MINISTERSTVO ZEMĚDĚLSTVÍ

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European Food Safety Authority

VYSOKÁ ŠKOLA CHEMICKO-TECHNOLOGICKÁ V PRAZE

FOOD RESEARCH IN SUPPORT TO SCIENCE-BASED REGULATIONS:

Challenges for Producers and Consumers

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Prague Congress Centre, Czech Republic

Food Processing Contaminants – Progress and Challenges in Mitigation Strategies

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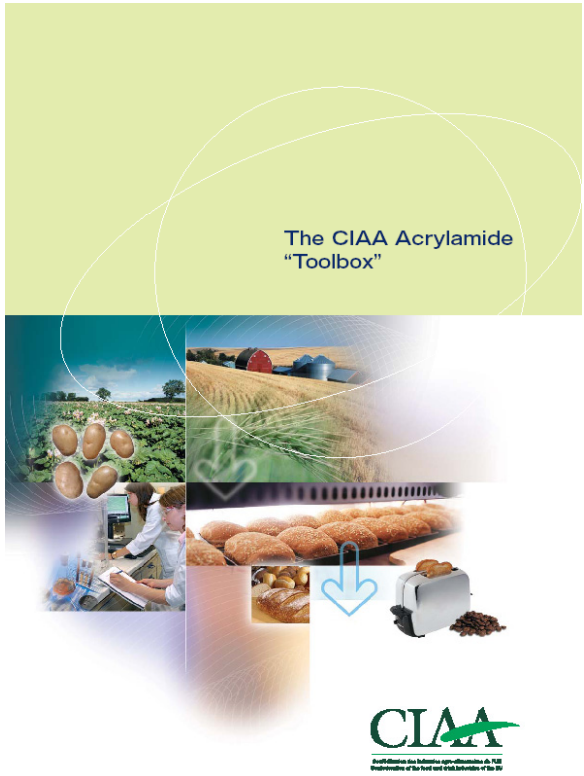
Content

- Acrylamide: the CIAA “Acrylamide Toolbox”
- Furan
- 3-MCPD Esters
- Conclusion

CIAA Acrylamide Toolbox

- CIAA Acrylamide Toolbox updated February 2009
- Grocery Manufacturers Association (GMA) USA information integrated into the Toolbox; endorsement and review
- Progression toward a « global » Toolbox
- Acrylamide « pamphlets » modified accordingly



Key updates: Toolbox

- 14 parameters, « Processing: Asparaginase » listed as a separate tool
- "Recipe: Raising agents (e.g. ammonium and sodium salts)" modified to better reflect the content of the tool
- Sectorial reviews (CAOBISCO, ESA, UEITP = EPPA) included
- Information from Switzerland on sugar contents in potatoes taken into consideration
- Latest scientific publications and projects (e.g. BLL, Germany) included where relevant

- **Processing**
  - Fermentation
  - Thermal input and moisture control
  - Pre-treatment (e.g. washing, blanching, divalent cations),
  - Asparaginase

Agronomical: sugars
Potato products

Industrial scale

Minimising sugars has been part of standard manufacturing practice

Selection of potato varieties with low reducing sugars that are suitable for the product type is key

- Lot selection based on reducing sugars content (crisp industry) or colour assessment of a fried sample (French fry industry)
- Controlling storage conditions from farm to factory; use of sprout suppressants following GAP; reconditioning at higher temp.
- Ensure that tubers are mature at time of harvesting

Processing: Asparaginase

Cereal products (bread, crispbread, biscuits/bakery wares, breakfast cereals)

Industrial and Pilot scale

Applied to commercial products (e.g. gingerbread, crispbread, short sweet biscuits, RTE cereals, certain cereal-based snacks) with potential also in other biscuit and cereal product types

