MILLENNIUM APPLICATION BRIEF

TOPIC: Capillary Ion Analysis (CIA) of anions in explosive residues

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Introduction:

Analysis of anionic contaminants in explosives before and after blasting was done to evaluate the ability to fingerprint or ID vaious anions from blast residues. This preliminary report shows some examples of the CIA's ability to analyze these water extracts. A sample of black powder from an envelope was analyzed (figure 2) as well as a water extract of a sample of flash powder before (figure 3) and after (figure 4) detonation. Samples were prepared by soaking the samples in a small volume of water for approximately 2 hours and then filtering. A standard of the expected anions is shown in figure 1.

EXPERIMENTAL:

Anion Analysis

System:	Q4000E
Electrolyte:	Chromate/OFM
Capillary:	75um X 60cm
Injection:	Hydrostatic, 30 seconds
Run Voltage:	-20kV
Detection:	Indirect UV at 254nm
Data:	Millennium 2010 Chromatography Manager, Ver. 2.0 with CIA Template

FIGURES:

Figure 1: Electropherogram of standard
Figure 2: Electropherogram of black powder sample from an envelope
Figure 3: Electropherogram of flash powder
Figure 4: Electropherogram of residue of flash powder after detonation

Millennium Results Report: Exp_FPBlasted Proc Chan: SATIN Page 1

For Sample: Flash Powder-Bl Vial: 8 Inj: 1 Chan: SATIN Date Processed 11/11/94 04:53:01 PM

