Overview of Food Analysis by LC/MS/MS

Applied Biosystems | Applied Markets Division
Agenda

• Overview of the Analytical Challenge for Food Analysis
• Why use LC/MS/MS
• Overview of EU Regulation for LC/MS/MS
• Analysis of Pesticides
• Analysis of Antibiotics (Nitrofuran and Chloramphenicol)
• Analysis of Mycotoxins
• Introduction of Cliquip™ Software for Food Testing
The Analytical Challenge for Food Analysis

• Need to be able to deal with complex matrixes like meat, tissue and organs
• As with any method, well characterized sample preparation methods are required
  • in many cases the throughput demands simple, almost universal sample preparation techniques
• The detection system must exhibit both selectivity and high sensitivity
  • For many contaminants, low or zero tolerance of residues presents a challenge to detector response
• In many cases, simultaneous quantitation and confirmation of contaminants is desired
• Need to be able to screen for a wide range of contaminants in a single analysis to maximize throughput
• In general, methods must be robust, precise and accurate (and validated)
Why Use LC/MS/MS for Screening and Confirmation?

Spectrometry - LC/UV/FL, GC/MS, HPTLC
- Insensitive, non-specific
- Rigorous sample prep and derivatization often required
- Difficulty to analyze multiple analytes in a single run

Immunoassay - RIA, EIA (screening only)
- Not specific, issues with cross contamination, false positive
- Expensive and only available for a few compound classes
- No way to analyze multiple analytes in a single run

LC/MS/MS
- Highly selective, sensitive and accurate
- Reduced preparation
- No issue with false positives
- Provides both qualitative and quantitative analysis in a single run
- Meet all requirements for modern residue analysis
- Technique recommended by EU for specific analysis
The Farming Industry Today

Modern Farming

• Intensive, controlled, high density agriculture
• Widespread applications of drugs and pesticides
  • To cure or prevent diseases in plants & animals
  • To increase growth rates / yields
  • To minimize stress in the high density environment

Animals and Products Concerned (96/23/EC)
Why Every Country Needs Residue Analysis?

October 23, 2003, 30 Tons of Taiwan Exported Seafood Returned by EU Due to Banned Drug Residue Levels Tested Over EU Regulations

Taipei Newspaper Report: The returned shipments will impact all seafood exports of Taiwan. The Agriculture Department stated today it will increase the sampling and it immediately approved a budget about $2 million USD to purchase high-end instruments in line with EU standards.

The Taiwan aquacultural industry produces about 350,000 tons products worth about $100 million USD, in which exports are about 100,000 tons worth about $30 million USD. This incident will impact not only the credibility, but also the financial lose of Taiwan food export industry.

The testing of many banned antibiotics including nitrofurans and chloramphenical are mandated and the testing technique has high requirements. For nitrofurans, the EU LOD is 0.1 ppb, while the Taiwan authority can only detect about 1ppb, so the use of high-end instrument and advanced analytical technology are urgently needed.

Based on the EU statistics last year, the returned shipments were: Taiwan had 5; China had 147; Thailand had 143; and the US had 25 cases; some of these cases resulted in a ban on imports.

Import and export quarantine for food safety monitoring is needed by both import and export countries!
Drug Use in Farming

- Used to promote growth, fight infection and reduce stress
- Some drugs are harmful to humans if present in sufficient quantity in the end product
- Some drugs are regulated substances with defined detection limits
- Other drugs are totally banned due to long term health effects

Forbidden substances (Group A)
- Hormones, beta agonists, etc.
- Forbidden veterinary products

Veterinary medicines (Groups B1,2)
- Antibiotics,
- Antihelminthics, etc.

Contaminants (Group B3)
- Pesticides, dioxins,
- Heavy metals...

