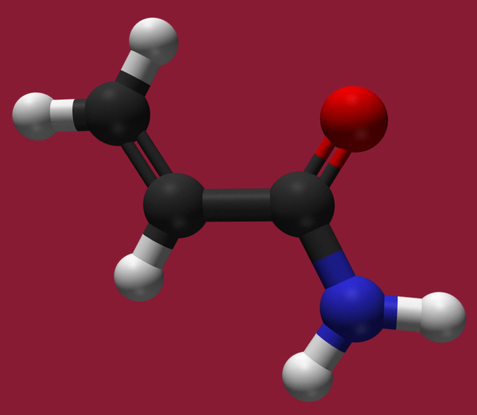
Acrylamide Quantification in Foodstuffs in Minutes Using a Thermal Extraction Ionisation Source without Chromatography

Carl M. Fletcher, Peter Luke, John G. Luke, Lance Hiley, Richard Sleeman
Mass Spec Analytical Ltd, Building 20F, Golf Course Lane, Filton, Bristol, BS34 7RP, UK

Abstract

Ambient ionisation mass spectrometry (AI-MS) is a rapidly growing field widely accepted for analyte identification but evidence is required to demonstrate that AI-MS is reproducible enough to quantify analytes without chromatographic separation.

This poster demonstrates the use of a Thermal Extraction Ionisation Source (TEIS) for the quantitation of acrylamide from real food samples with good reproducibility, suggesting that this method of AI-MS could be used for quantitation of analytes.



Introduction

Ambient Ionisation Mass Spectrometry (AI-MS) is an exciting field of mass spectrometry where direct analysis of samples in real time without sample preparation or long run times is possible.

However, without chromatographic separation to minimise matrix effects, there is concern that quantitation is not reproducible using AI-MS alone.

We present a Thermal Extraction Ionisation Source (TEIS) coupled to a SCIEX triple quadrupole instrument for the identification and quantitation of acrylamide within seconds using a direct injection.

Acrylamide is a an organic compound and a naturally occurring by-product in carbohydrate-rich foods that are prepared at low moisture levels and at temperatures above 120 °C. The European Food Safety Authority has confirmed acrylamide to be a probable carcinogen so it is important to be able to quantify levels are below commission regulation limits (EU) 2017/2158.

Key Features of the TEIS

- Simple to use, robust and self-purging therefore, requiring very little maintenance
- Provides real-time peak detection from swabs, vapours and direct injections
- Does not require chromatography for sample introduction, minimizing sample preparation and analysis time to a few seconds
- Reliable and reproducible, offering the potential for quantitation without prior separation
- Can support direct analysis, injections and auto-sampling without reconfiguration

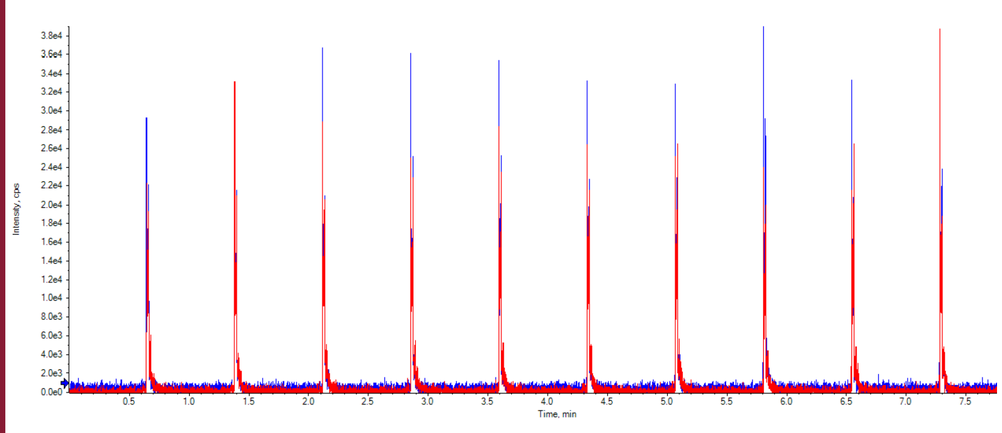


Figure 1: MRM data showing 10 injections of 50 pg/µl acrylamide/deuterated acrylamide mixture within 7.5 minutes. Red transition is for acrylamide (m/z 72/56) and the blue transition is deuterated acrylamide (m/z 75/58)

Results

Limit of detection for acrylamide was 25 pg/µL.

