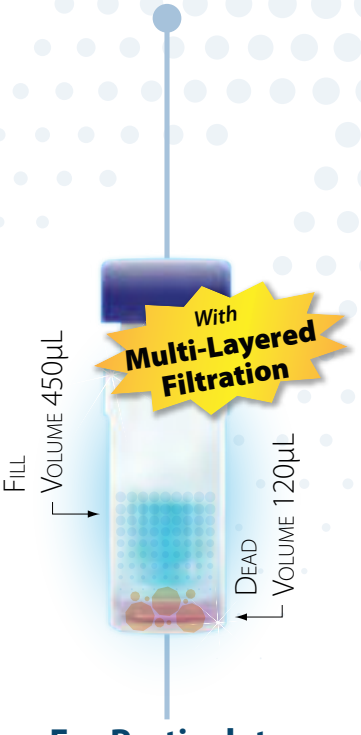
eXtreme|FV®

Patented



For Particulate Laden Samples

eXtreme|FV *(Multi-Layered Filtration)*

Thomson eXtreme|FV® *(patented)* offer multi-layer filtration for viscous samples and samples containing up to 30% solid particulates. The filter vial consists of two parts: a filter vial shell and a plunger which includes a multi-layer filter on one end and a vial cap on the other end.

eXtreme|FV® allow for compounds to be separated from the matrix which, results in both a higher signal to noise ratio and peaks that are more differentiated.

Prior to the introduction of the eXtreme|FV®, many samples containing high levels of particulates were "filtered" by using an SPE step in the method. These methods are readily amendable to the replacement of the SPE step using a rapid and lower cost eXtreme|FV® step.

Applications for Thomson eXtreme|FV® include filtration of cell and cell debris from cell culture; pesticide analysis in food, tissue, soil, and water; and toxicology analysis in blood and urine.

eXtreme|FV *(Pre-Slit Cap)*

.2µM PTFE Part No. 85530	.45µM PTFE Part No. 85540
.2µM PVDF Part No. 85531	.45µM PVDF Part No. 85541
.2µM NYLON Part No. 85538	.45µM NYLON Part No. 85539
.2µM PES Part No. 85535	.45µM PES Part No. 85545

All Styles Available in Quantities of 200 or 500

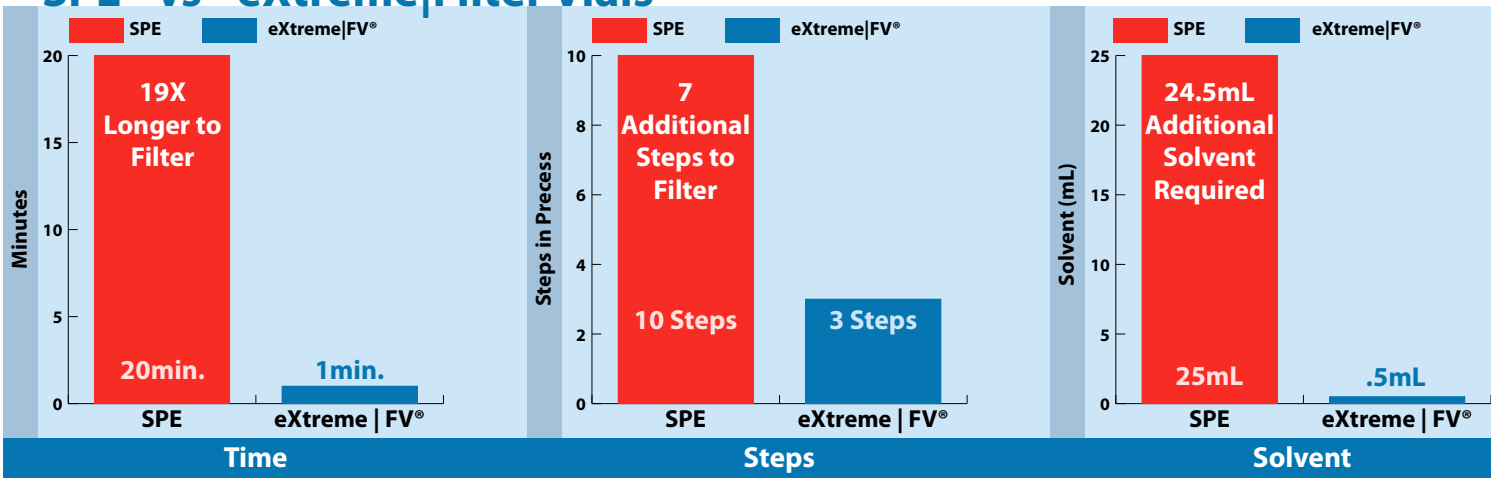
Improved Sample Preparation Methods for Athlete Doping Analysis of Common Compounds in Urine by LCMS

Australian Government
Department of Industry

WORLD ANTI-DOPING AGENCY

Authors : Dr. Catrin Goebel[2], Lisa Wanders[1], Sam Ellis[1]
Thomson Instrument Company[1]
Australian Sports Drug Testing Laboratory in the National Measurement Institute Department of Industry[2]
For reprints contact folks@htslabs.com

SPE -vs- eXtreme|Filter Vials®



Abstract

Anti-doping testing by urine analysis requires fast and robust screening methods with repeatable sample preparation. Since, every sample has to be screened, methods are designed to be sufficiently sensitive and specific to identify all suspect samples. One must be careful to minimize false suspects. Ensuring samples are spiked with internal standards accordingly will help verify that samples are being extracted and tested correctly and with accurate uniformity.

The Australian Sports Drug Testing Laboratory, our collaborators, have invested time in determining a limited number of comprehensive screening methods. These methods, using Thomson's eXtreme Filter Vials (patented), comply with the World Anti-Doping Agency's (WADA) Prohibited List.

In exploring new methods labs have looked at both detection and sample prep as routes to quicker and more accurate analysis. Liquid chromatography coupled with mass spectrometry detection is prevalent, superseding many of the gas chromatographic coupled with mass spectrometry methods because of the simpler sample preparation. Specifically, the anti-doping testing

shown below consisted of sample preparation without the initial use of cumbersome traditional SPE methods, and instead consisted of the comparison of filtration techniques. Filter plates versus Thomson eXtreme Filter Vials (patented) were tested to determine which product allowed for a method of simple and quick urine analysis while complying with the WADA's guidelines.

