LONESTAR™
Application Note - Food Freshness and Odour Detection

Lonestar can be used for rapid and accurate detection of taints and malodorous compounds in a range of foodstuffs and packaging materials. Exceptional limits of detection combined with simple sample introduction and the ability to reprogram the detector for different compounds makes Lonestar suitable for a broad range of online and lab based analysis applications in the food and drink industry

Introduction

Food quality and safety, from raw materials through production, is of paramount importance for producers and consumers of foodstuffs.

Degradation due to improper storage conditions[1], contamination from process lines or packaging materials[2] and irradiation[3] can all introduce off-odours in food. These compounds are often unpleasant and sometimes dangerous for human consumption.

Sampling and analysis throughout the lifecycle of food production would be a direct way to control quality and safety. Continuous capture of a significant number of samples and preparation for laboratory analysis is both complex and costly and not particularly feasible for high throughput. A range of volatile organic compounds (VOCs) are present in the headspace of foods and offer a more straight forward and faster method to control a process or the quality of food and raw materials. Available analytical techniques, which include gas chromatography / mass spectrometry (GC/MS) require sample preparation, are expensive, time consuming and require specialist trained operators. Lonestar is a powerful and adaptable chemical monitor in a portable, self contained unit. Incorporating Owlstone's proprietary FAIMS technology, the instrument can monitor the headspace of food and drink samples to detect malodorous compounds and taints in real time with exceptional limits of detection.

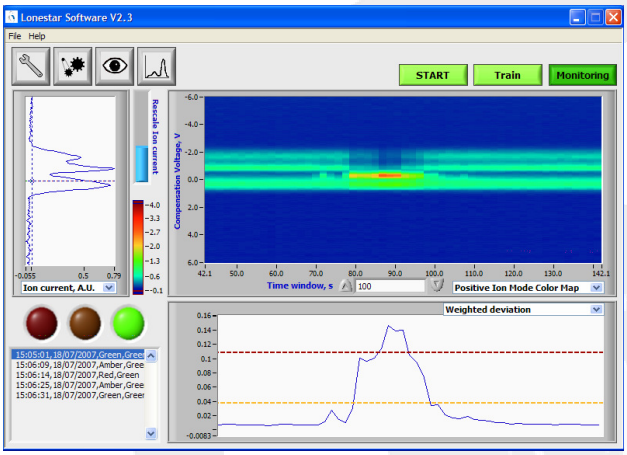
Set-up for Food Freshness Monitoring

Foods that contain muscle tissue (meat, poultry and fish) can form biological amines through enzymatic and bacterial actions of proteins and amino acids. For example, trimethylamine (TMA) is formed by a stepwise degradation of choline to betaine and then to TMA.

Choline → Betaine → TMA

The unpleasant odour of decay has been attributed primarily to TMA in addition to other compounds[4].

A range of experiments were performed in which a small quantity of pork was placed in a 20mm glass sample vial. Clean, dry air was flushed though the



Screen shot of Lonestar software with continuous spectra of the sample vial ambient headspace and alarm levels