Deuterated acrylamide was used as an internal standard because its chemically identical nature to acrylamide means that it will be equally effected by any matrix effects and the 1:1 ratio remains constant.

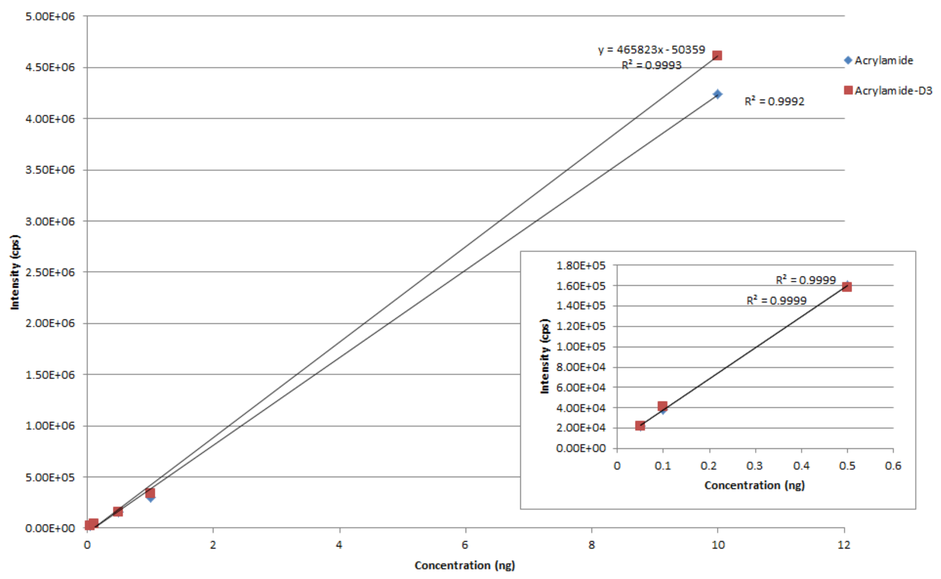


Figure 2: Calibration curve of direct injections of acrylamide and deuterated acrylamide using an autosampler across five concentrations for the transitions at *m/z* 72/55 and 75/58 respectively.

The calibration curve demonstrates a high degree of reproducibility with regression values of 0.9992 and 0.9993 for acrylamide and deuterated acrylamide respectively, at an %RSD of 4.8%.

In an attempt to quantify acrylamide levels in real food samples, a 'rich tea' biscuit and some instant (soluble) coffee was homogenized using a pestle and mortar, vortexed for 2 mins and then mixed with deuterated acrylamide (1 ng/µL) as an internal standard.

The sample preparation is significantly reduced compared to other sample preparation methods for chromatographic techniques.

The acrylamide concentrations calculated by response factor for the 'rich tea' biscuit and instant coffee were 5.87 µg/kg and 4.42 µg/kg respectively; significantly below the EU regulatory benchmark levels.

Conclusions

A rapid quantitation method for acrylamide in foods was demonstrated using the TEIS with a high degree of reproducibility suggesting quantitation is possible using AI-MS.
The sample preparation is simple and amenable to automation, suggesting that the TEIS method can significantly increase sample throughput without a concomitant loss in quantitation accuracy.

Contact Information

Dr Carl Fletcher MRSC
Mass Spec Analytical Ltd
Email: carl.fletcher@msaltd.co.uk
Phone: 0117 317 3600
Web: www.msaltd.co.uk