Experiment

The experiments were performed at the National Measurement Institute (Australia) in the Sports Drug Testing Laboratory.

The 11.8 minute run time for the instrumental analysis meets the requirements of the WADA Technical Document- Minimum Required Performance Level (TD2013MRPL). This document details the analysis of a large number of analytes from the classes on the WADA Prohibited List, while meeting sensitivity requirements. The analytes included compounds in the following classes anabolic agents, B2-agonists, hormone antagonists and modulators, diuretics, stimulants, narcotics, glucocorticoids, B-blockers, etc.

Full Method:

A comparison between sample preparation using filter plates sourced from several different manufactures, and Thomson eXtreme Filter Vials (patented) PVDF 0.2µm (85531-500) was conducted. The preparation with the Thomson eXtreme Filter Vials were automated using a Tecan robotics platform for liquid dispensing in the Thomson 48 position rack (#35010-RACK), and 48 position press (#35010).

Direct Urine Preparation:

1. Label each eXtreme Filter Vial with sample/quality control sample information.
2. Pipette 200 µL of each sample into labeled eXtreme Filter Vial.
3. Add 200 µL of the Mefruside Internal Standard (300 ng/mL in 0.5% formic acid) to each filter vial cup.
4. Place the eXtreme Filter Vial tops onto each vial and press shut.

LCHRMS System:

UPLC coupled to High Resolution Mass Spectrometry with an electrospray source in full scan mode. Data acquisition in both positive and negative polarity modes within a single 11.8 min chromatographic run.

Column: C18, 2.1mm × 50mm, 1.7µm
Column Temperature: 30 °C
Flow rate: 300µL/min

Mobile Phase:

A: 0.3% aqueous Formic Acid in Water
B: 0.3% Formic Acid in Acetonitrile

Gradient:

Time	A%	B%
0.00	95	5
0.50	95	5
3.50	80	20
5.50	75	25
7.00	43	57
8.00	10	90
8.60	10	90
8.80	95	5

Injection volume: 10µL
Sample tray temperature: 18°C
Column Temperature: 30°C
Method run time: 11.8 minutes
Gas: UHP Nitrogen

Conclusions

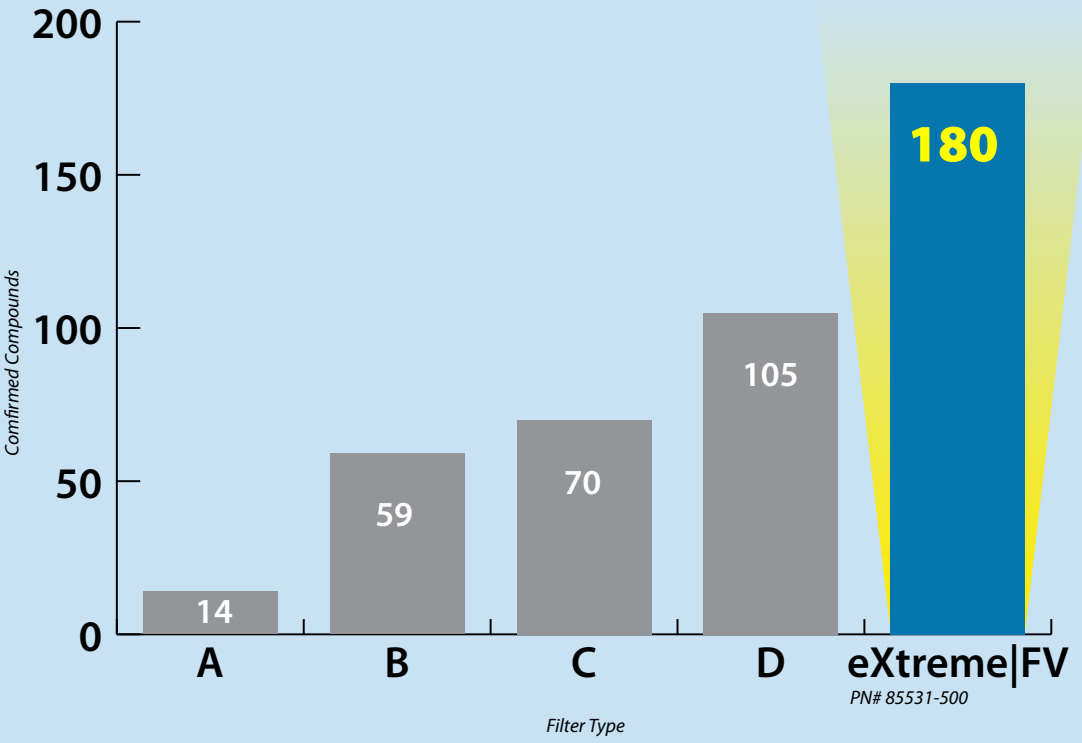
The Thomson eXtreme Filter Vials (patented) PVDF 0.2µm (85531-500) performed the best in compound extraction and identification while allowing the end user to follow the WADA validated method. The elimination of SPE steps from laboratory methods is a large time saver, and enables urine-direct-injection solely using Thomson eXtreme Filter Vials for filtration. Together the Thomson 48 position Filter Vial Press and automation enabled 48 position rack equaled timing of filter plate methodology but provided the best extraction and identification of all filter types. A total of 180 compounds can be identified through the screening analysis with the Thomson eXtreme Filter Vials (patented) PVDF 0.2µm (85531-500).

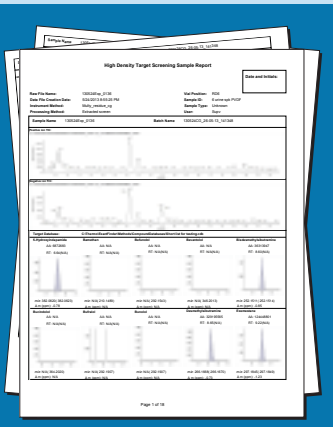
The method presented is being used for the analysis of athlete's urine samples for banned substances at the Australian Sports Drug Testing Laboratory.

