How to Avoid Formation of Acrylamide in Fried & Bake Foods

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Outline

- What is Acrylamide?
- Acrylamide in Foods
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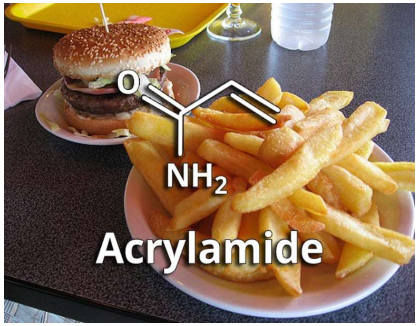
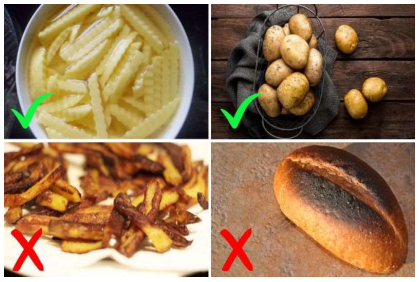
What is acrylamide?

- Acrylamide is a chemical that can form in some foods during high temperature cooking, such as frying, roasting and baking.
- Acrylamide in food forms from sugars and an amino acid (asparagine) that are naturally present in food.
- It does not come from food packaging or the environment.
- Acrylamide caused cancer in animals in studies where animals were exposed to very high doses.
- In 2010, the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives (JECFA) concluded that acrylamide is human health concern and suggested additional long-term studies.
- FDA has posted its current data on acrylamide in foods on the FDA website.





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Acrylamide in Foods

The main chemical reaction that causes this know as *"The Maillard Reaction"*; it is the same reaction that "Browns" food and effects its taste.

Acrylamide is formed from sugars and amino acids (mainly one called *asparagine*) that is naturally present in many foods.

Food high in asparagine/sugars are

Potatoes

Wheat flour

High protein rye flour

Asparagus

Almonds

Coffee(Green)

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Frying Oil - Mitigation

Frying Oil – Mitigation Plan

- Fry to golden yellow, or lighter color, and deep-frying at lower temperature will keep acrylamide level low.
- Keep cooking oil quality at its best by skimming often to remove crumbs and food particles left in the oil.
- Cut foods, such as potatoes, to similar sizes. This will help all foods to cook more evenly and help reduce acrylamide formation.
- The oil temperature for frying/cooking should ideally be below 175°C (347°F). This will keep acrylamide levels low.
- Reusing oil, dirt oil and cooking equipment will increase the levels of acrylamide in deep fried foods.

Frying Oil – Mitigation Plan

- High Oleic Soybean oil – Why is it a good frying oil?
  - Meets the demand that performs well under high-heat conditions
  - Contains beneficial monounsaturated fatty acids and less saturated fat
  - Provides a health alternative to many cooking/frying oils with greater shelf stability and fry life.
  - Increase fried food quality & functionality.
  - Extended fry life
  - Desired neutral flavor
  - Clean Label

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Frying Oil – Mitigation Plan

Improved fat Profile:

High Oleic soybean oil contains lower saturated fat and 3 times the amount of beneficial monounsaturated fatty acid (C18:1).

Greater shelf-life stability:

A high MUFA content makes the oil extremely stable, eliminating the need for partial hydrogenation.

Extended fry life:

HOSOY performs longer than standard vegetable oils in high temperature and extended-use applications because of the oxidative stability.

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Frying Oil – Mitigation Plan

- Desired neutral flavor:
  - Allowing the true and natural flavors of ingredients to stand out.
- Clean Label:
  - Qualifying products can be labeled as “U.S. grown” and “heart healthy”.
- Sustainability:
  - Ho Soy is sustainably grown in closed-loop, identity-preserved (IP) supply chain that makes it fully traceable from farm to fork.

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Frying Oil – Mitigation Plan

- Superior oxidative stability delivers shelf life and cleaner profile for **tortilla chips**, potato chips, shrimp crackers and other fried snacks.
- 2-3x fry life for restaurant deep-frying with less polymer build up than other commonly used vegetable oils.
- High smoke point and clean profile for pan frying sauteing and stir-fry.
- Clean flavor profile, longer shelf life and optimal fry performance for **frozen pan-fried** potatoes, chicken and seafood products and instant ramen noodles.

Baked Food - Mitigation

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Baked Foods – Mitigation Plan

- Use amidohydrolases (asparaginase) to inactivate amino acid precursors involved in formation reactions.
- Use antioxidants (e.g., rosemary and green tea extracts).
- Increase yeast fermentation time.
- Reduce oven temperature and increase bake time.
- Replace ammonium bicarbonate with sodium bicarbonate, although this needs to balanced against sodium intake.