*MRL – Maximum Residue Limits
Performance Criteria


Screening Methods

- Simple sample prep
- High sample throughput with many analytes
- Non-compliant results confirmed by a secondary analysis

Confirmatory Methods

- Methods with spectrometric detection (UV/VIS, MS, Fluorescence)
- Combination of methods with less specificity (GC-ECD, LC-UV-single wavelength, etc)
- Group A substances ➔ only methods with mass spectrometric detection
- Group B substances ➔ HPLC, GC, etc
EU Criteria for Qualitative Confirmation

- Guideline 2002/657/EG
  - SIM and MRM (4 identification points)
    - MS precursor 1.0
    - MS^n product 1.5
  \[2 \text{ MRMs} = 4\]
- Full scan MS/MS spectra (ions > 10% of base peak, mass spectral libraries)
- High resolution MS (>10 000)
Why is Pesticide Analysis Important?

Pesticide protection 'inadequate'

The public needs more protection from farming pesticides, a report warns.

The Royal Commission on Environmental Pollution report said more research was needed into a possible link between pesticides and ill health.

It recommended in the meantime no-spray zones to reduce potential risk to the public and more information on sprays.

Ministers will study the findings before responding. The Crop Protection Association said it was confident pesticides were safe if used correctly.
### Pesticide Classes Analyzed by LC/MS/MS Today

<table>
<thead>
<tr>
<th>Class of compounds</th>
<th>Example compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Triazines</td>
<td>Atrazine, cyanazine, Sebutylazine, Simazine, Terbutylazine, Desmetryn, Prometryn, Terbutryn, Terbumeton, DEA, DIA</td>
</tr>
<tr>
<td>- Triazones</td>
<td>Hexazinone</td>
</tr>
<tr>
<td>- Ureas</td>
<td>Chlorotoluron, Diuron, Neburon, Dimefuron, Isoproturon, Monoluron, Linuron, Metoxuron, Methabenzthiazuron</td>
</tr>
<tr>
<td>- Amide herbicides</td>
<td>Dimethenamide</td>
</tr>
<tr>
<td>- Dinitroaniline herbicides</td>
<td>Pendimethaline</td>
</tr>
<tr>
<td>- Chloroacetanilide herbicides</td>
<td>Acetochlor, Alachlor, Metazachlor, Metolachlor, Propachlor</td>
</tr>
<tr>
<td>- Carbamates</td>
<td>Carbaryl, Carbofuran, Benfuracarb, Pirimicarb, Methomyl, Aldicarb, Thiodicarb, Methiocarb</td>
</tr>
<tr>
<td>- Conazoles</td>
<td>Cyproconazole, Difenoconazole, Epoxyconazole, Hexaconazole, Propiconazole, Tebuconazole, Tetraconazole</td>
</tr>
<tr>
<td>- Strobines</td>
<td>Azoxyostrobin</td>
</tr>
<tr>
<td>- Organophosphorous Pesticides</td>
<td>Dimethoate, Acephate, Omethoate, Dicrotophos, Mevinphos, Phosphamidon, Dichlorvos,</td>
</tr>
</tbody>
</table>

\( \frac{3}{4} \) of 800 used pesticides are detectable by HPLC/MS/MS
## Sample Preparation and HPLC

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Add water to 5g or 10g of dry sample (sum 10mL)</td>
</tr>
<tr>
<td>2</td>
<td>Homogenize with 20mL methanol; if necessary filtration or centrifugation</td>
</tr>
<tr>
<td>3</td>
<td>Add NaCl solution to an aliquot and soak Chem Elut</td>
</tr>
<tr>
<td>4</td>
<td>Elution with dichloromethane; evaporate to dryness</td>
</tr>
<tr>
<td>5</td>
<td>Reconstitute in methanol/water (final sample concentration 1g/mL)</td>
</tr>
<tr>
<td>6</td>
<td>Pass through a 0.45µm syringe filter</td>
</tr>
<tr>
<td>7</td>
<td>HPLC on 50x2mm Aqua RP-18 column with H₂O/CH₃OH+5mM NH₄form</td>
</tr>
<tr>
<td>8</td>
<td>MS/MS detection in positive ESI for 300 Pesticides 3200 Q TRAP® LC/MS/MS system</td>
</tr>
</tbody>
</table>
The Pesticide Acquisition method