Acknowledgments

We would like to thank Dr. Catrin Goebel, Director, of Australian Sports Drug Testing Laboratory in the National Measurement Institute, Department of Industry (a WADA accredited laboratory in Australia) for her extensive testing. Dr. Goebel is also an Executive member of World Association of Anti-Doping Scientist.

Comparison of Filter Types

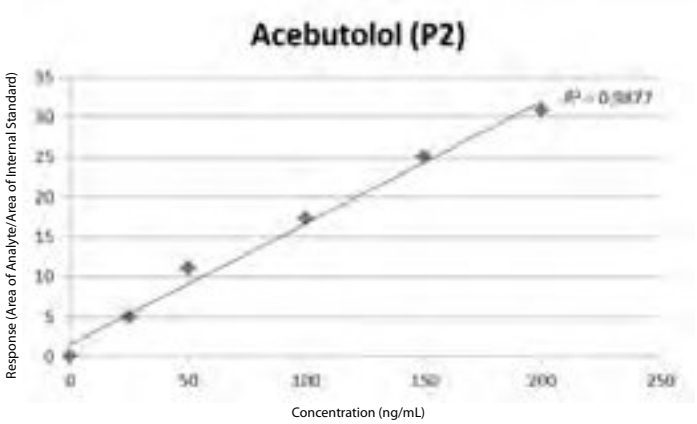


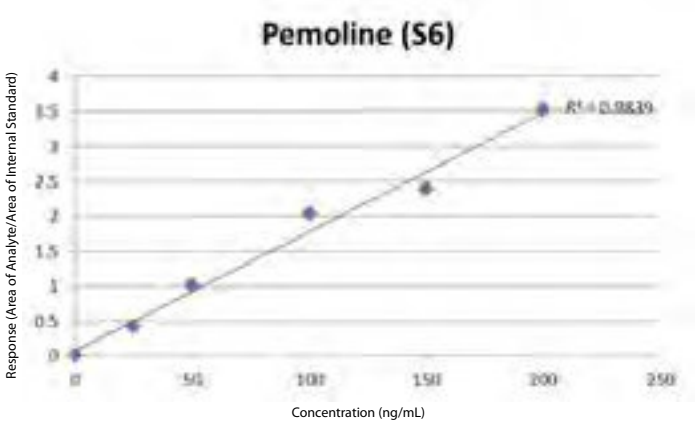


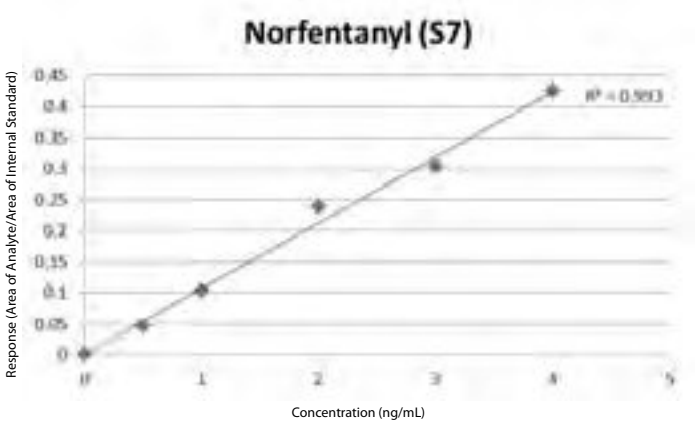
To View All Chromatograms
Visit http://bit.ly/wada-data

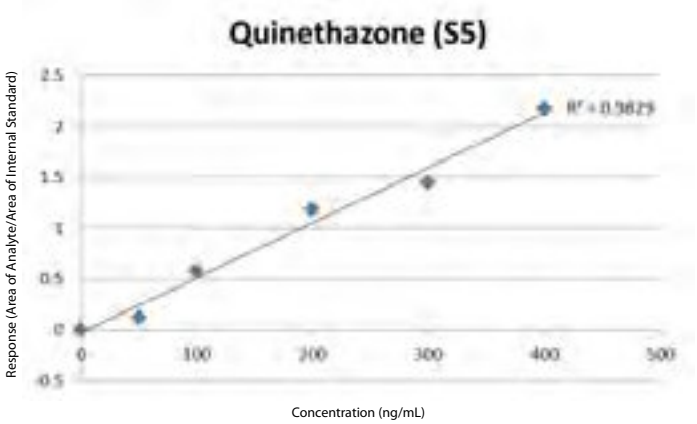
THOMSON

Linearity of The Analysis Method Was Assessed Over a Range From 25% To 200% Of MRPL With R2 Generally Being Greater Than 0.98









Time is Equal

With automation our customers are utilizing Filter Vials at the same speed filter plates were used in the past.

