# Shelf-life durability of oat based products

C. Cognat*, T. Shepherd and D. Stewart

SCRI, Invergowrie, Dundee DD2 5DA, UK
*Claudine.Cognat@scri.ac.uk

## Background

Bakery products are a large group of foodstuffs widely consumed on a daily or occasional basis for nutrition, pleasure or both. All of these products contain fats/oils for nutritional, technological and organoleptic purposes. However, these components are also often the source of product deterioration. Indeed, the oxidation of fats and oils are common reactions that may impact deleteriously upon flavour, aroma and nutritional quality and, in some cases, the texture of a product. This study involves a comparison of two different techniques of headspace analysis for measurement of the volatiles produced in oat based products throughout a normal shelf life through to rancidity. The model product is an oatcake; a type of cracker made from oatmeal.

## Materials & Methods

**Cheese oatcakes**
**Sources of fat/oil: cheese powder, palm oil and oat oil.**

- Analysis by Gas Chromatography-Mass Spectrometer (GC-MS).
- Volatiles collected on porous polymer (Tenax TA) for analysis by Automated Thermal Desorption (ATD) or by use of Solid Phase MicroExtraction (SPME) fibres.
- Compounds identified on the basis of their mass spectra and retention time.
- Each sample was analysed in triplicate.

**Plain oatcakes**
**Source of fat/oil: palm oil, sunflower oil and oat oil.**

### SPME-GC-MS

- Material: Carbowax-polydimethylsiloxane (PDMS) SPME fibre.
- Analysis using a Thermo Finnigan Tempus GC-ToF-MS system.
- Data acquired using the Xcalibur™ software.
- Statistical analysis performed using GenStat™ version 9.2.0.153.

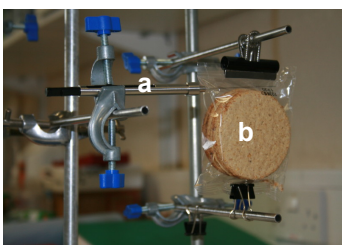
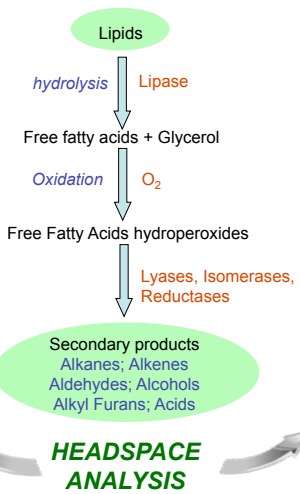



Figure 1. Oatcake sampling using a SPME fibre; (a) SPME fibre inserted in a sachet of oatcakes (b)



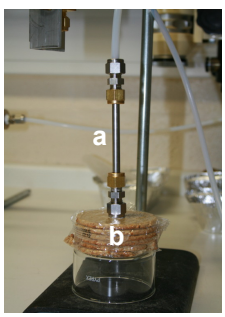




Figure 2. Oatcake sampling using an ATD tube; (a) ATD tube adhered to the sachet of oatcakes (b)

### ATD-GC-MS

- Material: Stainless steel tube containing a bed of Tenax TA
- Volatiles trapped at 200cm$^3$/min.
- Analysis performed using a Markes International Autosecure ATD system coupled to an Agilent Technologies 6890 GC and 5975B MSD.
- Data were acquired using the MSD chemstation™ software.
- Statistical analysis was performed using GenStat™ version 9.2.0.153.

## Results and Discussion

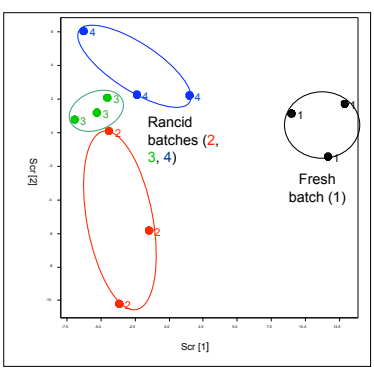



Figure 3. Principal Component Analysis of fresh and rancid Plain oatcakes analysed by ATD-GC-MS. Components 1 and 2 explained up to 48% and 27% of the variability, respectively.

- Rancid samples are mainly separated from fresh samples on the basis of changes in the composition of the aldehydes.
- *Zhou, M. et al.* (2000) reported the influence of aldehydes, particularly hexanal and pentanal, in the development of off-flavours from cereal.
- Therefore the ATD approach shows promise for determining the stage of the shelf life of oat based products.

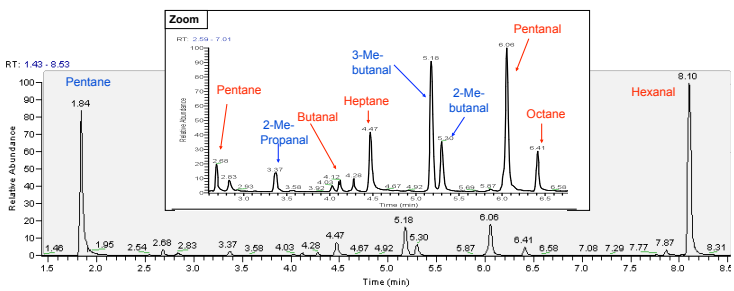



Figure 4. SPME-GC-MS chromatogram of rancid cheese oat products (Red compounds characterise rancidity whilst blue compounds are desirable flavour-related)

| ATD-GC-MS | SPME-GC-MS |
|---|---|
| Overall volatiles composition: Alkanes, Aldehydes, Alkenes, Alcohols, Ketones & Furans. | |
| • 120 compounds entrained.<br>• Many applications, especially in environmental and flavour analysis.<br>• Clean analysis with low chemical background.<br>• 1 min sampling.<br>• Method set up is fast, repeatable and easy to use for quality control. | • 75 compounds entrained.<br>• Fewer compounds described in comparison with the ATD technique.<br>• More expensive<br>• 15 minutes sampling.<br>• Easy to set up. |

## Future work

- Study the effect of added natural antioxidants on the shelf life of oat-based products using ATD-GC-MS techniques.
- Determine the source of the volatiles in terms of the lipid composition of oat products.
- Follow the product in detail from pre-production to confirmed rancidity, elucidate the key factors and mechanisms involved in the rancidity process.

## References

Robards, K., Kerr A.F., and Patsalides, E., 1988, Rancidity and its measurement in Edible oils and snack foods, *Analyst*, **113**, 213-224.
Zhou, M., Robards, K., Glennie-Holmes, M., and helliwell, S., 2000, Contribution of volatiles to the flavour of oatmeal, *Journal of the Science of Food and Agriculture*, **80**:247-254

## Acknowledgements

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