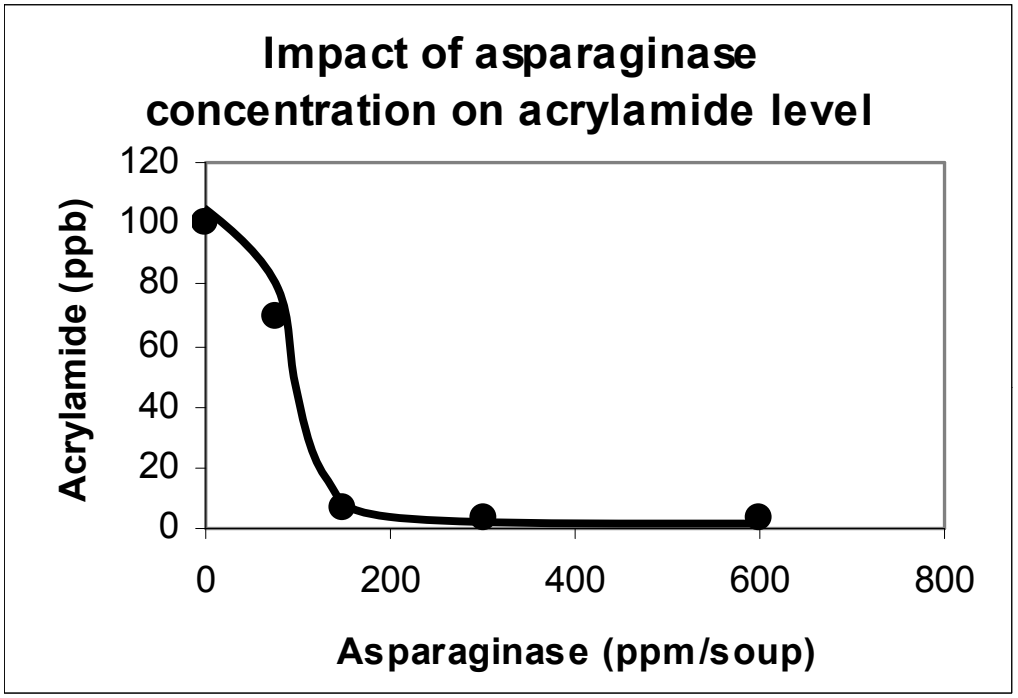
- Significant reductions (~70-90%) achieved through the use of asparaginase in certain cereal dough-based snacks
- Certain products are today produced with the use of asparaginase without any quality issues, e.g. gingerbread, crispbread and short sweet biscuits
- No significant Asn reduction in a cooked and toasted coarse grain cereal

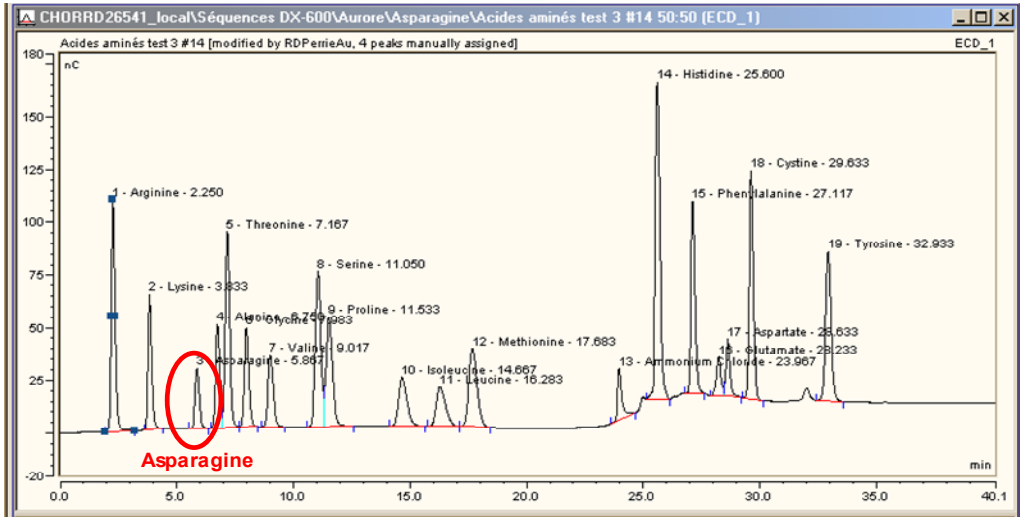
Cereal Product Asparaginase

- Pilot runs: reduction of acrylamide >80%
- Scale-up to factory conditions: ca. 40% reduction

Key Parameters

- Temperature increase required (25°C)
- Enzyme conc, 120 mg/kg
- No impact on organoleptic properties





Processing: Asparaginase
Coffee & Coffee Mixtures

Lab scale

Assessment of the opportunity to reduce the acrylamide levels in roast coffee through a treatment of green coffee with asparaginase is under way

Significant reductions in green coffee Asn levels after an enzyme treatment (20-40% lower acrylamide) after roasting with magnitude depending on roast/blend conditions and when compared to an untreated coffee which has been roasted under same conditions.