Confirmed Compounds *(180)*

Sample Name 130524Exp_0136 **Batch Name** 130524CG_26-05-13_141348

Raw File 130524Exp_0136

Compound Name	Found
State	
5-Hydroxyindapamide	Confirmed
Bisdesmethylsibutramine	Confirmed
Desmethylsibutramine	Confirmed
Exemestane	Confirmed
ISD.01 Mefruside (+)	Confirmed
ISD.02 Mefruside (-)	Confirmed
ISD.03 D3-epitestosterone glucuronide	Confirmed
ISD.04 D3-epitestosteronea	Confirmed
M1.03 AICAR	Confirmed
M1.04 GW1516	Confirmed
P2.03 Atenolol	Confirmed
P2.05 Bisoprolol	Confirmed
P2.12 Esmolol	Confirmed
P2.14 Metipranolol	Confirmed
P2.16 Nadolol	Confirmed
P2.17 Nadoxolol	Confirmed
P2.18 Oxprenolol	Confirmed
S1.00 Clenbuterol	Confirmed
S1.00 Gestrinone	Confirmed
S1.00 Methyldienolone	Confirmed
S1.00 Methyltrienolone	Confirmed
S1.00 Metribolone	Confirmed
S1.00 Tetrahydrogestrinone	Confirmed
S1.00 Tibolone	Confirmed
S1.00 Zilpaterol	Confirmed
S1.01 3'-Hydroxystanozolol	Confirmed
S1.02 4'-Hydroxystanozolol	Confirmed
S3.01 Bambuterol	Confirmed
S3.03 Formoterol	Confirmed
S3.04 Salbutamol	Confirmed
S3.05 Salmeterol	Confirmed
S3.06 Terbutaline	Confirmed
S4.00 Andarine	Confirmed
S4.1.00 Exemestane metabolite	Confirmed
S4.1.01 Aminoglutethimide	Confirmed
S4.2.00 Raloxifene	Confirmed
S4.3.00 Fulvestrant	Confirmed
S4.5.00 GW1516 (501516)	Confirmed
S5.00 Methazolamide	Confirmed
S5.00 Piretanide	Confirmed
S5.00 Quinethazone	Confirmed
S5.00 Spironolactone	Confirmed
s5.00 Trichlormethiazide	Confirmed
S5.01 Acetazolamide	Confirmed
S5.02 Althiazide	Confirmed
S5.02 Amiloride	Confirmed
S5.03 Bendroflumethiazide	Confirmed
S5.03 Benzthiazide	Confirmed
S5.04 Bumetanide	Confirmed
S5.05 Canrenone	Confirmed
S5.06 Chlorexolone	Confirmed
S5.07 Chlorothiazide	Confirmed
S5.08 Chlorthalidone	Confirmed
S5.09 Clopamide	Confirmed
S5.1.01 Probenecid	Confirmed
S5.10 Cyclopenthiazide	Confirmed
S5.11 Cyclothiazide	Confirmed
S5.12 Dichlorphenamide	Confirmed
S5.13 Epitizide	Confirmed
S5.14 Eplenerone	Confirmed
S5.15 Etacrynic acid (frag?)	Confirmed
S5.16 Furosemide	Confirmed
S5.17 Hydrochlorothiazide	Confirmed
S5.20 Mefruside metabolite 2	Confirmed
S5.21 Indapamide	Confirmed
S5.22 Metolazone	Confirmed
S5.23 Polythiazide	Confirmed
S5.24 Torasemide	Confirmed
S5.25 Triamterene	Confirmed
S5.26 Xipamide	Confirmed
S6.00 Caffeine	Confirmed
S6.00 Cis-4-Methylaminorex	Confirmed
S6.00 Cotinine (Nicotine metab)	Confirmed
S6.00 MBDB	Confirmed
S6.00 Methoxyamphetamine	Confirmed
S6.00 Methylenedioxyethylamphetamine	Confirmed
S6.01 Adrafinil	Confirmed
S6.03 Amiphenazole	Confirmed
S6.04 Amphetamine	Confirmed
S6.07 Benzoylecgonine	Confirmed
S6.09 Benzylpiperazine	Confirmed
S6.10 Carphedon	Confirmed
S6.11 Cathine	Confirmed
S6.14 Crotethamide	Confirmed
S6.15 Cyclazodone	Confirmed
S6.17 Ephedrine	Confirmed
S6.17 Phenylpropanolamine	Confirmed
S6.17 Pseudoepherine	Confirmed
S6.18 Etamivan	Confirmed
S6.20 Etilefrine	Confirmed
S6.25Fenetylline	Confirmed
S6.30 Hydroxy mesocarb	Confirmed
S6.32 Isometheptene	Confirmed
S6.33 Methylenedioxyamphetamine (MDA)	Confirmed
S6.34 Methylenedioxymethylamphetamine(MDMA)	Confirmed
S6.43 Methylphenidate	Confirmed
S6.44 Modafinil	Confirmed
S6.45 Modafinil Acid (metabolite)	Confirmed
S6.46 Nikethamide	Confirmed
S6.49 Oxilofrine	Confirmed
S6.50 Pemoline	Confirmed
S6.51 Pentetrazol	Confirmed
S6.53 Phenmetrazine	Confirmed
S6.56 Pholedrine	Confirmed
S6.57 p-Hydroxy amphetamine	Confirmed
S6.62 Ritalinic Acid	Confirmed
S6.64 nor-Selegiline	Confirmed
S7.00 Methylecgonine	Confirmed
S7.03 Codeine	Confirmed
S7.06 Hydromorphone	Confirmed
S7.08 Morphine	Confirmed
S8.04 JWH018 N-(5-hydroxypentyl) metabolite	Confirmed
S8.05 JWH073 N-butanoic acid metabolite	Confirmed
S9.03 Budesonide	Confirmed
S9.05 Cortisol	Confirmed
S9.06 Cortisone	Confirmed
S9.12 Flumethasone	Confirmed
S9.16 Fluticasone propionate metabolite	Confirmed
S9.17 Methylprednisolone	Confirmed
S9.18 16a-OH-Prednisolone	Confirmed
S9.18 Prednisolone	Confirmed
Sildenafil	Confirmed
Tadalafil	Confirmed
Vardenafil	Confirmed

Vegetation & Soil Application

1. Samples are extracted using 20g of homogeneous, ground sample
2. Sample clean-up was achieved using Thomson eXtreme Filter Vials (PTFE .2µm & PVDF .2µm)

The following compounds were seen in both soil and vegetation:

