Protection of children against pesticide residues in foods: current challenges and further improvements

Jana Hajslova

Pesticide use reduction for better health: scientific evidence and best practices for a European approach
Brussels, March 7, 2007
Pesticide residues unavoidably occur in conventional food crops.....
Prioritisation of Food Safety Measures by EU consumers (%)

(data source: INRA Europe, 1999)

- 60% for Justified restrictions on pesticides or hormones
- 50% for No preservatives
- 45% for Appropriate preservation methods
- 40% for Additives below recommended level
- 35% for Preservatives below recommended level
- 30% for No additives
- 25% for Testing for microbiological safety
- 20% for No hormone residues
- 15% for No pesticide residues
**Regulations**


- **Annex I** Active substances authorized for incorporation in plant protection products
- **Annex II** Requirements for the dossier to be submitted for the inclusion of an active substance in annex I introduction
- **Annex III** Requirements for the dossier to be submitted for the authorization of a plant protection product introduction
- **Annex IV** Risk Phrases
- **Annex V** Safety Phrases
- **Annex VII** Uniform principles for the evaluation of plant protection products

Documentation at:


▶ To date, more than 17,000 Community MRLs have been set for various commodities for 133 pesticide active substances.

MRLs - safe limits that define the maximum expected levels of a pesticide on a food commodity after safe and authorized use of that pesticide.

➢ prevent illegal and/or excessive use of a pesticide
➢ protect the health of consumers of the harvested products

MRLs are often mistaken for toxicological safety limits, nonetheless, care should be taken to ensure that the maximum levels do not give rise to toxicological concerns
COMMISSION REPORT: stable pesticide residues in EU (2001)

18 EU countries, 46,000 samples analysed within 1996 – 2001

¬ no detectable residues in 59% samples
¬ increasing no. of samples with more than one residue!

**Fresh fruit, vegetables, cereals**

<table>
<thead>
<tr>
<th>Year</th>
<th>No detectable residues</th>
<th>Residues ≤ national or EC MRL</th>
<th>Residues above MRL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>60/61/61/64/61</td>
<td>37/36/36</td>
<td>3</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td>3.4</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td>3.3</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td>4.3</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td>4.5</td>
</tr>
</tbody>
</table>
MRL-Violation-Rates in Conventionally Grown Fruits and Vegetables

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>9,2 %</td>
</tr>
<tr>
<td>2005</td>
<td>9,7 %</td>
</tr>
<tr>
<td>2004</td>
<td>12.0 %</td>
</tr>
<tr>
<td>2003</td>
<td>9,4 %</td>
</tr>
<tr>
<td>2002</td>
<td>9,7 %</td>
</tr>
<tr>
<td>2001</td>
<td>12,8 %</td>
</tr>
<tr>
<td>2000</td>
<td>8,5 %</td>
</tr>
</tbody>
</table>
# Residue situation in Conventional samples in 2006

(CVUA Stuttgart)

<table>
<thead>
<tr>
<th></th>
<th>Vegetables</th>
<th>Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No of Samples</strong></td>
<td>866</td>
<td>883</td>
</tr>
<tr>
<td><strong>With residue findings</strong></td>
<td>85 %</td>
<td>95 %</td>
</tr>
<tr>
<td><strong>No of different pesticides</strong></td>
<td>199</td>
<td>170</td>
</tr>
<tr>
<td><strong>Pesticides/sample</strong></td>
<td>4.3</td>
<td>5.3</td>
</tr>
<tr>
<td><strong>MRL-violations</strong></td>
<td>13 %</td>
<td>7.7 %</td>
</tr>
</tbody>
</table>
Average summed concentration of pesticides in samples: (bromide and post-harvest surface treatment pesticides excl.)

- **Conventional** samples fruits / vegetables 0.39 / 0.4 mg/kg
- **Organic** samples 0.016 / 0.009 mg/kg on average

- **Organic** samples (when deducting those which are assumed to have been misleadingly labelled as organic) 0.002 / 0.003 mg/kg

→ statistically found 195 / 133 times higher total pesticide residue concentrations in conventional fruits/vegetables compared to organic ones.

The factor is 24/45 when considering the organic samples as taken from the market without discriminating the mislabelled ones.
Concerns exists about the adequacy of the level of protection that the MRLs might afford to young infants

- Infants and young children have been shown to be very sensitive to certain toxic effects as a result of their immature physiological development.

