AOAC Europe Section

International Workshop
'Foods to Dye for – Contaminants-sampling, analysis, legal limits'

Monday 6th – Tuesday 7th November
Limassol, Cyprus

Acrylamide: Industry Perspectives

Richard Stadler, PhD

Nestlé Product Technology Centre
Orbe, Switzerland

Content

- Activities of the Acrylamide Techn. Expert Group
- CIAA Acrylamide «Toolbox » & Fundamental Research
- Communication to SME’s
- Challenges ahead

Acrylamide Techn. Expert Group

- Advisory group to FCPC
- « Technical » Expert Group
- Non-Industry Experts included
- Scope recently extended to encompass all major process toxicants (furan, MCPD, ….)

CIAA Techn Expert Group
« Acrylamide Agenda »

- **Commitment** to investigate all possible avenues of reduction *(incl. funding fundamental & applied research)*

- Continue with the established **momentum** in finding practical solutions

- Regular exchange of progress openly and **transparent**ly within the Expert Group and with all stakeholders (*meetings, publications, networks, etc.)*

Activities of the Techn Expert Group

- CIAA and EC Stakeholder meetings and Expert Workshops *e.g. March 2003*, February 2004*, Jan 2005, June 2005, March 2006*
- two peer-reviewed scientific publications
- > 20 publications related to industry research
- acrylamide status report (Dec 2004)
- **acrylamide Toolbox**

*DutchVWA/UK FSA/CIAA Workshop March 2003; EFSA Workshop Nov 2003

June 2006

Food Additives & Contaminants

Special Issue on:

Update on the Progress in Acrylamide and Furan Research

Presented during the DG Sanco/CIAA sponsored Workshop "Acrylamide" (16/17 March 2006), and Joint DG Sanco/EFSA/ DG JRC Workshop "Furan in Food" (19 May, 2006).

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Submission to 'Food Additives and Contaminants'

Only papers submitted by the deadline of November 1st 2006 will be published in the Special Issue – there will be no reminders and this deadline is absolute

You can only submit electronically and you do this by setting up an Account through "Manuscript Central" at:

http://mc.manuscriptcentral.com/tfac

More than 600 articles in the HeatoxNews database.

- ☞137 on Formation and Chemistry
- ☞133 on Ways to reduce

theheatoxproject

http://www.ciaa.be/documents/positions/The%20CIAA%20Acrylamide%20Toolbox.pdf

CIAA

Confédération des industries agro-alimentaires de l'UE
Confederation of the food and drink industries of the EU

The CIAA Acrylamide "Toolbox"

Avenue des Arts, 43 • B-1040 Bruxelles
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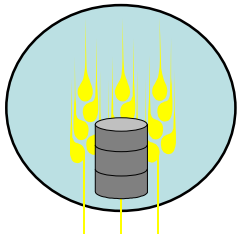
Toolbox 23 Sept 2005
Rev.6
ISSN number 1782-1584

Acrylamide: Toolbox format

Agronomic

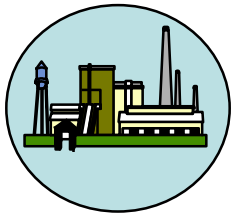


- Sugars
- Asparagine

Recipe

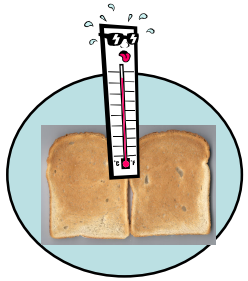
- NH_4HCO_3
- pH
- Minor ingredients
- Dilution
- Rework

Process



- Fermentation
- Thermal input
- Pre-treatment

Final Preparation



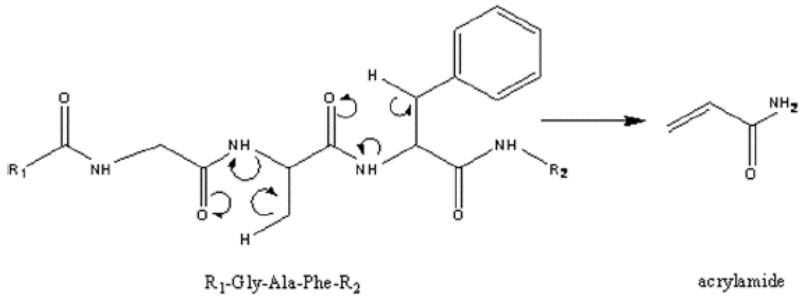
- Color endpoint
- Texture/flavour
- Product storage/ shelf life/ consumer prep.