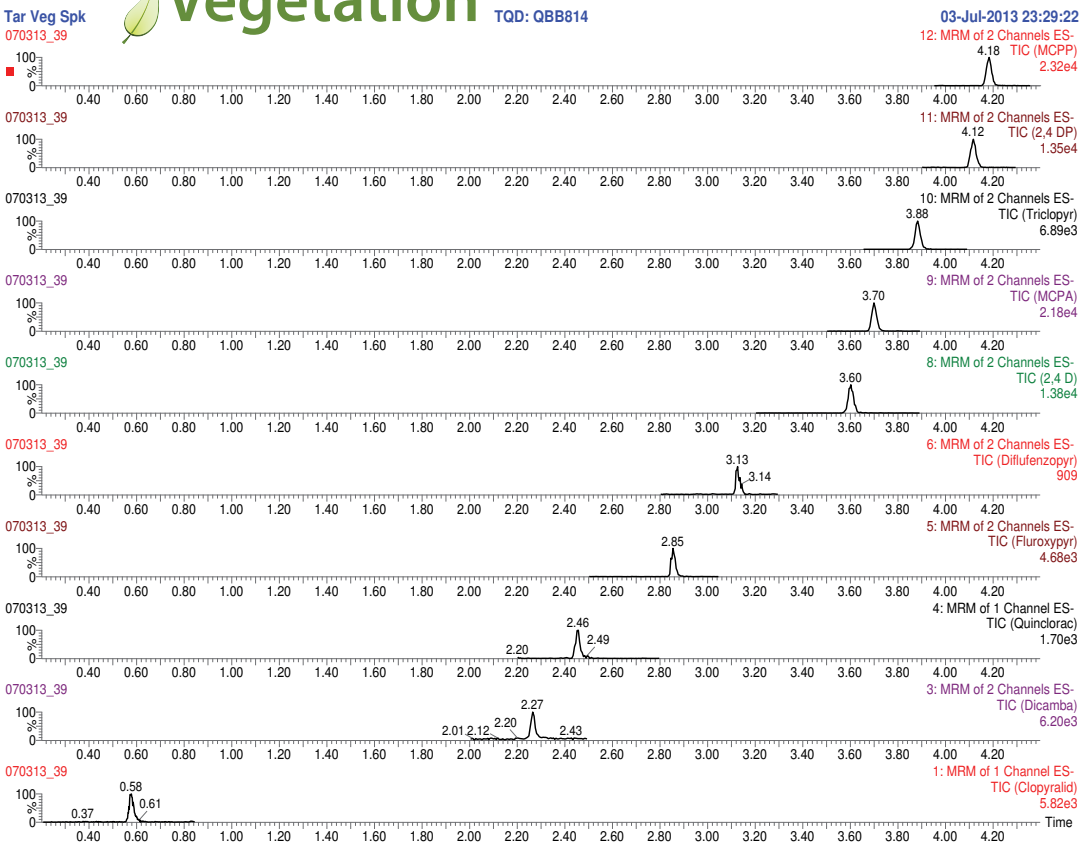
MCPP	Quinclorac
Clopyralid	Fluroxypyr
Aminopyralid	MCPA
Picloram	Diflufenzopyr
Dicamba	

System:	UPLC ®/MS/MS®
HPLC Column:	Zorbax Rx C8, 150 x 2.1 mm id
HPLC Guard Column:	Agilent Eclipse XDB-C8, 2.1 x 12.5mm, 5 micron
Column Temperature:	35°C
Autosampler Temperature:	15°C
Injection Volume:	10µl
Run Time:	8 min
Solvent A :	0.15% Glacial Acid in Water
Solvent B:	0.15% Glacial Acid in ACN

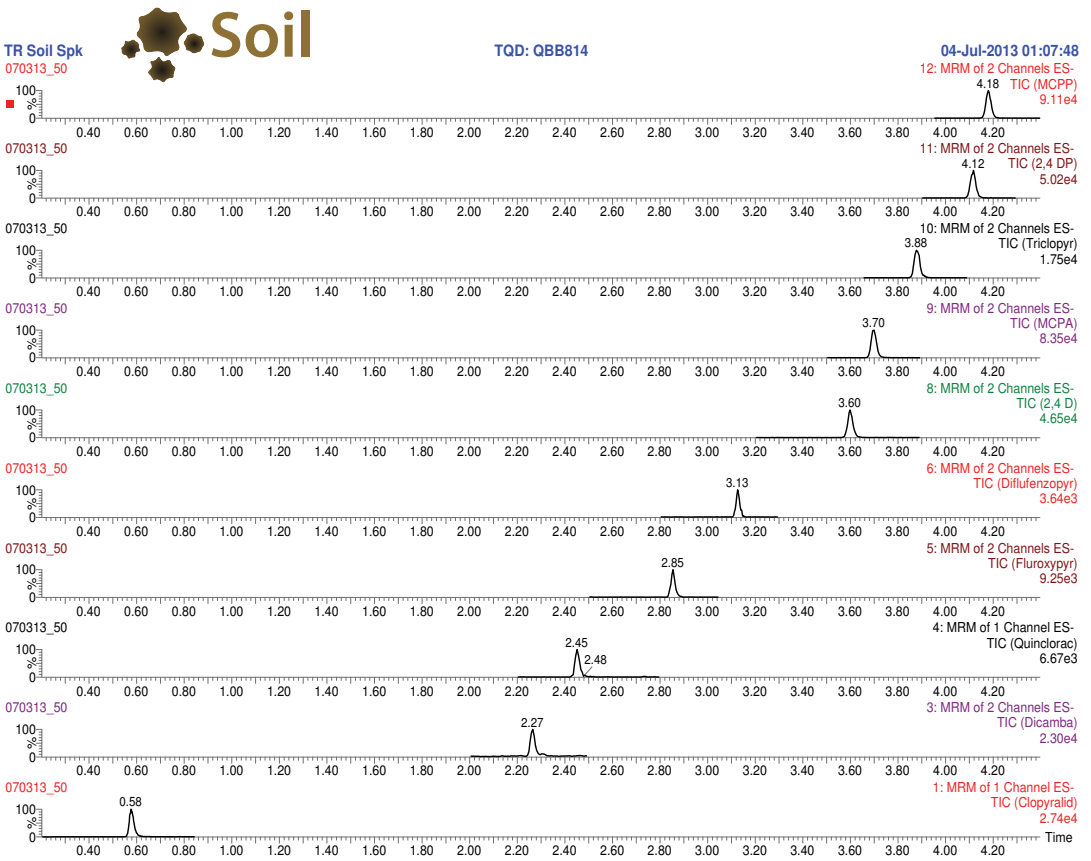
Gradient:

Time (min)	Flow Rate (ml/min)	%A	%B
Initial	0.8	95	5
1	0.8	95	5
2	0.8	80	20
3	0.8	70	30
4	0.8	60	40
5	0.8	50	50
5.5	0.8	5	95
6.5	0.8	5	95
7	0.8	95	5

Vegetation



Soil



eXtreme Filter Vials® vs SPE for the analysis of Pesticides in Orange Juice

MICRO QUALITY LABS INC.