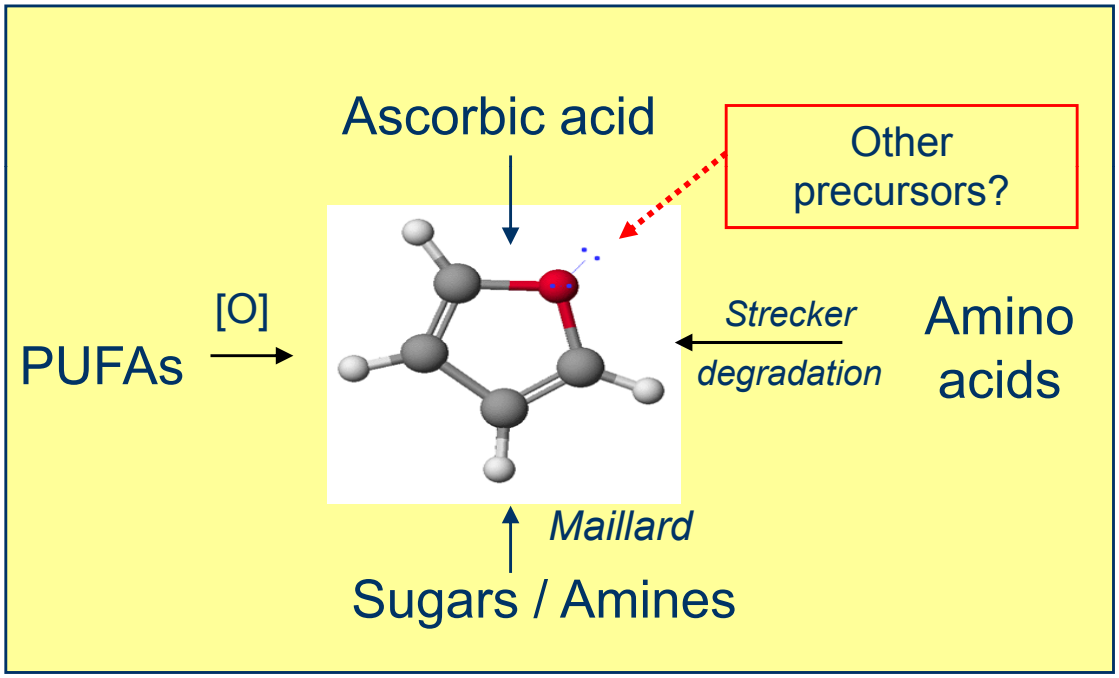
However, the full impact assessment needs to include the following considerations:

- Sensorial evaluations of trial samples showed significant differences in flavour
- Scaling up ……
- Assess if this reduction will not get almost "neutralized" during typical shelf life period of roast coffee

Furan
Several routes of formation

Potential considerations based on model system studies

- "Optimized" amounts of antioxidants in recipes
- Possible addition of PUFA after heat-treatment
- Impact of heat treatment in case of ascorbic acid fortification



FURAN: European Coffee Industry Task Group project*

Objective

To understand Furan formation potential at roasting and the effect of subsequent processing steps and the consumer practices

Key Findings

- Amounts are significantly reduced until the coffee is finally consumed (< 10 % of initially formed furan at roasting gets into the cup)
- Levels directly after roasting are dependent on roasting conditions
- Many desired coffee aroma components are volatile as well

  measures to retain aroma components for quality reasons will also limit furan losses

Guenther et al. Submitted: Food Additives & Contaminants 2009

Furan: Key Findings (Examples)

Grinding	At grinding furan levels are reduced. Fine grinds (< 300 µm) from same coffees will typically result in lower levels (up to 40%)
Opened packages during use-up period	Roast & Ground coffee packages typically contain coffee for more than one brewing. Any re-opening will allow furan losses (20-25%). This effect needs to be considered when targeting to determine typical R&G analytical data for exposure estimates

Furan: Key Findings (Examples)

Brewing and keeping coffee hot	Significant losses of furan occur at brewing. Brewing conditions (temperature, time, design of equipment) are determinants
Brew recipe	Higher brew recipe = higher furan levels per ml of brew (espresso preparation may have higher furan brew concentration but cup volumes are lower and overall consumption rate compared to standard coffees is less)