- It is reasonable to assume that residues in food may have adverse effects on the brain, immune system etc.

- Relative to their weight, children consume more food per weight unit than adults: e.g. 6 x more fruit, 2 x vegetables, 3 - 5 x more cereals

greater risk of exceeding the ADI or ARfD
Article 6

1. Processed cereals-based foods and baby foods shall not contain any substance in such quantity as to endanger the health of infants and young children. Necessary maximum levels shall be established without delay.

2. Processed cereal-based foods and baby foods shall not contain residues of INDIVIDUAL pesticides at levels exceeding 0.01 mg/kg except for those substances for which specific levels have been set in Annex VII, in which case these specific levels shall apply.

The above levels apply to processed cereal-based foods and baby foods as proposed ready for consumption or as reconstituted according to the instructions of the manufacturer.
In the case of a small number of pesticides or metabolites of pesticides even a maximum residue level of 0,01 mg/kg might, under worst-case intake conditions, allow infants and young children to exceed the acceptable daily intake. This is the case for pesticides or metabolites of pesticides with an acceptable daily intake lower than

<table>
<thead>
<tr>
<th>Chemical name of the substance</th>
<th>Maximum residue level (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadusafos</td>
<td>0,006</td>
</tr>
<tr>
<td>Demeton-S-methyl/demeton-S-methyl sulfone/oxydemeton-methyl (individually or combined, expressed as demeton-S-methyl)</td>
<td>0,006</td>
</tr>
<tr>
<td>Ethoprophos</td>
<td>0,008</td>
</tr>
<tr>
<td>Fipronil (sum of fipronil and fipronil-desulfinyl, expressed as fipronil)</td>
<td>0,004</td>
</tr>
<tr>
<td>Propineb/propyenethiourea (sum of propineb and propyenethiourea)</td>
<td>0,006’</td>
</tr>
</tbody>
</table>
However, in addition to processed cereals-based foods and baby foods with 0.01 mg/kg MRL, children also consume a lot of fresh food commodities for which often significantly higher MRLs apply......
Baby food producers apply precautionary approach „pesticide free“ crops - residues below 0.01 mg/kg is required.

Farmers are searching for pesticide preparations leaving low residues but still effective against pests.
Example of discrepancy:

MRL for phosalone in apples treated in accordance with GAP: **2 mg/kg → 200 x more than „baby food limit“ !!!**

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>CROP GROUP</th>
<th>COMMODITY</th>
<th>MRL</th>
<th>LOD</th>
<th>DIRECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosalone</td>
<td>TREE NUTS</td>
<td>Walnuts</td>
<td>1</td>
<td>88.298</td>
<td>EEC</td>
</tr>
<tr>
<td>Phosalone</td>
<td>POME FRUIT</td>
<td>Apples</td>
<td>2</td>
<td>88.298</td>
<td>EEC</td>
</tr>
<tr>
<td>Phosalone</td>
<td>POME FRUIT</td>
<td>Pears</td>
<td>2</td>
<td>88.298</td>
<td>EEC</td>
</tr>
<tr>
<td>Phosalone</td>
<td>POME FRUIT</td>
<td>Pome Fruit Others</td>
<td>2</td>
<td>88.298</td>
<td>EEC</td>
</tr>
<tr>
<td>Phosalone</td>
<td>POME FRUIT</td>
<td>Quinces</td>
<td>2</td>
<td>88.298</td>
<td>EEC</td>
</tr>
<tr>
<td>Phosalone</td>
<td>STONE FRUIT</td>
<td>Apricots</td>
<td>1</td>
<td>88.298</td>
<td>EEC</td>
</tr>
</tbody>
</table>
Occurrence of pesticide residues in fresh apples

Monitoring data reported by State Food and Agriculture Inspection (CZ)

control of the legal limits for common food products

Monitoring data reported by ICT to baby food producer

0.01 mg/kg limit control

No. of pesticides in MRM:
1999 - 56 (GC/MS)
2003 - 105 (GC/MS, LC/MS)
TYPICAL RESIDUE DISTRIBUTION IN APPLES

(4 year monitoring study in CZ)

"Baby food crops" should never be treated by phosalone!!

Other pesticides frequently occurring above 0.05 mg/kg: dodine, pyrimethanil, etofenprox, EBDCs, ...

