Reducing Acrylamide in Cereal-based Foods: Fact Sheet

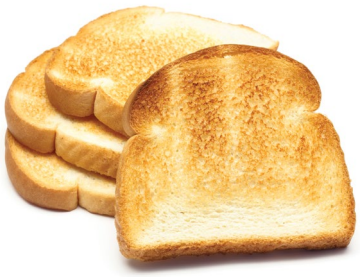
• Information on acrylamide • Resources for industry • Processing and mitigation tables

Acrylamide is a chemical that can form in some plant-based foods during high-temperature cooking, such as frying, roasting, and baking. Reducing acrylamide levels in foods may reduce potential human health risks from exposure to acrylamide.

What foods is acrylamide found in?

Acrylamide forms primarily in cooked plant-based foods, including:

- **Cereal-grain-based foods** such as cookies, crackers, breakfast cereals, and toasted bread
- **Potato products** such as French fries and potato chips
- **Roasted coffee beans**



How does acrylamide form?

Acrylamide forms in foods from a chemical reaction between asparagine (an amino acid) and reducing sugars (such as glucose and fructose). This reaction is part of the Maillard reaction, which leads to color, flavor, and aroma changes in cooked foods. Acrylamide usually forms at elevated temperatures used when frying or baking (above 120 °C (248 °F)) and in low moisture conditions.

Key points to consider

- Acrylamide can form in some cereal-based foods during certain types of high-temperature cooking.
- Acrylamide levels can be affected by raw materials, processing and ingredients, and preparation and cooking instructions on finished foods. For example, modifying baking times and temperatures and cooking to a lighter color may help lower acrylamide levels in cereal-based foods.
- FDA's Acrylamide in Foods Guidance provides information to help growers, manufacturers, and food service operators reduce acrylamide levels. This fact sheet contains information from the guidance on cereal-based foods.

What does the FDA guidance recommend?

- Manufacturers should be aware of acrylamide levels in their products.
- Manufacturers should evaluate approaches to acrylamide reduction that may be relevant to their products.
- When evaluating possible approaches to reduce acrylamide, manufacturers should consider the impact on overall chemical and microbiological safety, nutritional quality, and organoleptic properties such as taste and mouth feel.

Resources for Industry

The FDA encourages growers, manufacturers, and food service operators to read the following resources:

Acrylamide in Foods Guidance
www.fda.gov/media/87150/download

FDA Acrylamide Webpage
www.fda.gov/food/chemicals/acrylamide

Hazard Analysis and Risk-Based Preventive Controls for Human Food Draft Guidance, Chapter 3
www.fda.gov/media/99558/download

Processing and Mitigation Tables: Cereal-based Foods

Food	Process Step	Steps that may help reduce acrylamide
Cereal-based foods (such as bread, breakfast cereal, crackers, cookies, crispbreads)	**Raw materials**	• Using wheat varieties that are lower in asparagine and using wheat grown with adequate soil sulfate and without excessive nitrogen fertilization. • Partially substituting low-asparagine cereal grains for high-asparagine cereal grains in cereal-based foods.
	Processing and ingredients	• Replacing ammonium bicarbonate in cookies and crackers with alternative leavening agents, while avoiding overall increases in sodium levels. • Replacing reducing sugars with nonreducing sugars, using reducing sugars with lower fructose content, and only adding sugar coatings to breakfast cereals after toasting steps. • Using asparaginase treatment in cereal-based foods, but dose, contact time, dough water content, pH, and water chlorination are important considerations. • Using calcium supplementation in non-calcium-fortified breads or breakfast cereals, but the addition of calcium propionate may increase acrylamide levels. • Using yeast fermentation and changing fermentation conditions. • Lowering thermal input through modifying baking times and temperatures and considering alternative baking technologies. • Monitoring production by using color as an indicator of acrylamide, but the correlation between color and acrylamide may have to be determined on a product by product basis. • Setting a higher moisture endpoint in cereal-based foods, and monitoring moisture levels in finished products may be useful as an indirect indicator of acrylamide levels.
	Preparation and cooking instructions	• Baking and toasting breads and other baked goods to a light brown, not a dark brown color; and avoiding overly dry or crusty products in cereal-based foods.