Members and Associates

UK FLOUR MILLERS

BRIEFING DOCUMENT (revised August 2017)

Acrylamide

Summary
Acrylamide is a chemical compound that is produced during direct heating processes where asparagine in starchy foods reacts with reducing sugars. Since 2002 there has been awareness that dietary acrylamide has adverse impacts on the nervous system, reproductive health and is a carcinogen. Although a concern, the intake levels of acrylamide required to observe adverse effect on the nervous system and reproductive health are respectively 500 and 2000 times higher than the average dietary intake. Following initiatives by bakers, baked goods in the UK have lower acrylamide levels than the 'indicative levels' set by the EU.

This Briefing provides information on the background to the issue of acrylamide in foods and gives details of how these may be reduced in baked products.

Background
Acrylamide (or acrylicamide) (C_3H_5NO) has been found to occur in many cooked starchy foods and is of concern as a possible carcinogen. It was discovered accidentally in foods in April 2002 by scientists in Sweden when they found the chemical in starchy foods, such as potato crisps, French fries, and bread that had been heated higher than 120 °C (248 °F). Production of acrylamide in the heating process was shown to be temperature-dependent. It was not found in food that had been boiled or in foods that were not heated.

Acrylamide levels appear to rise as food is heated for longer periods of time. The compound is produced as a by-product of the Maillard reaction, occurring when the amino acid asparagine, found in proteins, is heated with reducing sugars (fructose, glucose, etc.) or reactive carbonyls at temperatures above 120 °C. Later studies have found acrylamide in black olives, prunes, roasted almonds, dried pears, coffee and in cocoa powder and chocolate (formed during roasting). It can also be found in whole wheat bread. Most acrylamide detected in bread and baked products is in the brown parts of the crust or baked surfaces. It is possible to inhibit the formation of acrylamide with the use of an enzyme treatment prior to applying heat to the food.

Toxicity from food exposure
Although acrylamide has known toxic effects on the nervous system and on fertility, a report by the Food and Agriculture Organization (FAO) in 2002 concluded the intake level required to observe neuropathy (0.5 mg/kg body weight/day) was 500 times higher than the average dietary intake of acrylamide (1 µg/kg body weight/day). For effects on fertility, the level is 2,000 times higher than the average intake. From this, they concluded acrylamide levels in food were safe in terms of neuropathy, but raised concerns over human carcinogenicity based on known carcinogenicity in

laboratory animals. However, they advised that that exposure to acrylamide in food should be as low as reasonably practicable.

The Heat-generated Food Toxicants (HEATOX) Project was a European Commission-funded multidisciplinary research project running from late 2003 to early 2007. Its objectives were to "estimate health risks that may be associated with hazardous compounds in heat-treated food, and to find cooking/processing methods that minimize the amounts of these compounds, thereby providing safe, nutritious, and high-quality food-stuffs. It found that "the evidence of acrylamide posing a cancer risk for humans has been strengthened," and that "compared with many regulated food carcinogens, the exposure to acrylamide poses a higher estimated risk to European consumers.

HEATOX sought also to provide consumers with advice on how to lower their intake of acrylamide, specifically pointing out that home-cooked food tends to contribute far less to overall acrylamide levels than food that was industrially prepared, and that avoiding overcooking is one of the best ways to minimise exposure at home.

In July 2014, EFSA published a draft scientific opinion on acrylamide in food which found that, based on animal studies, it causes an increased risk of developing cancer. The report highlighted biscuits, soft bread, crackers and crisp breads as some foods that are dietary sources of acrylamide.

The FSA launched a campaign in January 2017 encouraging consumers to minimise their acrylamide intake by not overcooking starchy foods such as potatoes and bread. The responses from the media were largely that the campaign was unnecessary and an overreaction to the risk, and highlighted the as yet unproven link between acrylamide and cancer in humans. The responses also noted the large quantities of food that would need to be consumed for acrylamide to pose a threat to health.

Acrylamide and flour millers

The production of acrylamide by starchy foods does not have a direct impact on flour millers. However, they are involved in the supply chain whereby acrylamide is produced in bread, biscuits, crackers, crisp breads and similar products. In Europe, bread is estimated to contribute 11 to 32% to dietary intake of acrylamide (depending on the type of bread). UK millers fully support the initiatives (such as the acrylamide toolkit) to reduce its presence in all foods. Although no maximum limits have been set by the EU, there are benchmark levels for food groups considered to contribute the most to consumer dietary exposure to acrylamide. These were revised downwards for many products in 2017, with those for cereal products given at 350 µg/kg for biscuits, 50 µg/kg for bread and as low as 40 µg/kg for baby foods. Monitoring carried out by the FSA in 2013 showed that the acrylamide levels in a range of UK bread products were well below the benchmark levels determined by the EU.

The benchmark levels, and a set of increased mitigation measures for acrylamide in foods, will apply from April 2018. The UK FSA has indicated that enforcement will examine whether mitigation measures were put in place rather than compliance with strict limits. Other Member States may take different approaches. It is probable that maximum limits may be set in the future, with baby food likely to be the first candidate.

Much work has been done at Rothamsted Research to identify the genetics of asparagine formation in the wheat plant. However, at present there are no viable low-asparagine wheat varieties that can be used as part of the acrylamide reduction process in cereal-based foods and their development will take at least fifteen years.

The role of sulphur in the formation of acrylamide is well understood. Sulphur is also key to the production of protein quality in wheat and the optimum growth of the plant. Most farmers are

aware of this requirement and information is available from AHDB and others to promote this (see Information sheet 28 ‘Sulphur for cereals and oilseed rape).

Probably, the most important role for UK millers is to be aware of the issue and to work with their customers to find ways of reducing baking times and ‘browning’ effects in their products.

The acrylamide toolbox

Acrylamide reduction in the range of foods in which it is found requires a comprehensive approach. Because of this, FoodDrinkEurope developed and maintain a 'Toolbox' which summarises the pathways of formation of acrylamide and indicates intervention steps to reduce exposure. The aim of the Toolbox is to provide national and local authorities, individual manufacturers, including SMEs with limited resources, and other relevant bodies with brief descriptions of intervention steps which may prevent and reduce the formation of acrylamide in specific manufacturing processes and products.

Considerable progress has already been made by the UK food industry in reducing levels of acrylamide. Between 2007 and 2011 the levels in bread decreased by 9.8%, while the acrylamide content in biscuits dropped 8.7% during the same period.

In January 2016, UK Flour Millers and the Federation of Bakers produced a position paper to bring together information and data on the bread supply chain in the UK to help inform the discussion regarding the challenges to reduce acrylamide in bread and to highlight the progress that has already been achieved.

Future actions

UK Flour Millers will continue to engage with the FSA, FDF, Federation of Bakers and others in the cereals supply chain to represent members’ views and communicate developments. UK Flour Millers will support research aiming to reduce acrylamide.