MULTIPLE RESIDUES IN APPLES !!! (up to 6 pesticides)
Stages of fruit, and cereals-based baby food production

GROWING AND HARVESTING
- Production inputs: fertilizer, water, AGROCHEMICALS: PESTICIDES
- Post-harvest handling and processing
- Packaging, marketing and distribution
- Packaging materials: semicarbazide

CONSUMPTION
- Environmental factors - pollution, MYCOTOXINS: patulin in apples fusarium toxins in cereals
- Ingredients and additives (sugar, vitamins, minerals etc.)
OVERALL PESTICIDE RESIDUES in fruit used for baby food production

Pesticide residues in apples:
FREQUENCY DISTRIBUTION
(total no. of samples 245)
LEVELS OF DON IN WHEAT:
(*artificial infection by Fusarium culmorum*)

In addition to leaving residues, some fungicides lead to increased mycotoxins levels!!
ANNEX III, part 8. 8.2.
Effects of industrial processing and/or household preparation on the nature and magnitude of residues

Aim of the tests (processing studies)

• to establish whether or not breakdown or reaction products arise from residues in the raw products during processing which may require a separate risk assessment,

• to determine the quantitative distribution of residues in the various intermediate and end products, and to estimate transfer factors

• to enable a more realistic estimate to be made of dietary intake of residues

Data from processing studies for regulation purpose provided (only) by pesticide producers ?!
SIGNIFICANT CHANGES OF PESTICIDE RESIDUES MAY OCCUR DURING INDUSTRIAL PROCESSING / HOUSEHOLD COOKING

**PROCESSING FACTOR:**

\[ P = \text{residue in processed commodity} / \text{residue in raw agriculture commodity} \]

(i) \( P > 1 \rightarrow \text{RESIDUES CONCENTRATE} \)
   in the processed fraction

(ii) \( P < 1 \rightarrow \text{residues degrade / are diluted} \)

(iii) **Toxic breakdown product originates**
## Concentration of residues in processed fraction

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>Bioresmethrin</th>
<th>Deltamethrin</th>
<th>Permethrin</th>
<th>Glyphosate</th>
<th>Phenotrin</th>
<th>Diflubenzuron</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>reduction (%) obtained by wheat processing</strong></td>
<td>5</td>
<td>64</td>
<td>43</td>
<td>80</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td><strong>transfer factor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Whole meal flour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>White flour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Whole meal bread</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>White bread</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bran / Wheat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RAW MATERIAL (fresh fruit)

washing (3x drink. water)

pulping, straining heating (90 - 95°C, 10-15´)

MIXING in tank

Semifinished materials + ingredients

FILLING $T \geq 85^\circ C$

CAPPING

Pasteurization (85°C, 15´)

labelling

FINAL PRODUCT

Pomace

CCP 1: raw material inspection

CCP 3: monitoring of heating temperature

CCP 8: Inside jar temperature control
CCP 10: sterilization conditions control
Case study

Changes of PROCYMIDONE content during processing of contaminated strawberries

(200 kg batch processed)

<table>
<thead>
<tr>
<th></th>
<th>Fresh</th>
<th>After Washing</th>
<th>Steam Boiled</th>
<th>Sterilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCYMIDONE</td>
<td>0.235 mg/kg</td>
<td>0.004 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing factor</td>
<td>0.017</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Processing factor = 0.017
**TECHNOLOGICAL EXPERIMENT - PROCESSING STUDY**

- Apples (Idared, Golden Delicious) treated according to registered conditions by pesticide preparations containing selected active ingredients - altogether 10 experiments
- Storage 1 month at 4°C
- Processed according to common industrial practice

<table>
<thead>
<tr>
<th>pesticide</th>
<th>solubility in water [mg/l]</th>
<th>M.w.</th>
<th>vapour pressure [mPa]</th>
<th>Log Kow</th>
</tr>
</thead>
<tbody>
<tr>
<td>fenitrothion</td>
<td>21 (20°C)</td>
<td>277.2</td>
<td>15 (20°C)</td>
<td>3.43</td>
</tr>
<tr>
<td>phosalone</td>
<td>3.05 (25°C)</td>
<td>367.8</td>
<td>&lt; 0.06 (25°C)</td>
<td>4.01</td>
</tr>
<tr>
<td>tolyfluanid</td>
<td>0.9 (25°C)</td>
<td>347.2</td>
<td>0.2 (20°C)</td>
<td>3.90</td>
</tr>
</tbody>
</table>