- ✓ **Guidance to assist in reducing AA levels in food**
- ✓ **Not meant as a formal prescriptive manual**
- ✓ **« Live » document**

CIAA

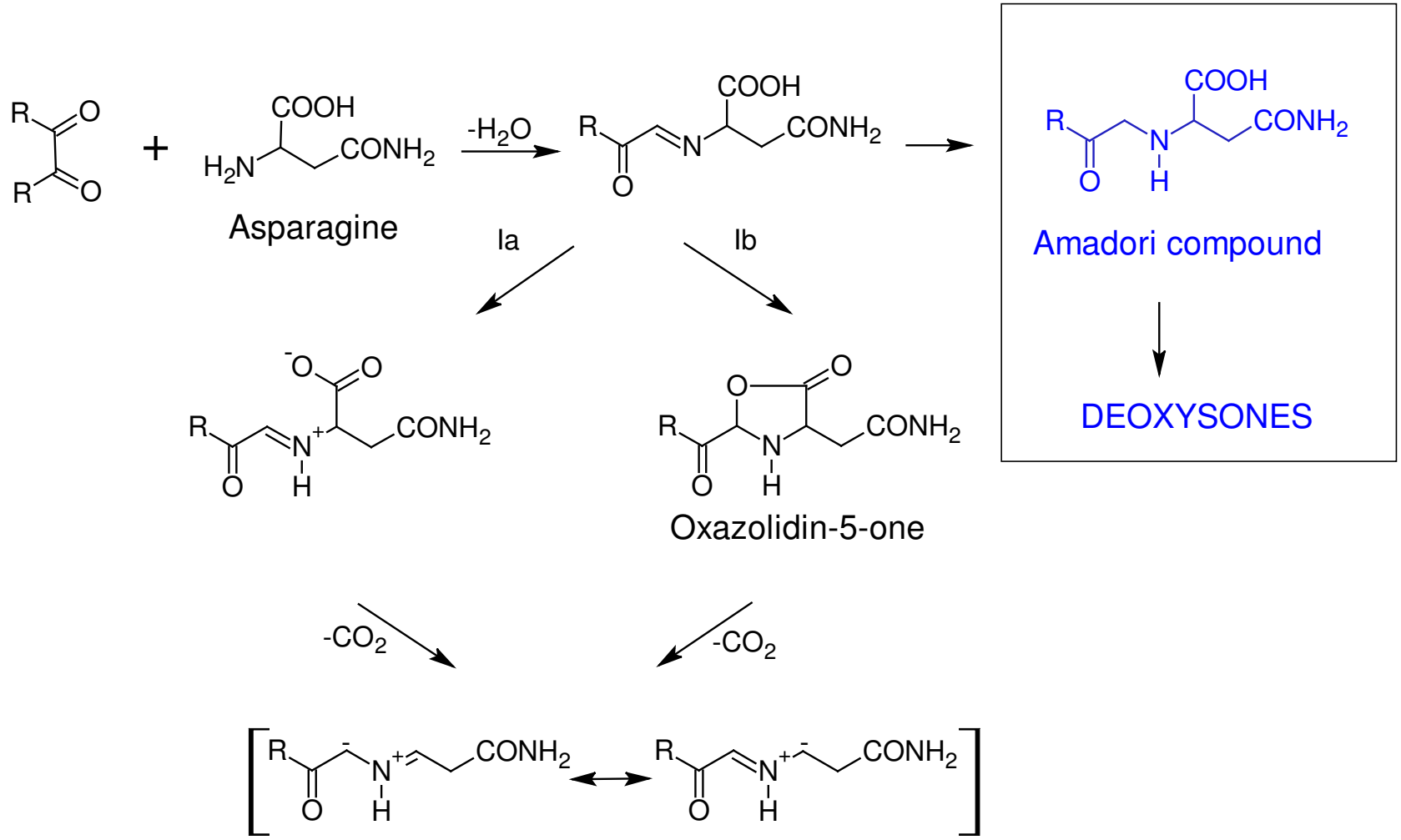
Fundamental Research

