



A “Toolbox” for the Reduction of Acrylamide in Fine bakery wares

Acrylamide

Acrylamide is a substance that is produced naturally in foods as a result of high-temperature cooking (e.g. baking, grilling, frying).

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

Acrylamide in food potentially increases the risk of developing cancer for consumers in all age groups. It is therefore of major importance for the protection of public health that mitigation measures are applied to reduce the levels of acrylamide in food as low as reasonably achievable.

The FoodDrinkEurope Acrylamide Toolbox

Following the discovery of acrylamide in food, the industry and other stakeholders, including regulators, took action to investigate how acrylamide is formed and the possible methods that can be employed to reduce levels of acrylamide in foods using the ALARA principle. FoodDrinkEurope initiated and continues to coordinate efforts and pool results together to update the Acrylamide Toolbox.

What does the Toolbox do?

- Details existing methods to reduce acrylamide in foods
- Allows users to assess and evaluate which reduction measures to use and at which production step
- Assists in implementing Commission Regulation (EU) 2017/2158, with the aim to achieve levels of acrylamide as low as reasonably achievable

ALARA

ALARA is an acronym for the concept “As Low As Reasonably Achievable”. This simply means that a Food Business Operator (FBO) takes appropriate measures to reduce the presence of a given contaminant in a final product to a minimum: taking account of the risk presented, but also taking account of other legitimate considerations, such as potential risks from other contaminants, organoleptic properties and quality of the final product, and the feasibility and effectiveness of controls.

To ensure continuing compliance with the ALARA concept the FBO should monitor the effectiveness of the implemented measures and should reassess these as necessary.

What can you do?

- Use this brochure to identify methods that you can use to reduce acrylamide levels.
- You will need to examine your production methods, raw materials, recipes, product quality and national legislation in order to identify the most appropriate “tools”.

- Consider that not all methods will apply to your manufacturing needs.
- You will need to assess the effectiveness of the mitigation measures by monitoring and use of the benchmark levels as performance indicators
- When benchmark levels are exceeded, you will need to review the mitigation measures applied and adjust processes with the aim to achieve levels as low as reasonably achievable below the benchmark level.

Acrylamide in Fine bakery wares

This brochure is designed to help manufacturers of fine bakery wares. For more detailed advice contact the European Association for Chocolate, Biscuits and Confectionary Industries (CAOBISCO) at caobisco@caobisco.eu

Read the full toolbox at:

<https://www.fooddrinkeurope.eu/publication/fooddrinkeurope-updates-industry-wide-acrylamide-toolbox/>

Methods of formation

- Acrylamide is formed via the reaction of asparagine and reducing sugars.
- Acrylamide is formed at temperatures higher than 120°C
- The amount of acrylamide formed depends on:
 - Temperature
 - Baking time
 - Recipe

Methods of Reduction for Biscuits, Crackers and Crispbread

The following “Tools” have been used successfully to reduce levels of acrylamide (AA) in different varieties of Fine bakery wares. 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 in Fine bakery wares. Manufacturers are advised to select those “Tools” that are most suitable to their type of product, process methods and product quality specification.

Raw Materials Selection	Recipe Design	Process Design	Finished Product Attributes
<ul style="list-style-type: none"> Sugars composition of cereal grains is not a key determinant of AA formation. Sulphur-deprived soils have been shown to impact the free asparagine (Asn) concentrations in certain cereal crops considerably. Less sulphur in the soil results in higher Asn levels in the crop and therefore higher risk of AA formation. Late and/or excessive application of nitrogen may increase free Asn and total free amino acid concentration in wheat and other cereals, causing a concomitant increase in AA forming potential. Fungal pathogen infection causes a significant increase in free asparagine concentration in cereal grain. Important to apply best practices on crop protection measures to prevent fungal infection 	<ul style="list-style-type: none"> If less wholemeal flour is used, less acrylamide will be formed, but will compromise the product’s organoleptic and nutritional properties. Replacing ammonium bicarbonate (fully or partly) with alternative raising agents (such as sodium bicarbonate and acidulants, sodium bicarbonate and disodium diphosphates with organic acids or potassium variants thereof) is a demonstrated way to relatively lower AA in certain products and on a case-by-case basis. For certain products asparaginase can be utilised, as it has proven to be one of the most efficient tools to reduce AA levels. However, trials have shown that there is limited or no effect in recipes with high fat content, low moisture or high pH value. Different types of grain typically contain different Asn-levels. Typical asparagine levels in grain cereals are: rye > oats > wheat > maize > rice. Hence, a partial replacement of wheat flour with an alternative grain flour can be an option; 	<ul style="list-style-type: none"> Heat treated co-ingredients such as roasted/toasted nuts and oven dried fruits are potential fructose sources that may have the potential to raise acrylamide levels in the final product. For relevant products, and when the product design allows, replacing fructose or fructose-containing ingredients (e.g. syrups, honey) with glucose or non-reducing sugars (e.g. sucrose) is seen an effective tool to reduce the AA formation - particularly in recipes containing ammonium bicarbonate. Considerations should accordingly include that replacing fructose or other reducing sugars may result in a modified product identity due to loss of flavour and colour formation. The addition of organic acids/ pH adjustment, in combination with other recommendations, may result in lower AA levels. Decreasing the pH will influence the Maillard reaction in the direction of decreased AA formation. This option, however, has its limitations as it may result in organoleptic changes (less browning, modification of taste). 	<ul style="list-style-type: none"> The Maillard reaction, which leads to the production of AA, also produces the colours and flavours which give baked cereal products their essential characteristics. If, though, one was able to produce lighter coloured and less baked products, without increasing the moisture content, the AA level could theoretically be reduced. Be cautious not to underbake the product as this could lead to microbiological problems during storage. Increasing the moisture specification for the final product and process can be a feasible measure if quality (incl. physical properties), shelf life and food safety standards are equally maintained. Whole meal products are desirable from a nutritional and taste point of view