### PROCESSING FACTORS

<table>
<thead>
<tr>
<th></th>
<th>raw apples (mg/kg)</th>
<th>washed apples</th>
<th>apple puree</th>
<th>final baby food</th>
<th>Pomace - mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>fenitrothion</td>
<td>0.016-0.022</td>
<td>0.88 - 0.95</td>
<td>n.d.</td>
<td>n.d.</td>
<td>3.31</td>
</tr>
<tr>
<td>phosalone</td>
<td>0.057-0.089</td>
<td>0.9 – 1.05</td>
<td>0.14 – 0.22</td>
<td><strong>0.005</strong></td>
<td>13.59</td>
</tr>
<tr>
<td>tolyfluanid</td>
<td>0.005-0.025</td>
<td>0.64 – 1.12</td>
<td>n.d.</td>
<td>n.d.</td>
<td>5.68</td>
</tr>
</tbody>
</table>
COMMISSION REGULATION (EC) No 1881/2006

of 19 December 2006

setting maximum levels for certain contaminants in foodstuffs

To ensure an efficient protection of public health, products containing contaminants exceeding the maximum levels should not be placed on the market either as such, after mixture with other foodstuffs or used as an ingredient in other foods.

Is it applied in a routine practice??
The purpose of the RASFF is to provide the control authorities with an effective tool for exchange of information on measures taken to ensure food safety.
ALERT NOTIFICATIONS ACCORDING TO THE IDENTIFIED RISK


pie chart showing:
- Pesticide residues: 2%
- Heavy metals: 4%
- Residues of veterinary medical products: 12%
- Mycotoxins: 7%
- Microbiological contamination: 31%
- Chemical contamination (other): 36%
- Other: 8%
2004 Information notifications according to the identified risk

- Pesticide residues, 41, 2%
- Parasitic infestation, 31, 2%
- Not determined / other, 39, 2%
- Heavy metals, 82, 4%
- Residues of veterinary medicinal products, 101, 5%
- Microbiological contamination, 301, 16%
- Chemical contamination (other), 363, 19%
- Foreign bodies, 21, 1%
- Other, 100, 5%
- Mycotoxins, 837, 44%
EVIDENCE OF EXPOSURE TO MULTIPLE PESTICIDE RESIDUES IN THE DIET

• The pesticides surveillance programme in which food commodities are analysed for a range of pesticides in each year

• Analyses of pesticides in the Total Diet Survey which measure levels in the main components of the diet

• Data on biomonitoring from certain human adipose tissue and breast milk, which gives evidence of the accumulation of pesticides within the body
Lettuce in 2006, 253 samples

With residues 89%
Violative 13 %
With multiple residues 76 %
Sweet Pepper in 2006, 170 samples

With residues 94%
Violative 14.1%
With multiple residues 86%
Strawberries 2006, 171 samples

With residues 100%
Violative 5%
with multiple residues 95 %

![Bar chart showing the number of samples with different numbers of pesticides per sample. The x-axis represents the number of pesticides per sample, ranging from 0 to 13. The y-axis represents the number of samples, ranging from 0 to 30. The chart shows that the majority of samples contain between 4 and 8 pesticides.]
Composite dialkyl phosphate (geometric means) for each demographic group. (Creatinine adjusted concentrations.)
OP metabolism: exposure markers

- **Diazinon oxon**

  - **NADPH, O\textsubscript{2}**
  - Dearylation or hydrolysis

  - Diethyldithiophosphate

  - **Hydrolysis**
    - Diethylphosphate
    - 2-isopropyl-4-methyl-6-hydroxypyrimidine

  - **Cholinesterase inhibition**
    - 2-isopropyl-4-methyl-6-hydroxypyrimidine

  - **IMPY glucuronide** + **IMPY sulfate**
COMMISSION RECOMMENDATION

of 18 January 2006

concerning a coordinated Community monitoring programme for 2006 to ensure compliance with
maximum levels of pesticide residues in and on cereals and certain other products of plant origin

and national monitoring programmes for 2007

(notified under document number C(2006) 11)
### Pesticide/Product Combinations to be Monitored

<table>
<thead>
<tr>
<th>Pesticide Residue to be Analyzed for</th>
<th>2006</th>
<th>2007 (*)</th>
<th>2008 (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acephate</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Acetamiprid</td>
<td></td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Aldicarb</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Azinphos-methyl</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Azoxystrobin</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Benomyl group</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>(b)</td>
<td>(c)</td>
<td>(a)</td>
</tr>
</tbody>
</table>

(a) Beans (fresh or frozen), carrots, cucumber, oranges or mandarins, pears, potatoes, rice, spinach (fresh or frozen).
(b) Aubergines, bananas, cauliflower, grapes, orange juice (1), peas (fresh/frozen, without pod), peppers (sweet), wheat.
(c) Apples, head cabbage, leek, lettuce, tomatoes, peaches, rye, oats, strawberries.
Pesticides-Online Database for Pesticide Residues
Targeted Sampling & Analysis

High-Tech-Instrumentation & Fast Sample Preparation are Important, but...