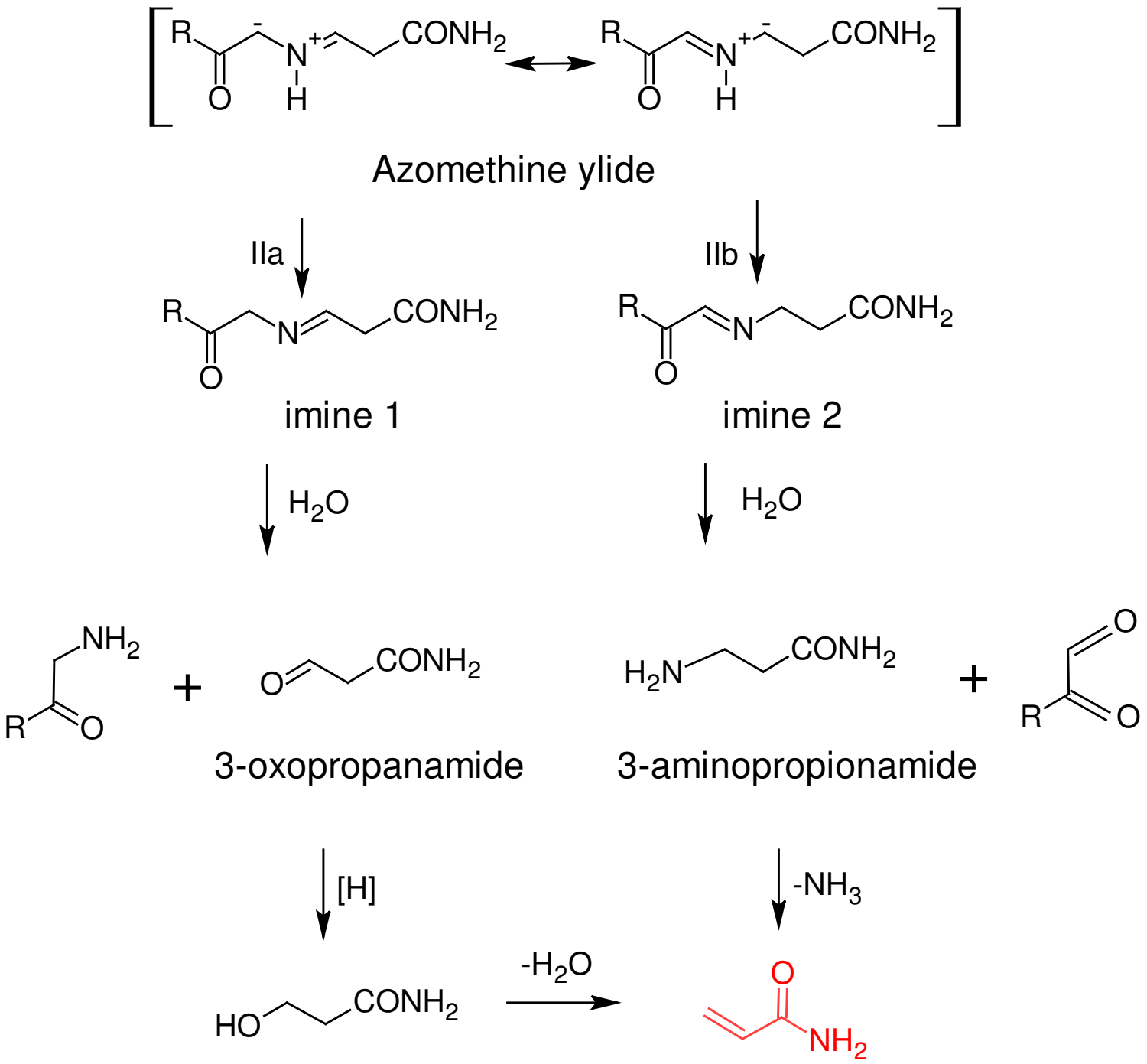
- Impact of extraction conditions on [acrylamide] at high pH
  FAC, Goldmann et al. 2006
- New formation pathways
- Ongoing work on mechanisms of formation