3-MCPD esters
Intensive efforts to close knowledge gaps

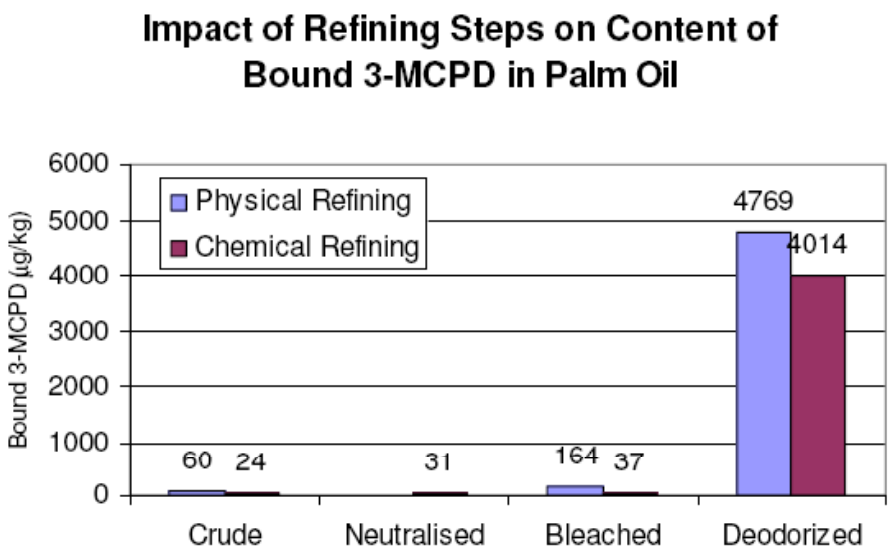
Säuglingsanfangs- und Folgenahrung kann gesundheitlich bedenkliche 3-MCPD-Fettsäureester enthalten

Stellungnahme Nr. 047/2007 des BfR vom 11. Dezember 2007

- Need for further research on the formation of 3-MCPD esters
- Efforts should be made to reduce the levels of 3-MCPD esters in edible oils, foods containing fats, and infant formulas

3-MCPD esters
Key results of industry-driven projects*

- Seed oils typically considerably lower in MCPD esters than palm-based fats
- Deodorization: key process step for the formation of MCPD esters during refining (temperature)
- Variation of classical refining parameters (deodorization time and temperature) does not allow to reduce the MCPD ester content in fully refined oils
- Chemical *vs*. physical refining: not a significant difference in the MCPD ester content



** FEDIOL presentation, ILSI / EC Workshop, 5/6 Feb, Brussels. http://europe.ilsi.org/events/past/PresentationsMCPDworkshop.htm*

3-MCPD esters
Key results of industry-driven projects

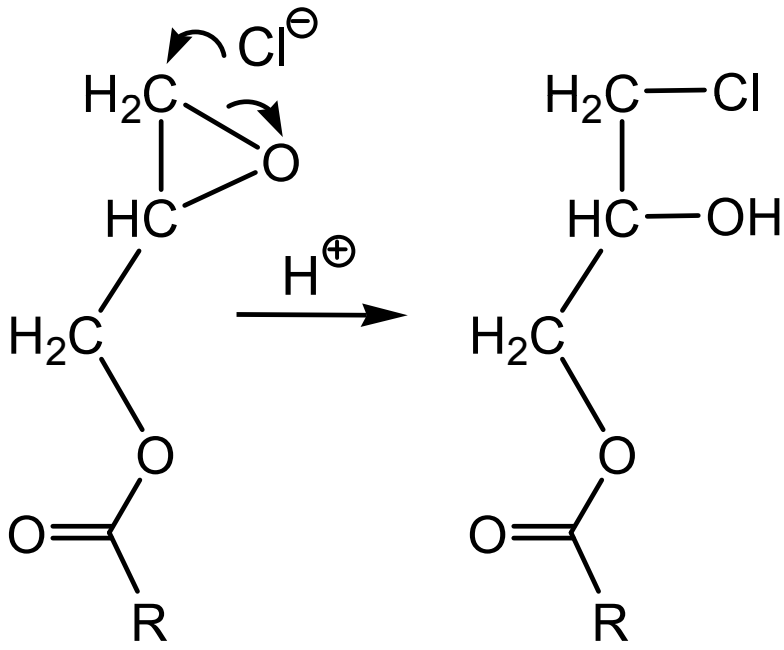
- Clear link between precursors like chloride and diglyceride content could not yet be established
- Parameter(s) triggering the formation of MCPD esters not yet elucidated

Conclusion

- Currently not possible to produce palm-based fats low in MCPD esters
- More understanding of formation mechanisms is required
- FEI/BLL research project to assess technological possibilities to minimise 3-MCPD esters in refined oils *(refining conditions, model studies, mitigation*)

Glycidol esters in refined vegetable oils
A new concern ?

- For glycidol esters in vegetable oil : no direct method of analysis and no capability to reliably quantify the glycidol esters
- No toxicological studies on the esters
- No studies on possible hydrolysis of the esters *in vivo*
- No knowledge on the mechanism(s) of formation of the esters in refined vegetable oils



Conclusion

Awareness that food contains a multitude of different compounds with many health beneficial and potentially hazardous effects

Apply a holistic approach: evaluate the potential risks of individual compounds (e.g. acrylamide, furan) together with the health benefits of the food (e.g. whole grain, PUFAs)

…… risk-benefit modelling as a basis for defining priorities and to support management decisions

Thank you !

The balanced diet …..

… for health and wellness