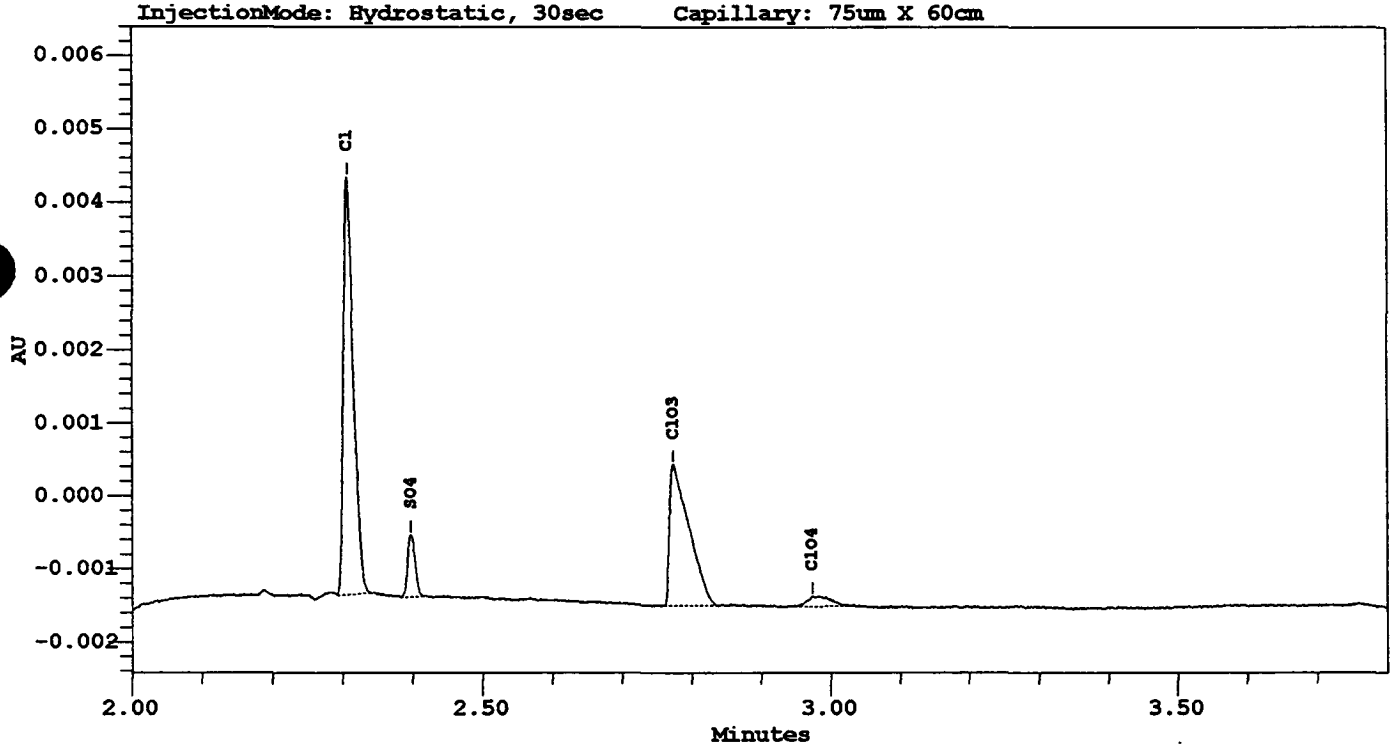
Channel Descr: Indirect UV

Northern Kentucky Laboratory

Sample Information

Project Name:	CIA_ExpResidues		
SampleName:	Flash Powder-Blasted(0.2-10mL)		
Vial:	8	Sample Type:	Unknown
Injection:	1	Volume:	30.00
Channel:	SATIN	Run Time:	4.5 min
Date Acquired:	11/11/94 04:10:49 PM	Date Processed:	11/11/94 04:53:01 PM
Scale Factor:	1.00	Dilution:	1.00000
Acq Meth Set:	CIA_Default		
Processing Method:	Residues01		

SampleName: Flash Powder-Blasted(0.2-10mL) Electrolyte: 4.0 mM Chromate/0.3 mM OFM
RunVoltage: -20kV Detection: Indirect 254nm, 0.1 TC
InjectionMode: Hydrostatic, 30sec Capillary: 75um X 60cm



Peak Results

#	Name	Migration Time (min)	Area (uV*sec)	Height (uV)
1	Cl	2.306	5605	5695
2	SO4	2.398	633	874
3	ClO3	2.773	3699	1935
4	ClO4	2.973	310	134