Important is not only
How You Analyse
but also...
What You Analyse!

Set priorities based on information...
DATA-POOL: Collection/Distribution of Information

INTERNET

Lab 1
Lab 2
Lab 3
Lab 4
Lab 5
Lab 6
Lab 7

pesticides
PESTICIDES-ONLINE

AIMS:
- Information Exchange between Laboratories
- Enable Targeted Pesticide-Analysis
Pesticides-Online Users Around the World:

Currently **580 users from 55 countries**
Residue Data

>1 000 000 Entries
(> 75 000 pos.)

314 Different Commodities

116 Countries of Origin

678 Compounds Sought

512 Compounds Found

91 Info Sources
Sorting options for the results

Various filter options for a targeted query

View reference and contact-information by clicking here
Agricultural Usage Data

>16 000 Entries

194 Commodities

473 Pesticides

35 Countries/Regions
### Agricultural Usage Data

The use of this data for statistical evaluations is not recommended!

<table>
<thead>
<tr>
<th>Year</th>
<th>Information Type</th>
<th>Pesticide</th>
<th>Application Info</th>
<th>Commodity</th>
<th>Botanical Class</th>
<th>Additional Info</th>
<th>Region of Validity</th>
<th>Info Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Registration for specific application of a biocidal product</td>
<td>Alar, mepanate</td>
<td>Pre-emergence</td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td>Expired 01.12.2010</td>
<td>Germany</td>
<td>PUBL</td>
</tr>
<tr>
<td>2004</td>
<td>Registration for specific application of a biocidal product</td>
<td>Acetamiprid</td>
<td>Pre-emergence</td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td>Expired 01.12.2010</td>
<td>France</td>
<td>PUBL</td>
</tr>
<tr>
<td>2003</td>
<td>Special permit according to § 15a LMBioSStV</td>
<td>Acetamiprid</td>
<td>Up to 0.66 mg/kg</td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td>valid for the entire EU</td>
<td>Spain, Portugal</td>
<td>PUBL</td>
</tr>
<tr>
<td>2004</td>
<td>Registration for specific application of a biocidal product</td>
<td>Bifenthrin</td>
<td>Pre-emergence</td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td>Expired 01.12.2010</td>
<td>Germany</td>
<td>PUBL</td>
</tr>
<tr>
<td>2004</td>
<td>Registration for specific application of a biocidal product</td>
<td>Chlorpyrifos</td>
<td></td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td>Valid for the entire EU</td>
<td>Italy</td>
<td>WEB</td>
</tr>
<tr>
<td>2004</td>
<td>Registration for specific application of a biocidal product</td>
<td>Diuron</td>
<td></td>
<td>Peppers, sweet</td>
<td>Solanaceae</td>
<td></td>
<td>Pow</td>
<td>PUBL</td>
</tr>
</tbody>
</table>

### Various Filter Options

- **Commodity:** Peppers, sweet
- **Botanical Class:** Solanaceae

### Sorting Options

- **Sort by:**
  - Information Type

### View Reference and Contact Information

Click here to view reference and contact information.
## Pesticides

### Sorting options

The results can be sorted by various columns such as pesticide name, class, or other relevant information.

### Printing option

A printing option is available to print the displayed results.