IDA (Information Dependent Acquisition) Method

- Survey Scan for each of 300 pesticides using MRM scans
- Look for any peaks
- Automatically triggered fingerprint for all peaks > 500 cps

- Dynamic Exclusion used to prevent repeat scans of the same compound
Analysis of 300 Pesticides in less than 17 minutes
Examples of sensitivity 1ng/mL

- Azoxystrobin
- Carbaryl
- Cyprodinil
- Dimethoate
- Fenhexamid
- Imazalil
- Imidacloprid
- Linuron
- Omethoate
- Pirimicarb
- Pyrimethanil
- Tebufenozid
Metalaxyl in grape

Metalaxyl 9µg/kg (10µg/kg MRL in baby food)
### Accuracy and Reproducibility

#### Fennel extract 300MRMs

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Sample Type</th>
<th>Analyte Concentration (ng/mL)</th>
<th>Calculated Concentration (ng/mL)</th>
<th>Accuracy (%)</th>
<th>Analyte Peak Name</th>
<th>Analyte Peak Area (counts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fennel 0.1</td>
<td>Standard</td>
<td>0.100</td>
<td>0.111</td>
<td>11.1</td>
<td>Haloxytop 362.0 / 316.0</td>
<td>2.25e+003</td>
</tr>
<tr>
<td>Fennel 1_01</td>
<td>Standard</td>
<td>1.00</td>
<td>0.901</td>
<td>90.1</td>
<td>Haloxytop 362.0 / 316.0</td>
<td>1.35e+004</td>
</tr>
<tr>
<td>Fennel 10_01</td>
<td>Standard</td>
<td>10.0</td>
<td>9.84</td>
<td>98.4</td>
<td>Haloxytop 362.0 / 316.0</td>
<td>1.41e+005</td>
</tr>
<tr>
<td>Fennel 100</td>
<td>Standard</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>Haloxytop 362.0 / 316.0</td>
<td>1.43e+008</td>
</tr>
<tr>
<td>Fennel 1_02</td>
<td>Quality Control</td>
<td>1.00</td>
<td>0.987</td>
<td>96.7</td>
<td>Haloxytop 362.0 / 316.0</td>
<td>1.44e+004</td>
</tr>
</tbody>
</table>

**Regression Analysis:**

Fennel:db (Haloxytop 362.0 / 316.0): "Linear" Regression ("1/x" weighting): \( y = 1.42e+004x + 673 \) (\( r = 0.9993 \))

<table>
<thead>
<tr>
<th>Expected Concentration</th>
<th>Sample Name</th>
<th>Number Of Values Use</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>%CV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000000</td>
<td>Fennel 1_02</td>
<td>5 of 5</td>
<td>0.971351</td>
<td>0.072304</td>
<td>7.443627</td>
<td>97.135092</td>
</tr>
<tr>
<td>10.000000</td>
<td>Fennel 10_02</td>
<td>5 of 5</td>
<td>10.030596</td>
<td>0.077273</td>
<td>0.770372</td>
<td>100.305960</td>
</tr>
</tbody>
</table>
Sensitivity of \(<1\text{ng/mL} \ (1\text{ng/g})\) is …

… More than enough for food analysis (0.1\text{µg/kg})

… Needed for baby food (0.01\text{µg/kg})

… Absolutely needed for milk (0.005\text{µg/kg} for some compounds)

(sample preparation is included)

(concentrations in brackets are the smallest maximum residue levels (MRL) given in the EU guidelines)
Antibiotics:
(Nitrofuran and Chloramphenicol)
LC/MS/MS Analysis of Nitrofurans in Chicken Meat

What are Nitrofurans?