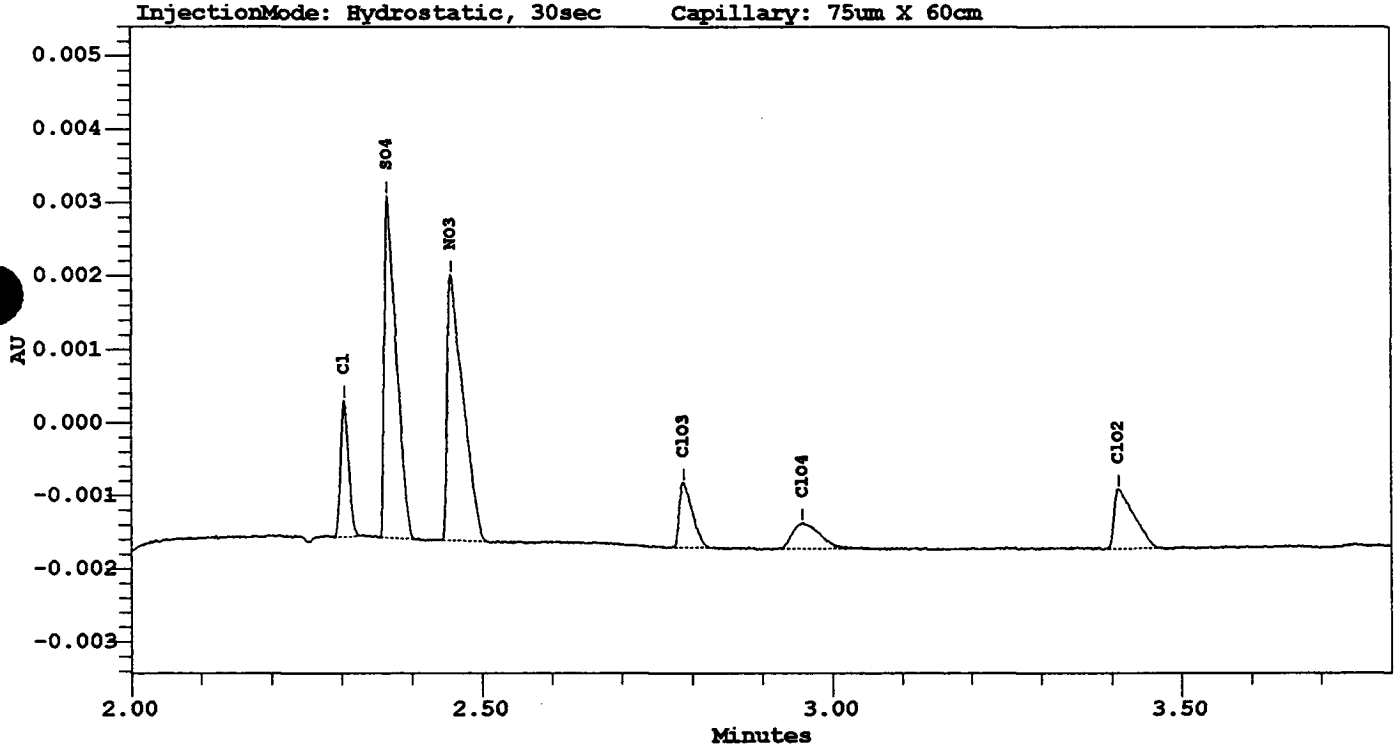
fig. 4

Millennium Results Report: Exp_Residues Proc Chan: SATIN Page 1
For Sample: ClOx,Cl,NO3,SO4 Vial: 9 Inj: 1 Chan: SATIN Date Processed 11/11/94 04:51:39 PM
Channel Descr: Indirect UV

Northern Kentucky Laboratory
Sample Information

Project Name:	CIA_ExpResidues		
SampleName:	ClOx,Cl,NO3,SO4 Std		
Vial:	9	Sample Type:	Unknown
Injection:	1	Volume:	30.00
Channel:	SATIN	Run Time:	4.5 min
Date Acquired:	11/11/94 04:18:01 PM	Date Processed:	11/11/94 04:51:39 PM
Scale Factor:	1.00	Dilution:	1.00000
Acq Meth Set:	CIA_Default		
Processing Method:	Residues01		

SampleName: ClOx,Cl,NO3,SO4 Std Electrolyte: 4.0 mM Chromate/0.3 mM OFM
RunVoltage: -20kV Detection: Indirect 254nm, 0.1 TC
InjectionMode: Hydrostatic, 30sec Capillary: 75um X 60cm



Peak Results

#	Name	Migration Time (min)	Area (uV*sec)	Height (uV)
1	Cl	2.304	1495	1866
2	SO4	2.366	5480	4656
3	NO3	2.456	5658	3617
4	ClO3	2.787	1101	892
5	ClO4	2.957	902	346
6	ClO2	3.410	1574	819