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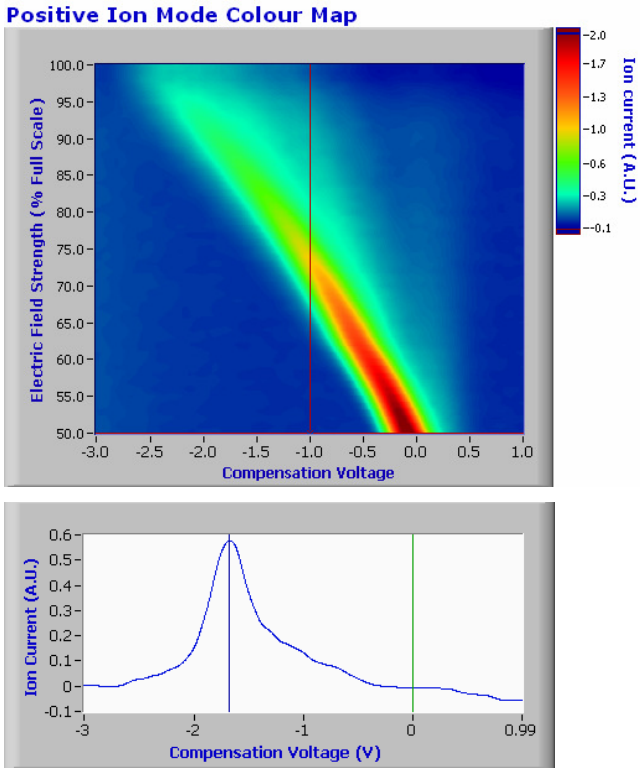
vial while the Lonestar unit directly sampled the headspace at a flow rate of 90ml/min. The instrument ran continuously while capturing and storing spectra at 1 minute intervals over a period of 48hrs. Meat samples were stored at various temperatures to investigate the effect on the rate of decomposition and degradation.

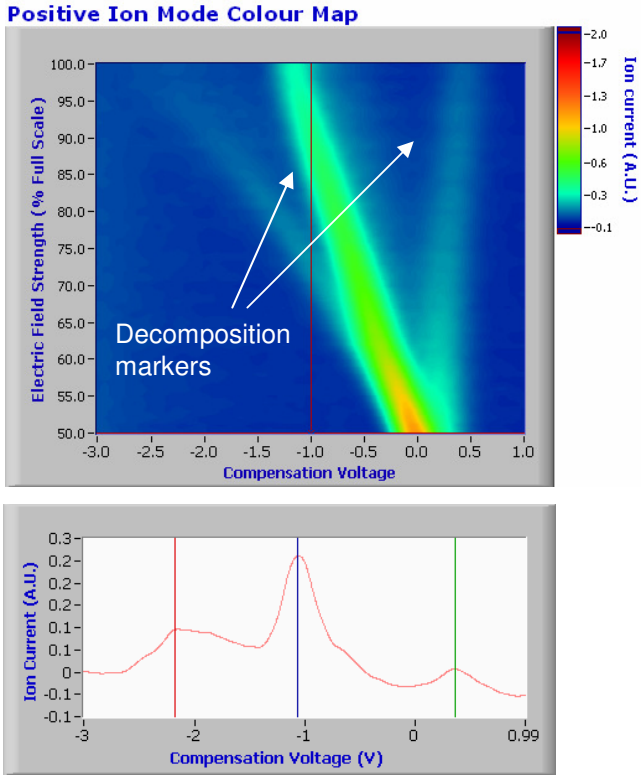
Results and Discussion

FAIMS spectra from the Lonestar instrument at 0 hours indicated that the headspace was relatively 'clean'. For pork samples stored at room temperature it was evident that significant levels of volatile biogenic amines were present in the headspace within 24 hours with the concentration increasing further over time as the meat decomposed.

As expected storage temperature has a marked effect on the rate of degradation and VOC generation. At lower storage temperatures the pork samples showed very little decomposition.



Spectra of pork headspace at time = 0hrs



Spectra of pork headspace at time = 25hrs at which point there are distinct markers for biogenic amines associated with the decomposition process

Conclusions

The results indicate that the Owlstone FAIMS technology and Lonestar instrument are useful in diagnosing food freshness and detecting spoilage. In addition to freshness the instrument sensitivity makes it suitable for general detection of contamination and taints.

References

1) Ion mobility spectrometry for food quality and safety
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b Dortmunder Actien-Brauerei AG (DAB), D-44145 Dortmund, Germany

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3) Nature, Cause and Control of Irradiation Induced Off-Odor in Ready-to-Eat Meat Products, Xuetong Fan, US Dept Agriculture

4) Ion Mobility Spectrometry, G.A.Eiceman, Z. Karpas, 2nd Edition 2005

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