

## CHAPTER 4 - ACRYLAMIDE AND CONTAMINANTS FORMED DURING COOKING



### COOKING CAN CREATE NEW MOLECULES

Some contaminants do not enter food from fields, soil or packaging: they form during preparation or processing. Their presence can depend on time, temperature, moisture and product composition. Acrylamide is a particularly well-studied example.

Not all cooking processes generate the same compounds. Acrylamide formation is characteristic mainly of carbohydrate-rich foods exposed to high temperatures with limited available water. Unlike frying or roasting, boiling generally does not create the same conditions for its formation.

### HOW DOES ACRYLAMIDE FORM?

Acrylamide can form during Maillard reactions, particularly when asparagine reacts with reducing sugars. These reactions also contribute to the colour and aroma of bread crusts, biscuits and golden-brown potatoes. However, it would be incorrect to assume that every browned food is heavily contaminated: outcomes depend on the recipe and process.

French fries, crisps, baked goods, biscuits and coffee may contribute to exposure. Amounts per serving vary considerably. Raw material composition, potato storage, product geometry and roasting conditions all influence the final result.

## ACRYLAMIDE DURING COOKING

When processing can create new molecules

1

### INGREDIENTS

**Asparagine + reducing sugars**

Precursors found in certain foods

2

### CONDITIONS

**Heat + low moisture**

Frying, baking and roasting can favour formation

3

### FOODS

**Potatoes, biscuits, coffee**

Levels depend on recipe and processing conditions

4

### REDUCTION

**Control the process**

Avoid excessive cooking and apply mitigation measures

**DARK COLOUR IS NOT AN ANALYTICAL MEASUREMENT**

## WHAT DO HEALTH ASSESSMENTS SAY?

EFSA has concluded that acrylamide in food could increase cancer risk, drawing particularly on experimental evidence of the genotoxicity and carcinogenicity of acrylamide and its metabolite glycidamide. Human epidemiological evidence is less conclusive. These statements are not contradictory: they describe different sources of evidence and their limitations.

For genotoxic and carcinogenic substances, assessments may use the margin of exposure rather than assume a universal safe threshold. Differences between children and adults in exposure relative to body weight are important in the overall assessment.

## OTHER PROCESS CONTAMINANTS

Intense cooking can also generate other classes of substances, including heterocyclic amines in some meats cooked at high temperatures and thermal breakdown products of ingredients. Polycyclic aromatic hydrocarbons, which can form during smoking and cooking over flames, are already covered in a separate Overorganic section and are not repeated here.

Attributing the same hazard to all these compounds would be incorrect: they differ in formation mechanisms, toxicity, exposure and available evidence. The practical priority is to control processes that are genuinely critical.

## **MITIGATION AND EUROPEAN REGULATION**

Regulation (EU) 2017/2158 establishes mitigation measures and benchmark levels for particular food categories. Benchmark levels are indicators of process performance and must not be described as a general system of maximum levels applying indiscriminately to every product.

In practice, mitigation focuses on selecting raw materials, recipes and preparation parameters. Avoiding burning and excessive cooking, aiming for a golden rather than very dark colour in relevant foods, and following specific instructions are sensible measures; they do not, however, guarantee the complete absence of acrylamide.

## **SCIENTIFIC AND REGULATORY REFERENCES**

- EFSA, Acrylamide: scientific overview [↗ Source](#)
- EFSA (2015), Risk assessment: acrylamide [↗ Source](#)
- Regulation (EU) 2017/2158, mitigation measures [↗ Source](#)