FOOD RESEARCH IN SUPPORT TO SCIENCE–BASED REGULATIONS:

Challenges for Producers and Consumers

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Food Processing Contaminants – Progress and Challenges in Mitigation Strategies

Dr. Richard Stadler, Nestlé Product Technology Centre, Orbe, Switzerland
• 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

<table>
<thead>
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<th>Processing</th>
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<td>o Fermentation</td>
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<td>o Thermal input and moisture control</td>
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<td>o Pre-treatment (e.g. washing, blanching, divalent cations)</td>
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<td>o Asparaginase</td>
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Agronomical: sugars

Potato products

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

Industrial scale
Minimising sugars has been part of standard manufacturing practice
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
**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

- 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

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

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

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 \textit{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