- A class of synthetic antibiotics
- Use for treatment of bacterial & protozoal infections in animals
- Used as feed additives in animal husbandry
- Metabolized rapidly into reduced forms
- Inexpensive and very effective
- Mutagenic & Genotoxic
- Banned (EU in 1995, USA in 2002)
Nitrofuran Sample Preparation

1g of a homogenised sample + ISTD (AMOZ-D5) 
HCl 0.125 and 2-nitrobenzaldehyde

Homogenize and heat at 37°C in a water bath for 16 hours

Adjust the pH-value to 7.4 and centrifuge

Extract the supernatant with EtOAc on an extrelut column

Evaporate and re-constitute in 500 µL mobile phase
HPLC + MS Conditions

- **Mobile Phase:**
  - A: H2O + 1 mM ammonium acetate
  - B: Methanol
  - Gradient mode
- **Flow rate:** 200 µL/min
- **Injection Volume:** 50 µL
- **Column:** LUNA C18, 3 x 150, 3 µm @ 25 °C
- **API 3200™ System with TurboIonSpray® Source**
- **Nitrofuran Metabolites monitored with 2 MRM transitions (1 for quantitation, 1 for confirmation):**
  - AOZ: 236.1/134.0 + 236.1/192.1
  - AMOZ: 335.1/291.1 + 335.1/262.1 (D5-AMOZ: 340.1/291.1)
  - SC : 209.1/192.1 + 209.1/166.0
  - AD: 249.1/134.0 + 249.1/178.1
Minimum Required Performance Limit (MRPL)

- The MRPL of nitrofurans is 1 µg/kg (Decision 2003/181/EC)
- The MRPL should not be mistaken for a tolerance limit, reporting limit, action limit or any other equivalent parameter or term
- Nitrofurans are banned substances and hence should be completely absent from food products
- EU enforcement of a zero tolerance threshold
- Regulatory laboratories are therefore obliged to try and find residues of these substances at the lowest technically possible concentration
LOQ of nitrofuran metabolites

AOZ: LOD = 0.02 ng/mL (linear range – 5 ng/mL)

AMOZ: LOD = 0.01 ng/mL (linear range – 5 ng/mL)

SEM: LOD = 0.1 ng/mL (linear range – 10 ng/mL)

AHD: LOD = 0.02 ng/mL (linear range – 10 ng/mL)

MRL is set to 0.5 or 1 ng/mL (μg/kg)
Nitrofurane metabolites in food

![Graphs showing nitrofurane metabolites in Standard, Chicken, Egg, and Shrimp samples.](Image)
AMOZ: 1ng/mL spiked to extract of shrimps
MRM ratio 2.24 (Std. average 2.246)

AOZ: 1ng/mL spiked to extract of shrimps
MRM ratio 5.69 (Std. average 5.704)

SEM: 10ng/mL spiked to extract of eggs
MRM ratio 1.02 (Std. average 1.017)

AMOZ: 5ng/mL spiked to extract of poultry
MRM ratio 3.24 (Std. average 3.196)
LC/MS/MS Analysis of Chloramphenicol in Honey

What is Chloramphenicol?

- Broad spectrum antibiotic
- Used in treatment prophylactically in food-producing animals
- Inexpensive and effective
- Potential carcinogenicity and genotoxicity, aplastic anemia, leukemia, causing antimicrobial resistance
- A safe dose in human unknown, the use of the contaminated food over a long period would increase the risk (CFIA)
- EU tolerance level 0.1 ppb
- Banned since 1994
HPLC + MS  Experimental Conditions

- Phenomenex Aqua 50x2mm
- Eluent A: H$_2$O + 0.1% formic acid + 5mM NH$_4$ac
- Eluent B: CH$_3$OH + 0.1% formic acid + 5mM NH$_4$ac
- Flow rate = 400µL/min
- Gradient:  
  0min  90/10
  5min  10/90
  7.5min 10/90 + equilibration
- Injection of 25µL
- Column oven 25°C
- API 3200™ LC/MS/MS system with Turbo V™ Source
- Probe (500°C) negative polarity
- CAP:  320.9/151.9 + 320.9/259.9
- D5-CAP: 325.9/156.9
Chloramphenicol - sensitivity

