Diacetyl
Health effects, issues & controls

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Specialist Inspector
HSE
Diacetyl

Popcorn & Roast coffee
What is diacetyl?

- Organic compound
- a.k.a. 2,3 Butandione
- Yellow-green liquid
- Food flavouring
Occurrences

Food containing natural diacetyl:

• Dairy products – cheese, butter, etc
• Alcoholic beverages – beers, wines
• Honey
• Most fruits
• Coffee (beans, grounds)
Uses

Food containing added diacetyl:

• Pseudo-dairy products – margarine, spreads
• Popcorn (microwaved)
• Butterscotch/vanilla flavoured foods
• Vaping solutions
Health Effects

• Bronchiolitis obliterans
• Lung transplant patients
• Exposure to diacetyl
  – Short of breath/wheezing
  – Coughing
  – Reduced lung function - scarring
  – On-set 2 – 6wks after exposure
  – No restorative treatment
### Industrial Injuries Disablement Benefits: technical guidance

**Bronchiolitis obliterans**

C31 | Bronchiolitis obliterans | The use or handling of, or exposure to, diacetyl (also called butanedione or 2,3-butanedione) in the manufacture of:
---|--------------------------|-------------------------------------------------------------
| (a) diacetyl; or         |                                                             |
| (b) food flavouring containing diacetyl; or |
| (c) food to which flavouring containing diacetyl is added. |
HSE [HSL] projects

• 2009 – 2010 – food & flavouring sites

• Handling of diacetyl

• Preparation

• Use

• Controls
Sampling results – Food flavouring

- 9 sites
- 0.01 – 1.7ppm [10 – 1700ppb] - 8hr TWA
- 0.09 – 0.33ppm [90 – 330ppb] – 15min TWA
- 179ppm [179000ppb] – peak (4min) – no local controls!
Controls

- Enclosure
- Pre-mix preparations
- LEV
- Late addition to mix
- Keep cool
- RPE
Benchmarks

- SCOEL – proposed
  - 8hr TWA – 20ppb
  - 15min TWA – 100ppb

- USA – 8hr TWA – 5ppb (?)

- Problems
  - Existing methodology

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62. Diacetyl is a yellow/green liquid with a buttery flavour. It is a naturally occurring substance found in plant oils and food products. It is widely used as a flavouring in food products, although its use appears to be decreasing as initial industry enquiries elicited few responses. None of these responses indicated additional costs might arise. A WEL will be established for this substance. The inclusion of diacetyl in the 4th list of IOELV's was raised by HSE at three separate industry meetings, the Food and Drink Manufacturers Forum, the Federation of Bakers and the Food and Drink Federation and no concerns were raised.
# Limits of Detection

<table>
<thead>
<tr>
<th>METHOD No.</th>
<th>LATEST REVISION</th>
<th>SAMPLING MEDIA</th>
<th>METHOD OF ANALYSIS</th>
<th>LIMIT OF DETECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV2118 (OSHA)</td>
<td>2006</td>
<td>TWO SILICA GEL TUBES (pumped at 50 ml/min)</td>
<td>SOLVENT DESORPTION (EtOH-water); GC-FID ANALYSIS</td>
<td>0.3 ppm (300 ppb) DIACETYL</td>
</tr>
<tr>
<td>1012 (NIOSH)</td>
<td>2008</td>
<td>TWO DRIED SILICA GEL TUBES (pumped at 50 - 200 ml/min)</td>
<td>SOLVENT DESORPTION (EtOH-water); DERIVATISATION WITH PFBHA; GC-ECD ANALYSIS</td>
<td>1.5 ppb DIACETYL</td>
</tr>
<tr>
<td>1013 (NIOSH)</td>
<td>2008</td>
<td>TWO DRIED SILICA GEL TUBES (pumped at 50 - 200 ml/min)</td>
<td>SOLVENT DESORPTION (EtOH-water); GC-FID ANALYSIS</td>
<td>11 ppb DIACETYL</td>
</tr>
<tr>
<td>MDHS 104* (HSE)</td>
<td>2016</td>
<td>THERMAL DESORPTION TUBES (diffusive; 8-hours)</td>
<td>THERMAL DESORPTION; GC-MS ANALYSIS</td>
<td>&lt; 1 ppb DIACETYL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THERMAL DESORPTION TUBES (Pumped; 3-litres)</td>
<td>THERMAL DESORPTION; GC-MS ANALYSIS</td>
<td>&lt; 0.1 ppb DIACETYL</td>
</tr>
</tbody>
</table>

* = General Method for Volatile Organic Compounds
Method development

HSL / HSE-SD

- Sampling strategy
- Sample stability
- Analytical recovery efficiency
- Analytical reproducibility
- Laboratory trials
- Field trials
Coffee Processing
## Coffee processing

<table>
<thead>
<tr>
<th>Process</th>
<th>Concentration</th>
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<tbody>
<tr>
<td>Roasting</td>
<td>10ppb to ≈ 200ppb</td>
</tr>
<tr>
<td>Grinding</td>
<td>200ppb to ≈ 400ppb</td>
</tr>
<tr>
<td>Packing</td>
<td>30ppb to ≈ 80ppb</td>
</tr>
</tbody>
</table>

### Proposed SCOEL

- 20ppb
Where are we now?

As a result from HSE intervention/work with:

- Flavouring manufacturers
- Food sites using flavourings
- Coffee processors

Outcomes:

- Research report RR1021.
- Validated Monitoring method by SD(HSL)
- Increased awareness, appropriate controls adopted
- Some have ceased use/handling
- Appropriate health surveillance regime
- Breweries? Maybe more work needed but no reports of adverse exposures/effects
Thank you for your attention

Any Questions

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