### Pesticide Data Sheet

Click here to see the "Pesticide Data Sheet" for a detailed view of physicochemical, toxicological, and analytical information on 795 pesticides and metabolites.
### Physicochemical and Toxicological Data

- **Molecular Formula:** $\text{C}_{2}\text{H}_{3}\text{NO}_{2}\text{PS}$
- **Water Solubility (mg/L) $pK_a$**
- **Vapour pressure (Pa)**: 0.0023
- **ARID / ADI (mg/kg bw)**: 0.01 / 0.004
- **Endocrine Disruption**
- **Add. Info:** Metabol of Acephate

### Analytical Data

<table>
<thead>
<tr>
<th>Method</th>
<th>Typical Recovery (% in %)</th>
<th>Remarks</th>
<th>GC-amenable</th>
<th>Matrix Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>QuECHERS (MeCN)</td>
<td>94</td>
<td></td>
<td>Yes</td>
<td>++</td>
</tr>
<tr>
<td>Stuttgart (Acetone)</td>
<td>94</td>
<td></td>
<td>Yes</td>
<td>++</td>
</tr>
<tr>
<td>SFE (CO$_2$)</td>
<td>X</td>
<td>94</td>
<td>Yes</td>
<td>++</td>
</tr>
<tr>
<td>DFG S 19 (Acetone)</td>
<td>X</td>
<td>94</td>
<td>Yes</td>
<td>++</td>
</tr>
<tr>
<td>Dutch (Acetone)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>++</td>
</tr>
<tr>
<td>Canadian (MeCN)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>+</td>
</tr>
<tr>
<td>CDFA (MeCN)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>+</td>
</tr>
<tr>
<td>Swedish (EFAC)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>+</td>
</tr>
<tr>
<td>L. Alder (MeCN)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>+</td>
</tr>
<tr>
<td>Stainbauer (Acetone, SFE)</td>
<td>X</td>
<td></td>
<td>Yes</td>
<td>+</td>
</tr>
</tbody>
</table>

**LC-BEHAVIOR**

- **Ionization Source:**
  - ESI (+)
    - Sensitivity: +++
    - M$\text{S}_{1}$ (m/z): 142, 112, 125
    - MS/MS Transitions: 142$\rightarrow$125, 142$\rightarrow$112, 142$\rightarrow$102, 142, 102
  - ESI (-)
    - No Data
  - APCI (+)
    - Sensitivity: ++
    - M$\text{S}_{1}$ (m/z): 142, 125
  - APCI (-)
    - No Data

**Read Comments on METHAMIDOPHOS**

**Write a Comment on METHAMIDOPHOS**
### Physicochemical Data
- **pKa**
- Water solubility
- ...

### Toxicological Data
- ARfD
- ADI

---

**Physicoc hemical and Toxicological Data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methidiphos (Acephate-met)</td>
<td>10265-92-6</td>
</tr>
<tr>
<td><strong>Water Solubility [mg/L] pKow</strong></td>
<td>2000000 (&gt; 20°C)</td>
</tr>
<tr>
<td>pKow</td>
<td>11</td>
</tr>
<tr>
<td>Vapour pressure [Pa]</td>
<td>0.0001</td>
</tr>
<tr>
<td>ARID / ADI [mg/kg bw]</td>
<td>0.004</td>
</tr>
<tr>
<td>Endocrine Disruption</td>
<td></td>
</tr>
<tr>
<td>Add. Info</td>
<td>Metab. of Acephate</td>
</tr>
</tbody>
</table>

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**ANALYTICAL DATA**

- **Typical Recoveries Using Various MultiResidue Methods (in %)**
  - Method
  - CuEChERs (MeCN)
  - Stuttgart (Acetone)
  - DFG S 19 (Acetonitrile)
  - Canadian (MeOH)
  - CDFA (MeOH)
  - Swedish (Elu)
  - L. Adler (MeOH)
  - Stainbaehn (Acetonitrile)
  - Ion Source: ESI (+) | ESI (-) | APCI (+) | APCI (-)
  - Sensitivity: NoData | ++ | 142 | 125

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**Detector**

- MSD El (+): NoData
- MSD CI (+): Data
- TOF El (+): NoData
- MSMS El (+): NoData
- APCI (+): ++

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**References**

- Methidiphos
  - **Water Solubility**
    - [1] Author: C. D. S. Tomlin
      - Title: The e-Pesticide Manual
      - Year of Publication: 2002
      - Journal/Book: http://www.bcpp.org
Typical recoveries with various multiresidue methods