- **0.1ng/mL Chloramphenicol**
- **D5-Chloramphenicol**
Chloramphenicol - linearity

**0.02 – 5ng/mL**

**Accuracy 91-106%**
Chloramphenicol - real samples

Chloramphenicol 0.5ng/mL spiked to extract of shrimps
MRM ratio 2.51 (Standard average 2.563)

Internal standard

Chloramphenicol 0.5ng/mL spiked to extract eggs
MRM ratio 2.61 (Standard average 2.563)

Internal standard
Mycotoxins in Food

Applied Biosystems | Applied Markets Division
What are Mycotoxins?

- Mycotoxins are secondary metabolites produced by various molds (for instance *fusarium* species).
- Fumonisines: metabolites of molds which grow on senescent or stressed plants
- DON and NIV: metabolites of plant pathogens
- OTA and Aflatoxins: metabolites of molds that colonise the plant before harvest
- Some common mycotoxins:
  - Fumonisines
  - Deoxinivalenol (DON)
  - Trichothecenes
  - Zearalenon (ZON)
  - Ochratoxin A
  - Aflatoxins
  - Patulin
Why are Mycotoxins So Important?

- Early death of Mozart (1791) is assumed to be caused by mycotoxins in rotten corn coupled with a lack of vitamin B
- First observations on the effects of mycotoxins were observed with animals fed with molded corn
- Animals showed diseases in brain, kidneys, liver, trachea, which could lead to death
- IARC (International Agency for Research on Cancer) sees mycotoxins as potentially carcinogenic
- In December 2003 the Legislation for DON and ZON were defined in the EU
- So far Legislations existed only for Ochratoxin A (3 ppb) and Aflatoxin (B1 2 ppb, total 4 ppb) related to wheat
- Discussions for further regulations are still continuing
## MTL for DON and ZON in Different Countries
*(FAO 1997; ROSNER et al. 1995)*

<table>
<thead>
<tr>
<th>Country</th>
<th>DON (µg/kg)</th>
<th>ZON (µg/kg)</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>500 750</td>
<td>60 60</td>
<td>Wheat and rye Hard wheat</td>
</tr>
<tr>
<td>Brasil</td>
<td>-</td>
<td>200</td>
<td>Corn</td>
</tr>
<tr>
<td>Canada</td>
<td>2000 1000</td>
<td>-</td>
<td>Uncleanded soft wheat (for baby food)</td>
</tr>
<tr>
<td>France</td>
<td>-</td>
<td>200</td>
<td>Corn, wheat, grains</td>
</tr>
<tr>
<td>Hungary</td>
<td>-</td>
<td>50</td>
<td>All food types</td>
</tr>
<tr>
<td>Romania</td>
<td>-</td>
<td>30</td>
<td>All food types</td>
</tr>
<tr>
<td>USA</td>
<td>1000</td>
<td>-</td>
<td>End product</td>
</tr>
</tbody>
</table>
Sample Preparation

20g of a homogenized sample
Extraction with 100mL (ACN/H₂O vv 85/15)
Shaking (1h) Filtration

SPE-Clean-up
Active coal/Al₂O₃/Celite

IAC Clean-up
AOZ-column VICAM®

Injection of 20 µL
HPLC Method

- Column: SB-RP18-Zorbax, 150x3, 3.5 μm
  Thermo Aquasil C18, 150 x 4.6
- (alternative column Synergy Hydro-RP from Phenomenex)
- Column oven: 50°C
- Integrated Valco valve
- Injection volume: 20 μL
- Eluents: Water (A) and MeOH (B)