Mol. Nutr. Food Res. 2006, *50*, 87 – 93

Zyzak *et al.*, Yaylayan *et al.*, Stadler *et al.*, 2003-2004




Azomethine ylide
IIa
IIb
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3-aminopropionamide
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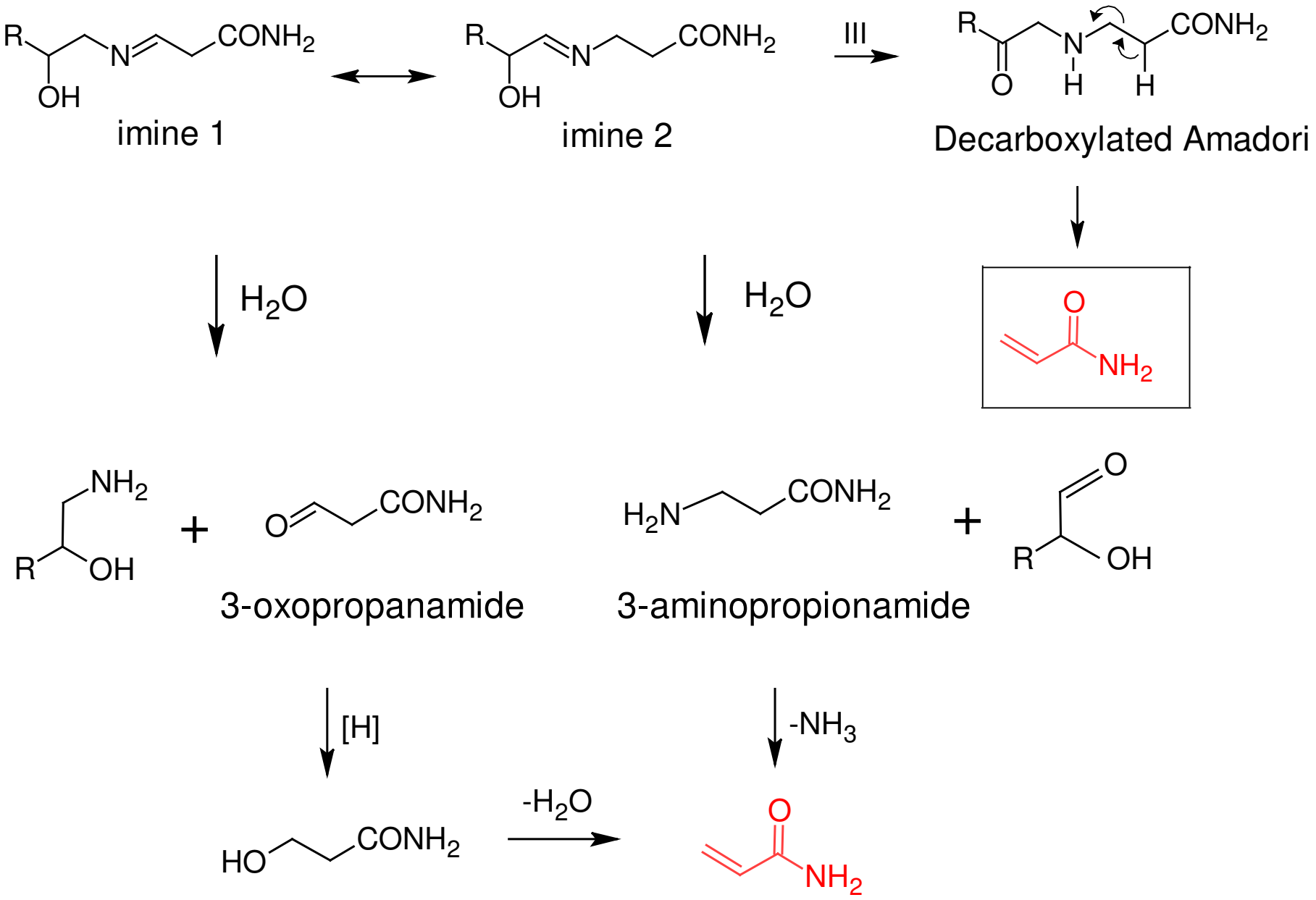
$-H_2O$


R
N
CONH2
OH
imine 1
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III
O
H
Decarboxylated Amadori
H2O
NH2
3-oxopropanamide
H2N
3-aminopropionamide
[H]
-NH3
HO
-H2O

Role of 3-APA

- 3-APA is a key transient intermediate in the formation of acrylamide
- It may in certain foods serve as an indicator of the potential of a food to form acrylamide during thermal processing
- 3-APA is a potent precursor of acrylamide, e.g. when foods are re-heated
- *(indicator of acrylamide formation in re-work applications ?)*

Modified: *Schieberle, Brussels, 16-03-2006*

Sector activities: potato crisps

Tools to try

- Variety selection
- Storage conditions > 6℃
- Reconditioning
- Process management - color
- Formed crips- partial potato replacement
- Blanching
- Vacuum frying

Future opportunities

- New varieties (sugar, storage qualities)
- Agricultural practices
- Potato varieties with lower Asn
- Asn-ase treatment: formed crisps
- Effect of Ca2+ addition – fabricated crisps

