Analysis of acrylamide in food, air and in environmental samples

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History

Railway tunnel at Hallandsås, Sweden September 1997.

- Leach into the nature affecting fish, cattle and humans.
- Analysing Hb-adducts in control groups, unexpected high amounts were found.
- Cooperation Analycen and Dep Environ. Chem, Stockholm, University to find the source.
**Different limits for acrylamide contaminations.**

<table>
<thead>
<tr>
<th>Category</th>
<th>Limit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging material, in foods or simulants</td>
<td>10 µg/kg</td>
<td>EU Commission, 2002b</td>
</tr>
<tr>
<td>Water</td>
<td>0.1 µg/L</td>
<td>EU Commission 1998</td>
</tr>
<tr>
<td>Cosmetics, body-care leave-on products</td>
<td>0.1 mg/kg</td>
<td>EU Commission 2002a</td>
</tr>
<tr>
<td>Cosmetics, other products</td>
<td>0.5 mg/kg</td>
<td>EU Commission 2002a</td>
</tr>
<tr>
<td>Air (occupational exposure)</td>
<td>30 µg/m³ as OEL</td>
<td>AFS 2005:17</td>
</tr>
</tbody>
</table>
Food, biological material

Aqueous extraction of sample (10:1, w/w), addition of internal standard

Extraction with modified pH (Paper IV)

Purification with Oasis HLB, Isolute Multimode SPE

Extraction of air samples (Paper III)

Purification with Carbograph 4 column

Derivatization

HPLC- MS / MS analysis

GC/MS analysis
Types of sample preparation:
Water/methanol/acetonitrile
Deproteinization
Defatting
Salting
ASE
SPE
Used SPE columns for sample preparation:

- Carbograph 4
- Isolute® Multimode
- OASIS® HLB
- AccuBOND II SCX
- Bond Elut AccuCAT
- Bond Elut C18
- Bond Elut Jr-PSA
- ENVI-Carb
- Isolute® MF C18
- OASIS® MAX
- OASIS® MCX
- Sep-Pak® Plus C18
- strata™-X-C
Used columns for LC:

Hypercarb®
Aquasil C18
Aminex HPX-87H
Inertsil ODS-3
IonPac® ICE-AS1
LiChrosphere® CN
LiChrosphere® 100 CN
Luna® C-18
Luna® Phenyl-Hexyl
Mightysil RP-18 GP
PrimeSphere™ C18-HC
Shodex™ RSpak DE-613
Shodex™ Sugar KS-801
Synergi™ Hydro-RP
Synergi™ Polar-RP
YMC-Pack™ ODS-AQ™
End determinations
Most common:
LC-MSMS
GC-MS

Also:
GC-EC
LC-UV/EC
Capillary electrophoresis
NIR
Standardized method?
Coming, LC-MSMS method.
GC-MS later

Need for less cost intense methods!
Water:
High sensitive LC-MSMS can do analysis with direct injection acc to directive in "pure" water.
Cosmetics
Can be more complex than food products.
Monomeric compounds in polyacrylamide and similar compounds.
Air sampling
Collect with
- Impinger flasks
- Different solid phase columns
Air sampling
-Kitchen
-Laboratory trial
-Dry matter determinations
Source of acrylamide:
Food
Up to 10% volatile (LWT, in press)
Smoke
Different extractions?
LWT, 2006, 39, 392-398
The normal analytical method for acrylamide monomer in food is not appropriate for analyzing residual acrylamide in polyacrylamide. Many authors have published methods for that purpose. These methods included the use of organic solvents, which shrank the polyacrylamide.
When increasing pH to 10-12 in a solution of polyacrylamide, it starts to deamidate (Muller 1981; Morawetz, Sawant & Suen 1981; Sawant & Morawetz, 1984) and swell (Mallo, Candau & Cohen 1985). This swelling can open up the polyacrylamide structure, so that residual acrylamide can be released into the solution.
Conclusion

Many methods available, mostly based on LC-MSMS and GC-MS
Normal water extraction enough.
Some acrylamide evaporates.
Acrylamide formation in heated biological materials, not only foods.
Other sources?
Acknowledgment

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