<table>
<thead>
<tr>
<th>Time</th>
<th>Flow (μL/min)</th>
<th>Eluent A (H2O)</th>
<th>Eluent B (MeOH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>250</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>250</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>250</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>25</td>
<td>250</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>
# Mass Spectrometer Parameters for Selected Mycotoxins

<table>
<thead>
<tr>
<th>RT, min</th>
<th>Compound</th>
<th>Parent, m/z</th>
<th>Production</th>
<th>Ratio*</th>
<th>Linearity (R2)</th>
<th>LOQ, ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>primary</td>
<td>secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.80</td>
<td>NIV</td>
<td>311</td>
<td>281</td>
<td>205</td>
<td>10</td>
<td>0.998</td>
</tr>
<tr>
<td>5.25</td>
<td>DON</td>
<td>295</td>
<td>265</td>
<td>138</td>
<td>1.4</td>
<td>0.998</td>
</tr>
<tr>
<td>9.19</td>
<td>VOL</td>
<td>265</td>
<td>125</td>
<td>143</td>
<td>1.6</td>
<td>0.995</td>
</tr>
<tr>
<td>9.7</td>
<td>OTA</td>
<td>402</td>
<td>358</td>
<td>167</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>13.95</td>
<td>ZAN</td>
<td>319</td>
<td>187</td>
<td>136</td>
<td>1.3</td>
<td>0.991</td>
</tr>
<tr>
<td>14.09</td>
<td>ZON</td>
<td>317</td>
<td>175</td>
<td>187</td>
<td>1.2</td>
<td>0.990</td>
</tr>
</tbody>
</table>

* ratio of primary to secondary production

Run on an API 2000™ System in ESI mode
Negative Ion Period of the Chromatogram

1. Period (negative polarity)

- Nivalenol (NIV)
- Deoxynivalenol (DON)
- Fusarenon X (FX)
- Verrucarol (VOL)
- Acetyldeoxynivalenol (ADON)
- Ochratoxin A (OTA)

RT (min)

1.6e4

3.0e4 cps
Summary of Mycotoxin Method

- The recovery was found to be between 65 % and 84 % for the extraction process.
- Detection limits are 10 ppb for all the Mycotoxin metabolites, with the exception of OTA, which was 1 ppb.
- Precisions between injections was found to be less than 10 %.
- A linearity of 0.998 could be determined in the concentration range of 25 to 500 ug/kg.
Review

• Challenges facing food testers in meeting emerging regulations

• Shown some examples of the analysis of Pesticides, Antibiotics and Mycotoxins utilizing LC/MS/MS triple quadrupole and hybrid triple quadrupole linear ion trap (Q Trap) technology that demonstrate how these can be used for fast and sensitive analysis of a wide range of food contaminants

• Have demonstrated two approaches for identification according to EU guidelines, the first being monitoring a single transition that is used to trigger a full scan of the analyte if it is found to be present using a Q Trap system and the second being the use of two transitions per analyte using a triple quadrupole system
Introducing the API 3200 Food Testing Solution:

- The first dedicated, out-of-the-box solution for routine, high performance LC/MS/MS based food testing
- Featuring Cliquid™ Software for Food Testing, the first dedicated software for food testing
- Uses the API 3200 triple quadrupole LC/MS/MS system coupled with the Agilent 1200 HPLC
- Contains preconfigured methods for key food contaminants
- Contains automated reports for quality control and reporting according to regulatory requirements
API 3200™ LC/MS/MS System

- High performance, bench-top, easy-to-use triple quadrupole mass spectrometer
- ESI, APCI, Photospray sources available
- Utilizes the Turbo V™ Source for maximum reliability, sensitivity and throughput with minimum downtime
- Features the LINAC® Collision Cell to maximize the number of analytes monitored in a single run while eliminating cross-talk
- System of choice to perform routine food testing
New Agilent 1200 HPLC