Authors: Uday Sathe[1], Karine Aylozyan[1], Lisa Wanders[2], Joe Machamer[2], and Sam Ellis[2]
Micro Quality Labs[1]
Thomson Instrument Company[2]
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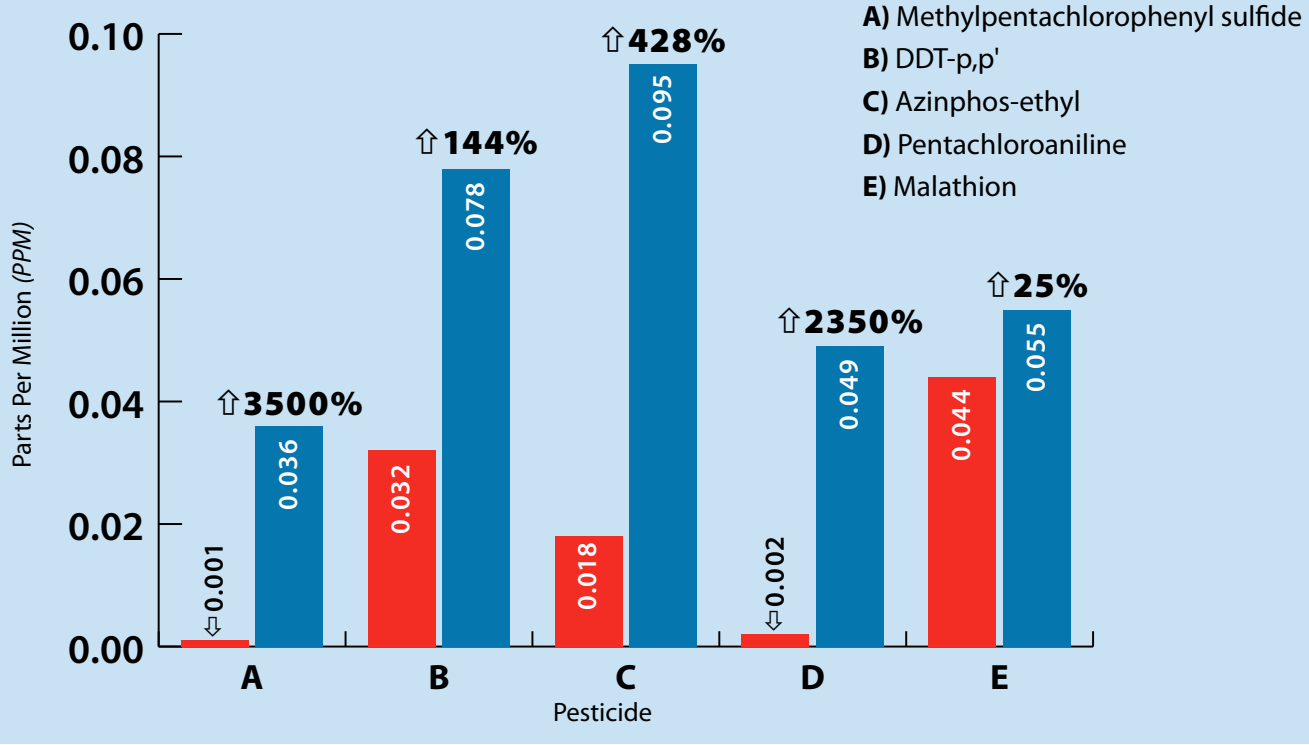
Comparison of Pesticide Recoveries



Abstract

Pesticides act as toxins when found in sufficient quantities as residues in food. This is of particular importance for orange juice because it is consumed in high quantities by children. Sensitive, rapid, and cost effective analytical methods are required in order to reduce the risk to consumers.

Solid Phase Extraction *(SPE)* is a common sample preparation technique used prior to GC or LC analysis of pesticides in food. Typically, SPE is used to concentrate analytes, reduce interference from co-eluting molecules or to clean up/"filter" sample particulates. Drawbacks to the use of SPE include cost, sample preparation time, large sample volumes, use and disposal of organic solvents, and potentially poor recoveries. The continuing development of higher sensitivity instrumentation and improved filtration devices has led many labs to investigate whether methods can be adapted to eliminate the SPE step.

Thomson eXtreme® Filter Vials offer multi-layer filtration for viscous samples and samples containing up to 30% solid particulates. Filtration time from unfiltered sample transfer to filtered sample in an autosampler ready vial is only 15 seconds. The filter vial consists of two parts: a filter vial shell and a plunger which includes the multi-layer filter on one end and a vial cap on the other end. Samples are filtered by pipetting the sample into the filter vial shell, inserting the plunger into the shell, and then pushing the plunger into the shell.

Prior to the introduction of the eXtreme Filter Vials, many samples containing high levels of particulates were only "filtered" by using an SPE step in the method. These methods are readily amendable to the replacement of the SPE step with a much faster and lower cost eXtreme Filter Vial step.

Experiment

Samples were prepared and analyzed at Micro Quality Labs, Burbank, CA.

Sample Preparation:

1.) Spike 10mL of commercially available High Pulp Orange Juice with 1mL of 1 ppm pesticide standard mix in a 40mL vial.
2.) Add one pack *(approximately 6g)* of Restek Extraction Salts *(Restek catalog #26236)* to the spiked orange juice.
3.) Extract the spiked orange juice with 4 x 25mL portions of methylene chloride.
4.) Concentrate to dryness using a Turbovap II concentrator.
5.) Dissolve the residue in approximately 10mL of acetonitrile.
6.) Vortex and sonicate the re-suspended residue with frequent swirling.
7.) Split the re-suspended residue into two 5mL portions.
8.) Dilute each 5mL portion with acetonitrile to 10mL using a volumetric flask.
9.) Label one flask "for SPE" and the other "for Thomson eXtreme Filter Vial".

SPE Cleanup Prior to Analysis - Restek 6mL Combo SPE Cartridge

1.) Wash one Restek 6mL Combo SPE Cartridge *(packed with 200mg CarboPrep 200 and 400mg PSA Restek catalog #26127)* with acetonitrile.
2.) Add the 10mL portion of the re-suspended residue from the flask labeled "for SPE" to the SPE cartridge.
3.) Elute the sample from the cartridge with 50mL of acetonitrile.
4.) Concentrate the eluted sample to 10mL using a Turbovap II concentrator.