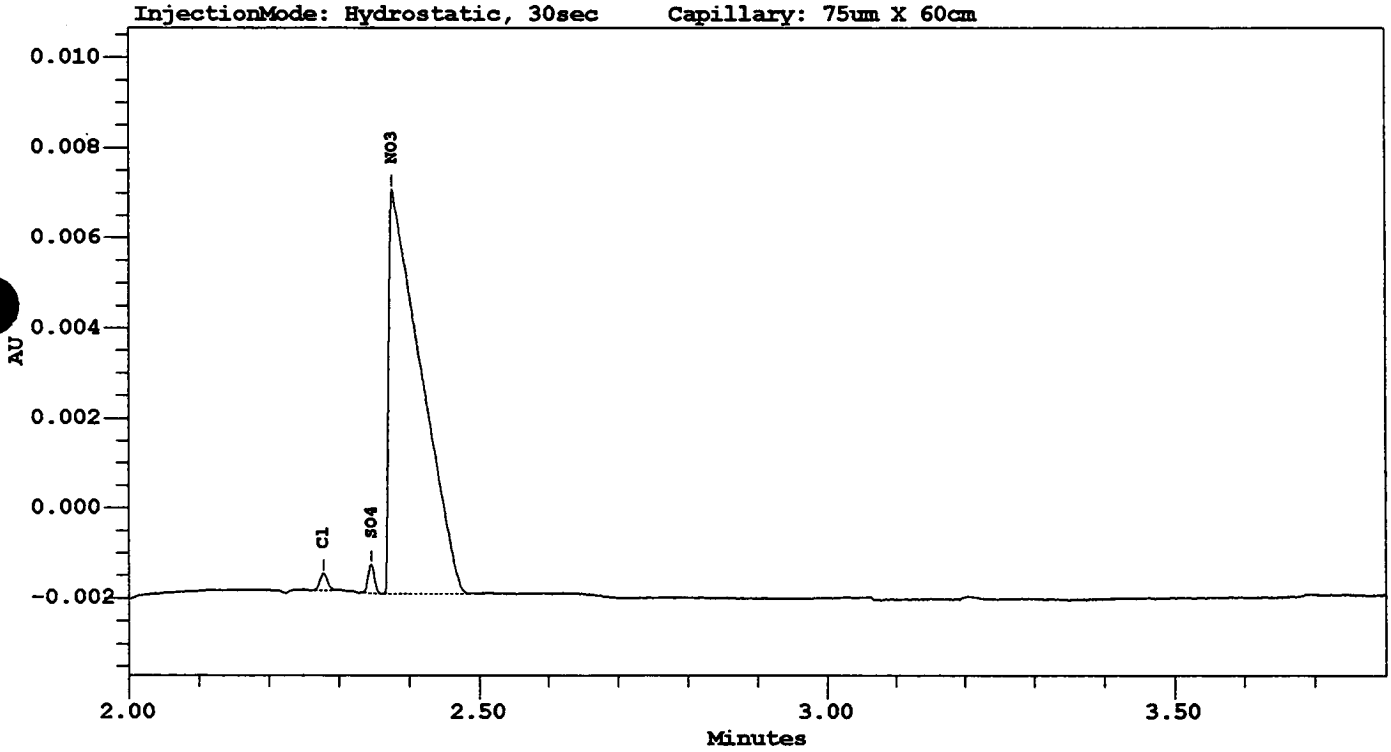
fig. 1

Millennium Results Report: Exp_BPowder Proc Chan: SATIN Page 1
For Sample: Black Powder Vial: 5 Inj: 1 Chan: SATIN Date Processed 11/14/94 12:13:23 PM
Channel Descr: Indirect UV

Northern Kentucky Laboratory
Sample Information

Project Name:	CIA_ExpResidues		
SampleName:	Black Powder		
Vial:	5	Sample Type:	Unknown
Injection:	1	Volume:	30.00
Channel:	SATIN	Run Time:	4.5 min
Date Acquired:	11/11/94 03:46:36 PM	Date Processed:	11/14/94 12:13:23 PM
Scale Factor:	1.00	Dilution:	1.00000
Acq Meth Set:	CIA_Default		
Processing Method:	Residues01		

SampleName: Black Powder Electrolyte: 4.0 mM Chromate/0.3 mM OFM
RunVoltage: -20kV Detection: Indirect 254nm, 0.1 TC
InjectionMode: Hydrostatic, 30sec Capillary: 75um X 60cm