- New improved HPLC system
- Binary Pump with configurable delay volume to 120 ul, electronic damping control, flow rate range from .001-5 ml/min
- New Low Carryover Flow Through Autosampler with <0.5% RSC from 0.01 – 2000 ul injected
- Peltier Column Compartment, Two Columns, Temp 10C below ambient to 100C, Optional Switching Valve
- Early Maintenance Feedback (EMF) system
- Robust, easy-to-use, proven performance from the trusted name in HPLC
“Cliquid™ Software is simply the easiest to learn, easiest to use software for routine LC/MS/MS analysis”
Homepage - showing tasks and already acquired samples
Single button to choose from preconfigured tests

Run Samples

Step 1
Choose test

Step 2
Build sample list

Step 3
Customize report

Step 4
Submit samples

Choose a test

- Pesticides – Phenyl ureas
- Pesticides – Triazines
- Nitrofuran metabolites
- Azo-dyes – Orange II in negative polarity
- Malachite Green
- Acrylamide – C18 column
- Acrylamide – Carbon column
- Mycotoxins
- Chloramphenicol
- Azo-dyes – 13 azo-dyes in positive polarity

Cancel  < Back  Next >
Quickly build or import sample list (from Excel, etc.)

Run Samples

Step 1
Choose test

Step 2
Build sample list

Step 3
Customize report

Step 4
Submit samples

Azo-dyes samples

<table>
<thead>
<tr>
<th>Name</th>
<th>Plate Position</th>
<th>Sample Position</th>
<th>Type</th>
<th>Dilution</th>
<th>Weight</th>
<th>Sudan C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Solvent</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
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Instrument Panel

Standby

Mass Spec Standby
Pumps Standby
Autosampler Standby
Column Oven Standby
Choose the report(s) that you want to generate

Run Samples

Step 1
Choose test

Step 2
Build sample list

Step 3
Customize report

Step 4
Submit samples

Choose one or more report styles

- Report all samples
- Report calibration curves (1 per page)
- Report QC statistics
- Report unknown samples
- Report unknown samples with MRM ratio (EU guideline)
- Report unknown samples with MRM ratio 20%

Instrument Panel

Standby

Mass spec: Standby
Autosampler: Standby
Column Oven: Standby

Done
Specify report delivery options (print, .pdf, email..)

Run Samples

Step 1
Choose test

Step 2
Build sample list

Step 3
Customize report

Step 4
Submit samples

Select desired report output format(s)

- Word (automatically generated)
- Print report
- Save report as pdf
- Email when report completed
- Email report with attached doc
- Email report with attached pdf

Instrument Panel

Standby

Stop
Standby
Live View
Restart
Event Log

Done

Local Internet
Review selection, verify HPLC setup and specify equilibration time before submitting samples.

- **Step 1**: Choose test
- **Step 2**: Build sample list
- **Step 3**: Customize report
- **Step 4**: Submit samples

Enter an equilibration time and ensure that your system complies with the conditions listed below:

- **Equilibration time**: 18 minutes
- **Conditions**:
  - Column: Phenomenex LUNA 5u C8 100A, 150x3mm
  - Ion source: TurboIonSpray source
  - Eluent A: water + 0.2% formic acid + 2mM ammonium acetate
  - Eluent B: acetonitrile + 0.2% formic acid + 2mM ammonium acetate

Instrument Panel:
- Standby
- Mass Spec: Standby
- Autoanalyzer: Standby
- Column Oven: Standby

Standby
Acquisition starts automatically

Instrument status is graphically displayed
Report calibration curves and statistics of analytes
Report results of unknown samples including chromatograms and confirmation (MRM ratios)
The API 3200™ Food Testing Solution Package:

A Comprehensive Package for Routine Food Testing

Includes everything you need to get started out-of-the-box:

- API 3200™ Triple Quadrupole LC/MS/MS system
- Agilent 1200 Series Binary HPLC System
- Cliquid™ Software for Food Testing
- Start Up Kit with Columns and Test Mix
- Installation, Familiarization and One Year Warranty
- Course tuition for system and software training
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