

Acrylamide: A Poison In Our Food

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Acrylamide seems to form in our starchy food primarily when frying or baking at elevated temperatures (above 120°C) and in low moisture conditions. We all love our baked potatoes, or fried potato chips (French fries), with battered and fried fish, especially on outings. It is an enjoyable treat, but you should realise that you are eating a poison in it, that can cause cancer, if you enjoy eating it too frequently.

Asian cuisines are mainly cooked in boiling water at 100°C and at that cooking temperature it is most unlikely that acrylamide will appear in the starchy food. Nevertheless, food should not be cooked excessively, as commonly done in Asian cooking, especially for softening meat to get a particular flavour. However, all food, especially meat and meat products, should be cooked sufficiently to destroy food poisoning bacteria.

You need to fry or bake foods over 120°C for long periods for the chemical acrylamide to appear. Elevated levels of acrylamide have been found in home cooked foods, as well as pre-cooked, packaged and processed foods.

It was a Swedish scientist who first discovered it in many cooked foods. It is presumably an animal chemical carcinogen and a human neurotoxicant. Most governments are considering warning people against eating such food. In the U.S., nearly 200 articles were written on acrylamide in food, plus there has been intense media coverage.

It is considered an industrial chemical used in products of water purification, grouts, packaging, and scientific research. The chemical is used to make polyacrylamide materials. Polyacrylamide is used in the treatment of drinking-water and waste water where it is used to remove particles and other impurities. It is also used to make glues, paper and cosmetics. Polyacrylamide materials contain very small amounts of acrylamide.

So how does this chemical enter the foods? The researchers found that acrylamide was forming in food as a result of a heat-induced reaction between two naturally occurring ingredients, the amino acid asparagine and reducing sugars, such as glucose and fructose. The formation of acrylamide is part of the Maillard reaction, which led to browning and flavour changes in cooked foods. Browning of toast made from bread slices is a good example of such a reaction.

Furan

It was also found that Furan, previously unnoticed, is another cooking-related chemical occurring in large amounts in a variety of foods. It is an industrial chemical used in production of other chemicals, including tetrahydrofuran, resins, lacquers and agricultural products. Furan was subsequently identified in certain low moisture foods as well, including crackers, potato chips, and tortilla chips. The levels detected by the FDA range from < 0.2 parts per billion (ppb) to over 170 ppb, and the FDA has estimated the average intake by U.S. consumers as 0.2 µg/kg-bw/d.¹⁵ The formation of furan is not as well understood as that of acrylamide. Multiple mechanisms have been proposed, including oxidation of polyunsaturated fatty acids, breakdown of ascorbic acid derivatives, breakdown of carbohydrates, and breakdown of amino acids in the presence or absence of reducing sugars.

The European Food Safety Authority (EFSA) has issued a report updating results of monitoring on the levels of furan found in food. In order to allow a better estimate of dietary exposure to furan, the European Commission asks member States to collect data on furan levels in heat-treated commercial food products.

A first report on these findings was published by EFSA in 2009 and the current update brings additional data to the compilation. EFSA specifies that the reduction of furan formation in food seems to be more challenging compared to other process contaminants, such as acrylamide, since furan formation is closely connected with the taste and smell of foods.

Acrylamide has been found primarily in plant-based foods, notably potato products such as French fries and potato chips; cereal foods such as cookies, crackers, breakfast cereals, and toasted bread; and coffee.

Carcinogenic

Acrylamide is found to be carcinogenic in rodents. So, it could be carcinogenic to human beings as well. In 2010 a joint Food and Agriculture Organization and World Health Organization expert committee determined there was evidence that acrylamide could cause cancer in laboratory animals. There is no direct evidence acrylamide causes cancer in humans but food regulators agree that we should reduce our exposure. It is known that certain doses of acrylamide are toxic to the nervous system of both animals and humans.

To reduce or to mitigate the amount of acrylamide formed in cooking, and eat less acrylamide, many proposed techniques have been detailed, and fall into several categories:

- 1) Reducing the availability of free asparagine or reducing sugars.
- 2) Changing cooking time and temperature during cooking.
For potatoes, choosing low reducing sugar, and controlling storage conditions.
- 3) Do not store potatoes at temperatures below 8°C. This can increase the components that prompt acrylamide formation.
- 4) For cereal products, modifying the time or temperature of cooking, avoiding use of ammonium bicarbonate, and using materials low in asparagine.

Other suggested techniques for acrylamide mitigation include the use of minor

ingredients (e.g., amino acids, calcium, and citric acid) that interfere with acrylamide formation, and the use of asparaginase to reduce asparagine levels prior to cooking. Wash or soak vegetables for several minutes before frying- this can reduce the components that prompt acrylamide formation.

Asparagine is a nonessential amino acid, which means that it is manufactured from other amino acids in the liver; it does not have to be obtained directly through the diet. Asparagine is interrelated with the amino acid, aspartic acid. Low levels of asparagine may indicate poor metabolism or synthesis of aspartic acid, which can result in the inability to properly synthesize and excrete urea, which is the major waste product of excess dietary protein. The inability to excrete urea can result in buildup of nitrogen-containing toxic metabolites that can lead to confusion, headaches, depression, irritability, or, in extreme cases, psychosis.

There is no evidence that acrylamide is produced in the human body, other than from levels that are consumed in food. Even in food the acrylamide is formed as a result of cooking at high temperatures, or cooking for long periods.

The bottom line is, it is safer to eat home cooked foods, cooked with boiling water temperature, as our ancestors did, and avoid accumulating too many chemicals in our human bodies.

Some reference to Food Safety Magazine June/July 2007 issue and EFSA report, July 2010