Thomson eXtreme Filter Vial Cleanup Prior to Analysis

1.) Add 400µL of the re-suspended residue from the flask labeled "for Thomson eXtreme Filter Vial" to the shell of one Thomson eXtreme Filter Vial 0.45µm, PTFE *(Thomson Part Number 85540-500)*.
2.) Insert plunger completely.

Analysis

Samples were analyzed utilizing an Agilent Technologies® GC/MS, 7000 Triple Quad system equipped with a 7890A GC system and 7693 auto sampler.

Compound/SAMPLE NAME	SPE+ ROUTINE Syringe FILTER	ONLY EXTREME FV W/O SPE
Alachlor	0.043	0.053
Aldrin	0.025	0.032
Azinphos-ethyl	0.018	0.095
Azinphos-methyl	0.023	0.115
BHC-alpha (benzene hexachloride)	0.026	0.033
BHC-beta	0.054	0.073
BHC-delta	0.062	0.081
BHC-gamma (Lindane, gamma HCH)	0.032	0.043
Bromophos-ethyl	0.025	0.057
Bromopropylate	0.063	0.076
Carbophenothion	0.051	0.071
Chlordane-cis (alpha)	0.04	0.052
Chlordane-oxy	0.034	0.042
Chlordane-trans (gamma)	0.039	0.049
Chlorfenvinphos	0.061	0.071
Chlorpyrifos	0.035	0.047
Chlorpyrifos-methyl	0.035	0.046
Cyfluthrin I	0.082	0.113
Cyhalothrin (lambda)	0.076	0.091
Cypermethrin I (Zeta)	0.082	0.117
Cypermethrin II {CAS # 52315-07-8}	0.08	0.113
Cypermethrin III (Beta)	0.058	0.104
Cypermethrin IV {CAS # 52315-07-8}	0.07	0.097
DCPA (Dacthal, Chlorthal-dimethyl)	0.04	0.048
DDD-o,p'	0.052	0.06
DDD-p,p'	0.056	0.066
DDE-o,p'	0.043	0.039
DDE-p,p'	0.045	0.057
DDT-o,p'	0.035	0.065
DDT-p,p'	0.032	0.078
Deltamethrin	0.053	0.102
Diazinon	0.028	0.035
Dicofol	0.033	0.028
Dieldrin	0.041	0.052
Dimethoate	0.061	0.077
Endosulfan I (alpha isomer)	0.041	0.076
Endosulfan II (beta isomer)	0.053	0.065
Endosulfan sulfate	0.061	0.074
Endrin	0.045	0.058
Ethion	0.057	0.069
Etrimfos	0.03	0.038
Fenchlorphos oxon	0.047	0.061
Fenitrothion	0.041	0.053

Fenpropathrin	0.068	0.078
Fensulfothion	0.1	0.117
Fenthion	0.041	0.05
Fenthion sulfone	0.081	0.107
Fenthion sulfoxide	0.106	0.134
Fenvalerate I	0.076	0.106
Fenvalerate II {CAS # 51630-58-1}	0.055	0.073
Fluvalinate-tau I	0.078	0.082
Fluvalinate-tau II {CAS # 102851-06-9}	0.058	0.084
Fonofos	0.023	0.028
Heptachlor	0.022	0.029
Heptachlor endo-epoxide (isomer A)	0.039	0.048
Heptachlor exo-epoxide (isomer B)	0.037	0.045
Hexachlorobenzene	0	0.019
Malaoxon (metabolite of Malathion)	0.07	0.086
Malathion	0.044	0.055
Mecarbam	0.052	0.062
Methidathion	0.063	0.08
Methylpentachlorophenyl sulfide	0.001	0.036
Mirex	0.042	0.056
Octachlorodipropyl ether (S421)	0.021	0.047
Omethoate	0.052	0.061
Paraoxon	0.071	0.08
Parathion	0.039	0.049
Parathion-methyl	0.035	0.045
Pendimethalin	0.038	0.048
Pentachloroaniline	0.002	0.049
Pentachloroanisole	0.017	0.021
Permethrin I	0.068	0.097
Permethrin II (trans)	0.071	0.115
Phosalone	0.005	0.089
Phosmet	0.031	0.104
Piperonyl butoxide	0.117	0.105
Pirimiphos-ethyl	0.044	0.053
Pirimiphos-methyl	0.04	0.05
Procymidone	0.064	0.082
Profenofos	0.058	0.071
Prothiofos	0.033	0.06
Quinalphos	0.042	0.061
Quintozene	0.02	0.028
Ronnel (Fenchlorphos)	0.031	0.04
Tecnazene (TCNB)	0.011	0.014
Tetradifon	0.062	0.077
Vinclozolin	0.043	0.052

GCMS Data (links to PDF)

With Out Internal Spike

SPE w/ Filtration	| http://bit.ly/spe-spike
eXtreme|FV® 85540	| http://bit.ly/extreme-no-spike

With Internal Spike

USP 36 <561> with 0.1 PPM	| http://bit.ly/usp-spike
eXtreme|FV® with 0.1 PPM	| http://bit.ly/extreme-with-spike

Conclusions

The Thomson eXtreme 0.45µm, PTFE Filter Vials patented *(Thomson #85540-500)* yielded 26% higher recoveries on average when tested with 87 common pesticides. In the cases highlighted in the results table, greater than 428% recovery increases were seen. In the case of Hexachlorobenzene, no pesticide was detected in the sample prepared by SPE and 0.019 ppm was detected in the sample prepared with the eXtreme Filter Vial. The use of Thomson eXtreme 0.45µm, PTFE Filter Vials as a substitute for SPE conforms to USP Method 561.

The results show Thomson eXtreme Filter Vials offer a viable alternative with higher recovery and less preparation time compared to SPE for the preparation of juices prior to pesticide analysis.

