Federation of the European Union Manufacturers and Suppliers of Ingredients to the Bakery, Confectionery and Patisserie Industries

POSITION PAPER
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Position paper on Acrylamide in bread and bread products and the role of bread improvers

Introduction

Acrylamide is a food contaminant that can be formed in foods when heated above 120 °C, if carbohydrates, especially reducing sugars, and free asparagine are present. Grain and potato based foods are mainly affected. Acrylamide is proven to be a genotoxic and carcinogenic substance in animal studies. Epidemiological studies indicate that in humans the relative risk is low and the evidence is not consistent[2].

Relevance and prevalence of acrylamide for bread and bread products

Bread contributes for 10% (Netherlands) to 14% (Sweden) to our daily intake of acrylamide, although subpopulations experience higher exposures (e.g. 19% for adolescents in Belgium)[2]. Nevertheless total intakes are so low that the Food Standards Agency (UK) advises not to alter diets or cooking methods of consumers[1].

The levels of acrylamide in breads (192 samples) varied between 5 and 1987 µg/kg, with an average of 30 µg/kg[2]. Normal bread types (rye, wheat; white, wholemeal; loaf, bread rolls) seldom exceeded 30 µg/kg. The levels in fine bakery wares (puff pastry , laminated doughs, fried bread, etc.) were on average higher: 145 µg/kg (minimum 4 and maximum 3324 µg/kg)[4].

The number of data on levels of acrylamide in bakery mixes is very limited. From the relative lack of variability within the broad range of bread types it seems likely that the bread improver composition has little impact on the formation of acrylamide[4].

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Formation of acrylamide in bread[3] and the role of bread ingredients

Acrylamide is formed at temperatures above 120°C and below a moisture content of 10%, moisture content being more important than temperature. This means that the crust of bread is the most likely place where acrylamide is formed. Prolonged toasting of baked bread will increase acrylamide levels[1].

Asparagine is one of the precursors of acrylamide. The asparagine level is high in bran and consequently wholemeal has a higher level than white flour. From the limited analytical data that are available (n=48) of white and wholemeal wheat and rye breads and rolls, no difference in acrylamide level was obvious. Asparagine level can also be increased by sour dough processes. This will be counteracted by the lower pH that is unfavourable for acrylamide formation

In view of the invariability in acrylamide level of a broad range of bread types it can be inferred that the effect of bread ingredients on the formation of acrylamide.

The enzyme asparaginase is effective in reducing the asparagine level in dough and thus the acrylamide levels in bread.

Next to the oven conditions fermentation time determines to a large extent the level of asparagine and thus the acrylamide formation. After 60 min yeast fermentation asparagine is reduced to a low level.

Solutions

Very pragmatic solutions for reducing the formation of acrylamide are provided in the CIAA toolbox[5] and the toolbox for reduction of acrylamide in bread products[6]. In 2009 the Codex Alimentarius also adopted a code of practice to reduce acrylamide in foods which is based on the CIAA toolbox[7].

Processing:
- Longer fermentation times
- Lower baking temperatures

Raw material selection:
- Flour with low asparagine level. In practise this is difficult to achieve.
- Select malt products with low levels of acrylamide

Recipe:
- Use of the enzyme Aspariginase
- If used: replacement of ammonium bicarbonate by sodium or potassium variants
- Use of calcium salts (calcium carbonate, lactate or sulphate).

Consumer/industrial secondary preparation:
- Minimise toasting time

Literature

1. Federation of Bakers Position statement on acrylamide (Federation of Bakers, March 2005)
2. EFSA Scientific Colloquium no 11, Acrylamide carcinogenicity. New evidence in relation to dietary exposure, Tabiano, Italy, May 22-23 (2008)
3. Konings, E.J.M., Ashby, P., Hamlet, C.G. and Thompson, G.A.K. Acrylamide in cereal and cereal products: A review on progress in level reduction, Food Additives and Contaminants, Supplement 1, 2007, 24(S1):47-59.
4. Monitoring database Institute of Reference Materials and Measurement http://irmm.jrc.ec.europa.eu/html/activities/acrylamide/EUacrylamidelevelmonitoringdatabase_statusJune2006.xls
5. The CIAA Acrylamide Toolbox http://www.ciaa.be/documents/brochures/toolbox%20rev11%20nov%202007final.pdf
6. A "Toolbox" for the reduction of acrylamide in bread products http://www.ciaa.be/documents/others/bread-EN-final.pdf
7. Codex Code of Practice to reduce acrylamide in foods (Alinorm/09/041 Appendix IV) http://www.codexalimentarius.net

It is the aim of Fedima to support the bakery sector in limiting the levels of acrylamide in bakery products. Therefore Fedima members are and will be actively involved in (national) studies on the formation of acrylamide. Fortunately the average level of acrylamide in bakery products is relatively low although peak values are sometimes observed.

So far, few to no means are available for reducing the formation of acrylamide through the composition of bread improvers and bread mixes. For this reason Fedima and Fedima members will continue supporting the use of the existing toolboxes for the reduction of the formation of acrylamide whenever appropriate.

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