### GC-Behavior

<table>
<thead>
<tr>
<th>Method</th>
<th>0.0 - 20</th>
<th>20 - 50</th>
<th>50 - 70</th>
<th>70 - 110</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuEChERs (MeCN)</td>
<td>X</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stuttgart (Acetone)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFE (CO2)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DFG S19 (Acetone)</td>
<td>X</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch (Acetone)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian (MeCN)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDFA (MeCN)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Swedish (EtAc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. Alder (MeOH)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainthaber (Acetone)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Detector</th>
<th>Sensitivity</th>
<th>Spectrum</th>
<th>m/z</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSD EI (+)</td>
<td>+</td>
<td>EIC/LC</td>
<td>141</td>
</tr>
<tr>
<td>MSD CI (+)</td>
<td>NoData</td>
<td>NoData</td>
<td>141+</td>
</tr>
<tr>
<td>MSD CI (−)</td>
<td></td>
<td></td>
<td>141+</td>
</tr>
<tr>
<td>TOF EI (+)</td>
<td>NoData</td>
<td>NoData</td>
<td>141</td>
</tr>
<tr>
<td>MSMS EI (+)</td>
<td>NoData</td>
<td>NoData</td>
<td>141</td>
</tr>
<tr>
<td>NFD/ECD J FPD</td>
<td>+++/0/+++</td>
<td></td>
<td>141</td>
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</table>

### LC-Behavior

<table>
<thead>
<tr>
<th>Ionization Source</th>
<th>Sensitivity</th>
<th>MS (m/z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESI (+)</td>
<td>+++</td>
<td>142, 112, 125</td>
</tr>
<tr>
<td>ESI (−)</td>
<td>NoData</td>
<td>142, 125</td>
</tr>
<tr>
<td>APCI (+)</td>
<td>+</td>
<td>142, 125</td>
</tr>
<tr>
<td>APCI (−)</td>
<td>NoData</td>
<td>142, 125</td>
</tr>
<tr>
<td>Author</td>
<td>Message</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Cook B</td>
<td>Does anyone have any experience with the analysis of dithianon in fruit and vegetables using a multiresidue method (e.g. QuECHERS)? Also I have seen very little information on this compound using either LC/MS or GC/MS. Any conditions or recommendations as part of a multiresidue method will be appreciated.</td>
<td></td>
</tr>
</tbody>
</table>
| Labor 31 | Dear Mr. Cook,  
We use in our lab the following LC/MS parameters:  
Universal C18 column;  
Mobile phase: HCOH add 0.01% HCOOH (alternative HAC)  
Eluent 1: HCOH add 0.01% HCOOH (alternative HAC); positive ionization mode  
The pH of the modified QuECHERS (pH 5) (see www.quarchers.com) is good enough to keep it stable over 4-5 days. We have also running some experiments in this matter. Maybe we will updating our posting in the near future. GA give attention to the pKa value of the standard and working solutions, which one should be not higher than 3.  
Greetings  
Benjamin Tadelen, CVUA-S |
| Brown D  | Re: Dithianon  
For MESS try negative i.e. elut with 296=294 or 295=295.  
Hope it works on your system! Good luck!  
Don Brown |

Return to search result
Control strategies - optimal concept

(i) SCREENING to remove the compliant samples - fast, high throughput methods (validated)

Example:

screening for pesticide residues

(ii) CONFIRMATORY method for suspect screening results – mass spectrometry of non-compliant samples (validated methods)
SCREENING FOR TOXIC COMPOUNDS

NEGATIVE samples → ELIMINATION

POSITIVE samples → CONFIRMATION
Groups of Chemical contaminants → The Interface → Emerging technologies
Some technologies aimed at Measuring effects

Chemical → Receptor → Nucleus → Responses → Nucleic acid, Protein, Metabolic

Cytoplasm
Selected genes will then be employed to print tailored DNA and microchips for the development of a low cost high-throughput microarray platform.
From Farm to Fork

Production systems:
- Agriculture
- Fisheries
- Aquaculture

Processing

SAFE, HIGH QUALITY FOODS

From Fork to Farm

Food intake

Health and well-being of consumers

Environmental factors

From Farm to Fork
Evolution of the number of notifications since 1999

- 2000
- 2001
- 2002
- 2003
- 2004
- 2005

Legend:
- Alert
- Information
- Addition to alert
- Addition to information
CONCLUSIONS / SUGGESTIONS

- Organically grown crops for baby food production?
- Employing treatment regimes leaving minimum residues in conventional production; excluding (though complying) persistent pesticides identified in monitoring studies - EU comprehensive databases
- More attention to planning appropriate processing studies, more knowledge on the post-harvest fate of residues
- Biomonitoring for exposure assessment
- Pesticide mixtures (multiple residues) : Introduction of measurement of biological activities exerted by structurally diverse residues or (or mixture thereof) rather than individual concentrations