

Methods of Detection and Quantitation of Acrylamide in Cooked Food Products

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Personal Background

- ◆ **Ph.D. (1974), Agricultural Chemistry, UC Davis (Thesis: Formation of Pyrazines in Sugar-Amino Acid Browning Model Systems)**
- ◆ **Professor, Department of Environmental Toxicology, UC Davis, since 1979**
- ◆ **Research: Chemical and Biological Studies on Browning Reaction (Anti-oxidant, anti-mutagen, anti-carcinogen, volatile chemicals)**
- ◆ **Over 230 publications on articles associated with browning reactions out of over 290 publications**

Methods of Detection: General Considerations

- ◆ Three different instruments are available for acrylamide analysis (GC/MS, LC/MS, GC/Nitrogen-Phosphorous Detector (NPD) or Electron Capture Detector (ECD) .
- ◆ LC/MS is most the widely used but is too expensive for most individual laboratories to own.
- ◆ Cost of performing the tests depends on the laboratory.
- ◆ The Limit of Detection depends on nature and chemical complexity of samples (e.g., solid food samples such as bread vs. liquid samples such as coffee).
- ◆ LC/MS has an advantage over GC/MS or GC.
 - LC/MS can analyze aqueous samples, while the other methods require the use of organic solvents. (Acrylamide is highly water soluble but less soluble in organic solvents).
- ◆ Limit of Quantitation is more important than Limit of Detection in selecting an appropriate test method for acrylamide.
- ◆ Adequate preparation of the sample is critical for accurate detection and quantitation. Variations in sample preparation quality may require general reliance on the higher Limit of Quantitation.

	Gas Chromatograph/ Mass Spectrometer (GC/MS)	Liquid Chromatograph/ Mass Spectrometer (LC/MS)	Gas Chromatograph/ NP or EC Detectors
Cost of Instrument	\$ 50,000 ~ \$ 70,000	\$ 200,000 ~ \$ 300,000	\$ 20,000 ~ \$ 30,000
Operation	Helium gas	Water/Organic solvents	Helium gas
Sample Preparation	Tedious	Relatively easy	Tedious
Limit of Detection	1 µg/kg~15 µg/kg	1 µg/kg~15 µg/kg	0.5 µg/kg~15 µg/kg
Limit of Quantitation	5 µg/kg~50 µg/kg	5 µg/kg~30 µg/kg	1 µg/kg~50 µg/kg

Cost of Analysis: 1 sample = roughly \$100 ~ \$1,000, depending on the laboratory

- Limits of Detection and Quantitation depend on the sample preparation

Sample Preparations for Acrylamide Analysis

FOODS

Less lipid

(Bread, Cereal, etc.)

Dissolve in water/methanol

Filtration

Methanol/water

LC/MS

Lipid rich

(French fries,
Potato chips, etc.)

(Defat with organic solvent)

Centrifuge

Organic solvents

GC/MS
GC/NPD

Lipids

(Butter, Cooking oils, etc.)

Dissolve in
organic solvent

Bromination

GC/ECD

Solid phase extraction