Sector activities: bread, bakery wares and breakfast cereals

Tools to try

- Ammonium bicarbonate replacement
- Fructose replacement
- Color / moisture specification change
- Oven condition optimization
- Substitution with < Asn raw materials

Future opportunities

- Low Asn raw materials
- Agricultural practices
- Asparaginase
- Fermentation (e.g. yeast)
- Oven profile optimization
- Innovative processing
- Amino acid addition (e.g. glycine)

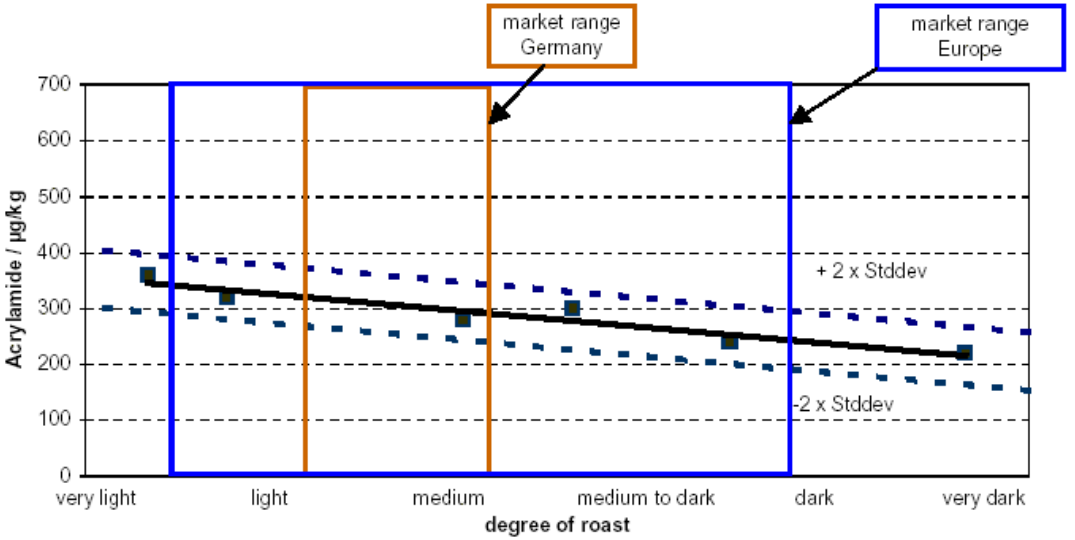
Acrylamide: CAOBISCO results

- **105** approaches investigated
  - **39** changes already applied to products on the market
  - **8** could be implemented without any alteration of the product quality.
- Even with significant changes to recipes and/or processes, only modest reductions in acrylamide were achieved, often at the expense of quality.
- Direct conflict with health targets such as salt reduction, and use of wholegrains.

Sector activities: coffee

Tools to try

- Roasting time *
- Dark roasting *



Future opportunities

- Inherent compounds that irreversibly « bind » acrylamide
- New roasting technologies (e.g. steam roasting *)

** Major impact on organoleptic quality*

FOOD manufacture
THE INFORMATION RESOURCE FOR FOOD AND DRINK PROCESSING

Food to die for?

Fearful that a carcinogenic ingredient may be cancerous to its reputation, the food industry is pulling out all the stops to cut acrylamide levels. Sarah Britton reports

By Sarah Britton

Published: 01 April, 2006

Page 28

An ingredient associated with cancer is every food manufacturer's nightmare and, while UK consumers are currently oblivious to the danger, the industry isn't taking any chances.

"Acrylamide is not something that manufacturers can ignore," says Snack, Nut and Crisp Manufacturers Association (SNACMA) scientific regulatory affairs manager Dr Robert Foot. Any responsible processor recognises that work needs to be done to reduce acrylamide levels, he says.

" But without legislation or pressure from retailers or consumers, some smaller manufacturers have little incentive to reduce acrylamide levels in their products -- especially when other business issues are more pressing."

"Currently we aren't doing anything to reduce levels," admits ……

….. SME's are not getting the (right) message !

