into waste. This procedure avoids baseline fluctuations as a result of buffer depletion. Buffer vials were replaced after 10 runs when using 2 ml vials, after 5 runs, when using 1 ml vials.
Sample preparation consisted simply of dilution with water, or dilution and additional filtration through a 0.22 µm filter, as indicated in figure 1.

Results

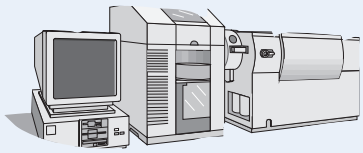
Figure 1 shows the analysis of food spiked with cyanide and arsenite. Depending on the results of this quick analysis, the sample can then undergo a more detailed analysis.

The assay was linear over the range 10–100 ppm with $r^2 > 0.999$. The method detection limit was 5–10 ppm. For the analysis of curry, the repeatability for arsenite (n = 6) was 0.06 % RSD for migration time and 2.7 % RSD for peak area. For cyanide in Oolong tea the respective values were 0.13 % RSD for migration time (n = 10) and 4 % for peak area (sample diluted in 0.01 N NaOH).

Other toxic anions that can be determined are arsenate, azide and selenate (which migrates between azide and carbonate). Compared to ion chromatography (IC), the advantages of CE for this type of analysis are the shorter analysis time and the minimal sample preparation needed for samples with a complex matrix (e.g. curry). Additionally, the analysis of azide and arsenate together with cyanide and arsenite is not possible in one run with IC.

Equipment

- Agilent Capillary Electrophoresis system
- Agilent ChemStation
- Agilent Forensic Anion Analysis Kit



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