Peak Results

#	Name	Migration Time (min)	Area (uV*sec)	Height (uV)
1	Cl	2.277	283	379
2	SO4	2.347	382	635
3	NO3	2.376	28098	8990

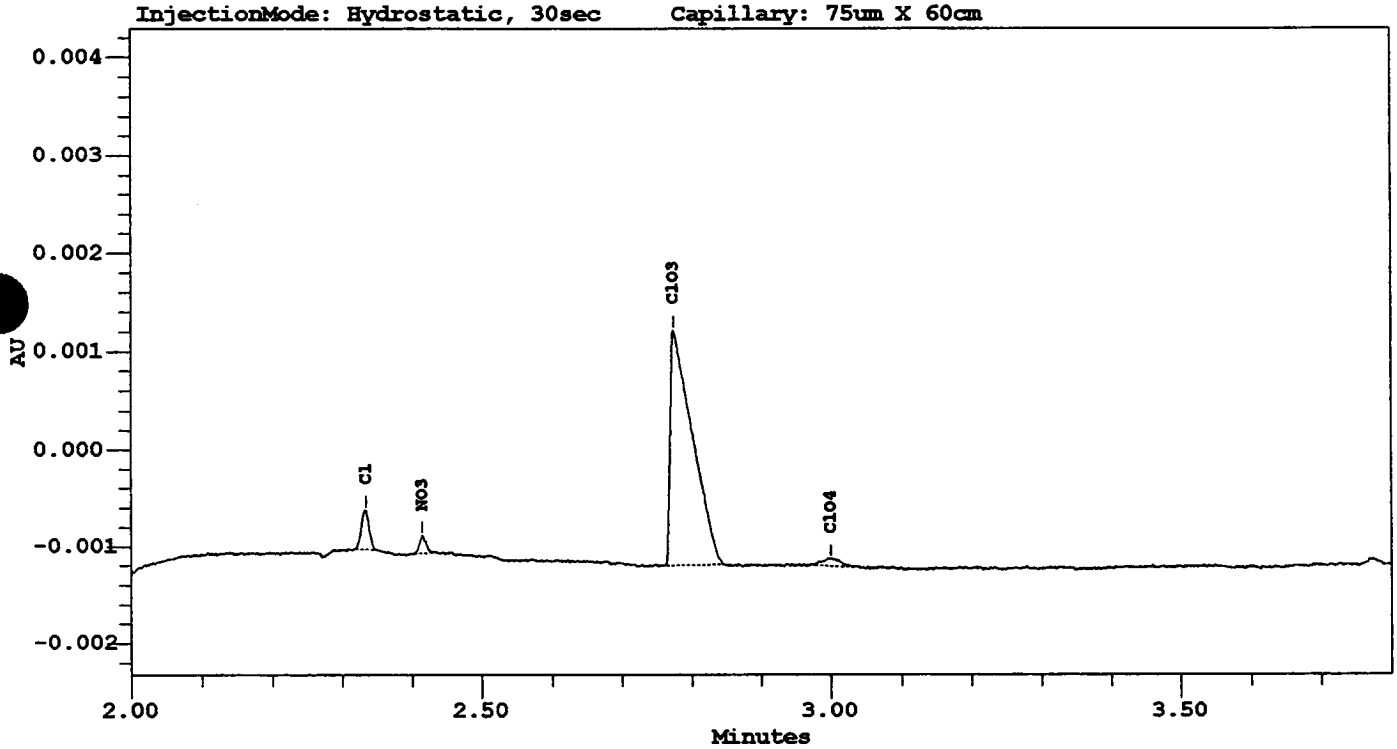
fig. 2

Millennium Results Report: Exp_FPowder Proc Chan: SATIN Page 1
For Sample: Flash Powder Vial: 7 Inj: 1 Chan: SATIN Date Processed 11/11/94 04:54:14 PM
Channel Descr: Indirect UV

Northern Kentucky Laboratory
Sample Information

Project Name:	CIA_ExpResidues		
SampleName:	Flash Powder		
Vial:	7	Sample Type:	Unknown
Injection:	1	Volume:	30.00
Channel:	SATIN	Run Time:	4.5 min
Date Acquired:	11/11/94 04:03:38 PM	Date Processed:	11/11/94 04:54:14 PM
Scale Factor:	1.00	Dilution:	1.00000
Acq Meth Set:	CIA_Default		
Processing Method:	Residues01		

SampleName: Flash Powder Electrolyte: 4.0 mM Chromate/0.3 mM OFM
RunVoltage: -20kV Detection: Indirect 254nm, 0.1 TC
InjectionMode: Hydrostatic, 30sec Capillary: 75um X 60cm



Peak Results

#	Name	Migration Time (min)	Area (uV*sec)	Height (uV)
1	Cl	2.334	321	410
2	NO3	2.415	113	183
3	ClO3	2.774	5360	2417
4	ClO4	3.000	128	77

fig. 3