Acrylamide Pamphlets will help reach out to SMEs

… for the different sectors* to promote the contents of the Toolbox to SMEs, particularly those who are not members of trade organizations

*French fries, fried potato products, bread, biscuits

A "Toolbbox" for the Reduction of Acrylamide in Biscuits,Crackers & Crispbreads

Acrylamide

Acrylamide is a chemical that is produced naturally5 in foods as a result of high-temperature cooking. (e.g., baking, grilling, frying). Acrylamide can cause cancer in animals and experts believe it can probably cause cancer in humans. Although acrylamide has probably been part of our diet since man first started cooking, because of concerns over safety, world experts have recommended that we reduce the levels of acrylamide in foods.

Acrylamide has been found in a wide variety of foods, including those prepared industrially, in catering and at home. It is found in staple foods such as bread, potatoes as well as in some specialty products such as crisps, biscuits and coffee.

The CIAA Acrylamide Toolbox

Following the discovery of acrylamide in food, the food industry took action to investigate how acrylamide is formed in foods and possible methods that can be employed to reduce levels of acrylamide in foods. The European Food and Drink Federation (CIAA) coordinated the efforts of industry and pooled the results together to produce the Acrylamide Toolbox.

What does the Toolbox do?

- Details existing meth[illegible] red[illegible] acrylamide in foods
- Allows users to [illegible]ss [illegible] evaluate which reduc[illegible] to use

This brochure is designed to help manufacturers of Biscuits,Crackers and Crispbreads. For detailed advice contact CAOBISCO (EU Association of Chocolate and Confectionery) at www.caobisco.be

What can you do?

- Use this brochure to identify methods that you can use to reduce acrylamide levels
- Not all methods will apply to your manufacturing needs
- You will need to examine your production methods, recipes, product quality and national legislation in order to identify the most appropriate "tools".

Acrylamide in Biscuits,Crackers & Crispbreads

Methods of formation

- Acrylamide is formed via the reaction of asparagine, which is naturally present in flour, and reducing sugars such as fructose and glucose .
- Acrylamide is formed at temperatures higher than 120 °C
- The amount of acrylamide formed depends on
  - Recipe
  - Baking time/temperature

Tools to Try

- Replacement of ammonium bicarbonate with other raising agents
- If possible avoid using fructose
- Do not over bake

Methods of Reduction for Biscuits,Crackers and Crispbread

The following "Tools" have been used successfully to reduce levels of acrylamide in some varieties of product. However owing to the vast range of different recipes,ingredients and processes used in traditional biscuit manufacture there is no simple way to reduce acrylamide formation.For example, fermented crispbread generally contains substantially less acrylamide than non-fermented crispbread, but each has it's own distinctive characteristics.Manufacturers are advised to select those "Tools" that are most suitable to the type of product that they are producing and to contact the EU Association of Biscuit,Chocolate and Confectionery (CAOBISCO) for more detailed advice.
caobisco@caobisco.be

Manufacturing Stage	Reduction Measures	Comments
Recipe	When raising agents are used, for example in hard sweet biscuits, replacement of ammonium bicarbonate sometimes works.Alternatives are potassium carbonate with potassium tartrate or disodium diphosphate with sodium bicarbonate.	There may be an impact on loss of stack hight, flavour or texture.If sodium salts are used as an alternative take care not to end up with excessive sodium in the finished product
	Fructose, [illegible] used in products like gingerbread [illegible] ed with glucose.On[illegible] ucose syrups sh[illegible]	Carefully monitor the effect on finished product colour and flavour
	[illegible] pr[illegible]s are [illegible] om a nutrition[illegible] taste point of vie[illegible] ess [illegible] meal [illegible] will be formed	Significantly lowering the wholemeal content will reduce the nutritional quality of the product.
Processing: Baking Co[illegible]s	Baking at a lower temperature for a longer time, but to the same final moisture content has been effective in lowering acrylamide in some products.	The product will inevitably have a less dark, less 'baked' colour. Take care not to underbake the product as this could lead to microbiological problems on storage.

How will the pamphlets be used ?

- It is important to obtain the authorities' endorsement, as they will be expected to promote the pamphlets to SMEs while industry delivers the technical content

- In order to facilitate access to SMEs, it is also vital that these papers be translated

Challenges ahead .....

No common solution !

Toolbox concept shows different measures/ combinations to achieve moderate reductions

In many food categories no reductions achieved so far (exhausting all currently available options)

Need to address urgently possible measures at agronomical level

....and keep in mind:

- **Total product quality**
  - The consumer is the judge
  - Quality is competitive
- **Risk/benefit considerations**
  - **Understand** the impact of mitigation steps on safety, nutritional and organoleptic properties
  - **Position** the relevance of the suspected side effects of mitigation measures
  - **Quantify** their potential impact.