Baked Foods – Mitigation Plan

Vacuum based thermal technology:

- Cooking with vacuum method requires a vacuum chamber with a pressure of about 60 kPa. The operating pressure is lower than of a typical oven, so the cooking temperature can greatly decrease.
- Vacuum pre-drying is used to mitigate acrylamide content of foods. One of the main factors causing acrylamide formation is the moisture content in foods.
- Vacuum roasting is a particular roasting method that is especially beneficial for roasting nuts and coffee beans or other ingredients in a controlled setting, where air pressure has been greatly decreased to create vacuum.

Acrylamide levels can be affected by raw materials, processing and ingredients and preparation and cooking/baking instructions on finished foods.

Potato Based Food - Mitigation

Potato based foods – Mitigation Plan

- Selecting potatoes varieties that are low in acrylamide precursors, keeping in mind seasonal variation may help reduce acrylamide.
- Avoiding handling potatoes with excessive roughness, avoiding bruising potatoes, and sorting out or carefully trimming potatoes with defects may help reduce acrylamide
- Managing storage conditions to control sprouting and provide ventilation may help reduce acrylamide
- Assessing reducing sugar levels in incoming potatoes, identifying target levels for incoming potatoes, or using treatments to reduce sugar level may help reduce acrylamide.

Potato based foods – Mitigation Plan

- Soak raw potato slices in water for 15-30 minutes before frying or roasting.
- Soaked potatoes should be drained and blotted dry before cooking to prevent splattering or fires.
- Store potatoes in the refrigerator carefully to prevent defects.
- Generally, more acrylamide accumulates when cooking is done for longer periods or higher temperatures.
- Cooking cut potato products, such as frozen French fries or potato slices, to golden yellow color rather than a brown color helps reduce acrylamide formation.

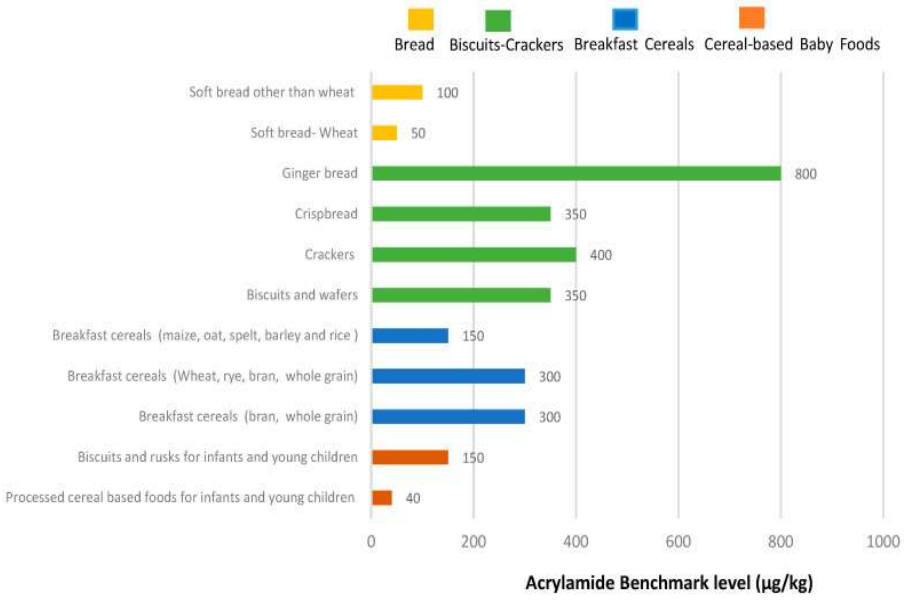
Cereal Based Foods - Mitigation

Cereal Based Foods – Mitigation plan

- Replacing ammonium bicarbonate in cookies and crackers with alternative leavening agents, while avoiding overall increase in sodium levels, may help reduce acrylamide.
- Replacing reducing sugar with non-reducing sugars, and only adding sugar coating to breakfast cereals after toasting step may help reduce acrylamide.
- Using asparaginase treatment may help reducing acrylamide in cereal-based foods.
- Using yeast fermentation for changing fermentation conditions may help reduce acrylamide.
- Setting a high moisture endpoint may help reduce acrylamide.

Cereal Based Foods – Mitigation plan

- Modify baking time and temperatures to lower thermal input.
- Consider alternative baking technologies
- Monitor production using color as an indicator of acrylamide.
- Use calcium supplementation (but be cautious with calcium propionate).



Above figure presents the benchmark levels for each cereal-based food product categories in different groups according to the Regulation set by European Union, Commission Regulation (EU) 2117/2158

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Risk/Benefit Positioning

- Frying potatoes at lower temperatures to a comparable endpoint can reduce acrylamide formation.
- Excessive blanching of potatoes results in further loss of minerals and vitamins.
- Using refined flour reduce acrylamides formation potential, however it seems as less nutritionally desirable compared with whole grain (Bran) products.
- Replacing ammonium bicarbonate with sodium bicarbonate helps control acrylamide formation, however if applied systematically will increase sodium levels.

It is important that food manufacturers assess the suitability of proposed mitigation steps considering the actual composition of their product, their manufacturing equipment and their need to provide consumer with quality products consistent with consumer expectations.

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Any Questions?

Thank you!!

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