



FUNCTIONAL
TECHNOLOGIES

Acrylamide – Questions and Answers

What is acrylamide?

Acrylamide is a chemical compound commonly used as an intermediate in forming polyacrylamide and is known to cause cancer in animals. Polyacrylamide is used in the treatment of drinking water and wastewater to remove particles and other impurities. Certain doses of acrylamide are toxic to the nervous system of both animals and humans. It is a WHO Group 2A carcinogen considered “probably carcinogenic to humans.”

In April 2002, Swedish researchers were the first to report the presence of acrylamide in starchy foods processed at high temperatures, and published evidence linking it to cancer in rats. When starchy carbohydrate foods are baked, toasted or fried at high temperatures, a suspected carcinogen — acrylamide — is formed. The main mechanism for acrylamide formation in starchy foods involves two common components of these foods, namely, reducing sugars and the amino acid *asparagine*. The sugars react with asparagine when the food is heated and, through a cascade of reactions, the side chain of asparagine is converted to acrylamide. These reactions, which produce acrylamide, are part of the usually heat-induced Maillard reactions that create the brown colour and characteristic tasty flavour of baked, fried and toasted foods. Many different savoury snacks and food staples such as bread are at risk of acrylamide formation during current food manufacturing processes.

How serious is acrylamide as a health issue?

Acrylamide has been a serious cancer threat as an industrial compound for many years and is officially labeled by the World Health Organization’s International Agency for Research on Cancer (IARC) as a Group 2A carcinogen. Acrylamide joins such compounds as lead, PCBs, diesel exhaust, and creosotes in this group, described as “probably carcinogenic to humans,” one below Group 1 (“definitely carcinogenic”). See: <http://en.wikipedia.org/wiki/Carcinogen>

Since acrylamide’s discovery in a wide variety of manufactured foodstuffs, food safety and health authorities worldwide have been closely monitoring food manufacturers’ attempts to reduce its formation during their processes. Currently, the State of California is seeking public comment on listing acrylamide on its Proposition 65 list of substances known to cause cancer, birth defects or other reproductive harm. Acrylamide has been on this list since 1990 as a cancer risk, but the Californian authorities are recommending revising the list to label acrylamide as a known reproductive toxicant. Any products sold in California that contain a Proposition 65 listed compound must carry a label warning the purchaser of the substance’s presence in the product.

What foods can acrylamide be found in?

Acrylamide is found in a broad range of foods — basically, any carbohydrate foods that are baked, toasted or fried at high temperatures. These include bread, potato chips, French fries, cookies, breakfast cereal, cereal-based baby foods, fine bakery products, crackers, baked potato products, pan-fried potatoes, pie crusts and bread-coated foods such as chicken strips. Almost any starchy food or food product containing baked, toasted or fried starchy ingredients is at risk for acrylamide formation.

Is acrylamide also formed in home cooking?

Yes, acrylamide is formed in many starchy foods when they are baked or fried at high temperatures, regardless of whether it is being produced industrially or prepared at home.

How does acrylamide form when food is cooked at high temperatures?

Acrylamide forms via the Maillard reaction through baking, toasting or frying. The main mechanism for acrylamide formation in starchy foods involves two common components of these foods, namely reducing sugars and the amino acid asparagine. The sugars react with asparagine when the food is heated, and, through a cascade of reactions, the side chain of asparagine is converted to acrylamide. These reactions, which produce acrylamide, are part of the usually heat-induced Maillard reactions that create the brown colour and characteristic tasty flavour of baked, fried and toasted foods. Many different savoury snacks, such as potato chips and French fries, as well as staples like bread, are at risk.

What is the Maillard Reaction?

The Maillard reaction is a chemical reaction between an amino acid and a reducing sugar, usually requiring heat. It is very important in the preparation or presentation of many types of food and, like caramelization, is a form of non-enzymatic browning. The reaction is named after the chemist Louis-Camille Maillard, who first described it in the 1910s although it has been used in cooking for thousands of years.

In the Maillard reaction process, hundreds of different flavour compounds are created. These compounds in turn break down to form yet more new flavour compounds, and so on. Each type of food has a very distinctive set of flavour compounds, and it is these same compounds that food scientists have used over the years to create artificial flavours in many different foods.

How are food manufacturers attempting to reduce acrylamide formation?

Food manufacturers worldwide have been very responsive to this issue since its discovery in 2002, and have been working cooperatively with the regulatory authorities and their competitors to develop methods to reduce the formation of acrylamide in their products. These methods include changing the pH to alter the reaction products, cutting heating temperatures and times, using an enzyme to convert asparagine into an impotent form using an enzyme, binding asparagines to make it inaccessible, adding amino acids and removing compounds from the recipe that may promote acrylamide formation. Additives may also include flavour enhancers and/or caramel and other colorants to enhance the taste and colour of the final product(s) which otherwise would not be achieved through the modified production processing temperatures required to reduce acrylamide levels. All of these methods are either expensive or not very effective.

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