SUPPLEMENT ANALYSIS OF HUPERZINE A BY HPLC

.45µm eXtreme|FV Nylon

Huperzine A Summary

1. Samples are extracted with 10mM HCl (aqueous)
2. Non-soluble plant parts or excipients are filtered out using a 0.45µm Nylon filter
3. Samples are injected onto the HPLC System

Figure I: Chromatogram of Huperzine A extracted from the Chinese Club Moss, Huperzia serrata

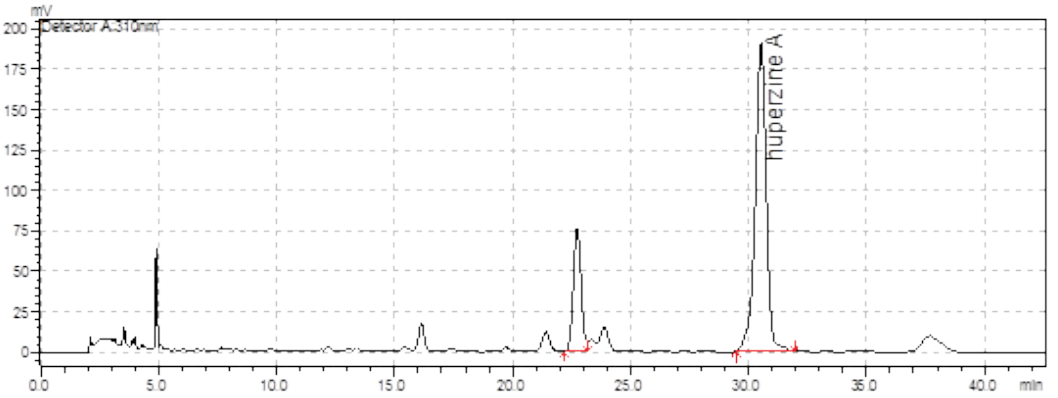
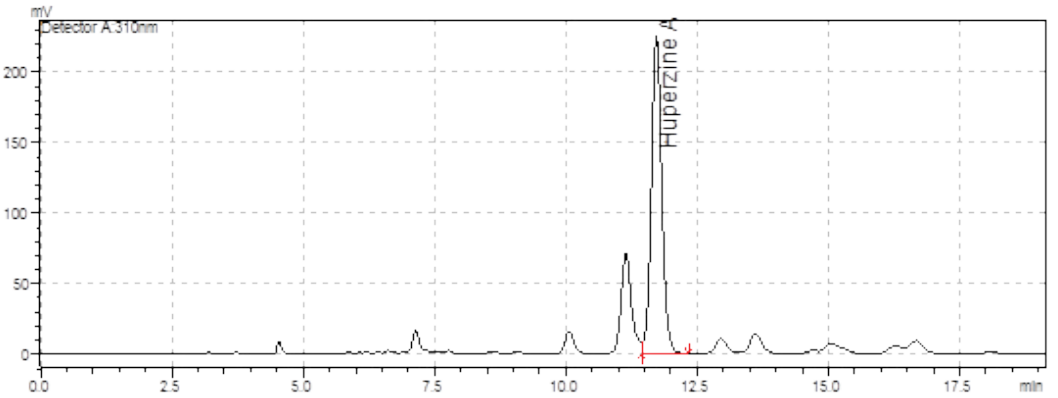
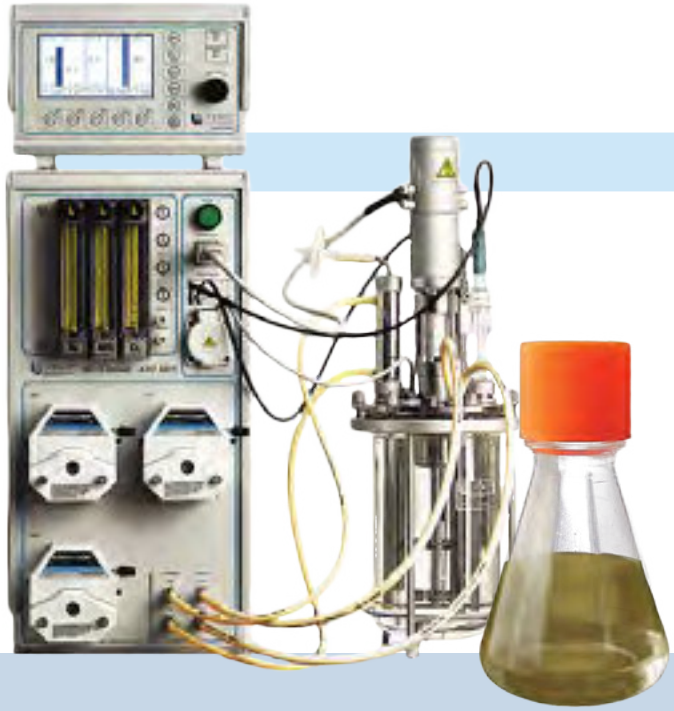


Figure II: Chromatogram of Huperzine A extracted from a Club Moss Powdered Extract



Antibody Analysis
with eXtreme|FV®



Use #85535-200 or 85535-500

HPLC Column and Method

Column
Poros® Protein A by Applied Biosystem® 2-1001-00 Column

Method
A Solvent: PBS pH 7.4
B Solvent: 150 milimolar Sodium Cloride pH 2.2
Isocratic 6 minute run on an Agilent® 1200

Filter Vials Allow

- Real Time Monitoring
- Quantify Antibodies
- Ideal For Timepoints
- Accurate On The Fly Adjustments
- Fits In Standard Autosampler

ANALYSIS OF NITROSAMINES IN TOBACCO

Prep:

1. 0.25g of unburned/smokeless tobacco sample
2. Extracted with 100mM ammonium acetate solution, filtered with eXtreme|FV® PVDF 0.45 µm

HPLC:

Injection Volume: 5µL
Column: Waters Xterra MS C18, 50x4.6mm, 5µm
Aqueous phase: 5mM ammonium acetate in HPLC water
Organic Phase: 5mM ammonium acetate in 95/5 acetonitrile/water blend.

Gradient:

Time [min]	Organic %
0	5
1	5
2	35
5	35
6	5
8	5

Flow rate: 1mL/min
Temperature: 60°C
Detection: MS/MS

Analyte	Ion pair Q1/Q3 (amu)	
NAB	192/162	N-Nitrosoanabasine
NAT	190/160	N-Nitrosoanatabine
NNK	208/122	N-Nitrosonornicotine
NNN	178/148	4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone
NNAL	210/180	4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol