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HEADSPACE ANALYSIS OF FOODS AND FLAVORS

THEORY AND PRACTICE

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FOREWORD

There has been a resurgent interest in the measurement of headspace gas components as an analytical technique. Part of this increased interest is due to the introduction of new technologies such as solid phase micro extraction, SPME, as well as the introduction of automated techniques to collect and introduce the volatiles into the gas chromatograph. Recent innovative technologies such as electronic noses also rely on headspace sampling techniques.

Headspace techniques have always offered an attraction to food, flavor and environmental scientists as many food and environmental samples are difficult matrices from which to extract volatiles. Alternative techniques such as distillation, extraction or absorption are not only tedious but often produce artifacts in the process. In contrast, headspace techniques are rapid, relatively clean and usually do not require the use of solvents. Solventless techniques are becoming increasingly desirable as they do not incur additional disposal costs nor create environmental concerns.

Headspace analysis is not without its problems. Reproducability has been a problem of long standing which has been solved in large measure by a number of automated technologies that carefully control how samples are collected and desorbed. Some of the more persistent problems include how to interpret the differences between the results from static and dynamic headspace analyses. It is generally accepted that dynamic headspace techniques will produce extracts which have enriched the highly volatile components at the expense of the less volatile components. Static headspace samples are more reproducible but produce extracts containing low amounts of volatiles. Thus, it is often difficult to identify potent trace components in extracts from this technique. Finally, there appears to be no general agreement as to which technique produces extracts which are most representative of the original product.

This book attempts to bring together the latest advances in the increasingly divergent area of headspace analysis of food volatiles. The information is presented in the hope that it can be immediately applied by those working in this area as well as provide a springboard for ideas that might further improve this valuable technology.
Headspace gas analysis is an analytical technique that has been successfully applied to food flavors for over 20 years but has experienced a resurgence of interest and innovations in recent years. In the strictest sense, headspace analysis represents the direct collection, concentration and analysis of volatile components in the space immediately above a food or beverage. The technique offers several advantages for workers interested in how a product smells and ultimately tastes. It offers the advantages of speed, simplicity, and more importantly, represents the aroma profile a consumer is likely to experience just before consuming a product. Since only volatile components are collected, the sample is completely free of nonvolatile residues which commonly plague comparison liquid-liquid extracts of the same product.

Headspace analysis has undergone many advances which have not been addressed in a unified manner since George Charalambous edited *Analysis of Food and Beverages: Headspace Techniques in 1979*. The current volume was developed to examine recent developments in this field and has been organized according to the following outline:

- Overview of headspace analysis
- Headspace theory—definitions
- Sample matrix/binding—headspace interactions
- New techniques
  - Electronic nose—dynamic headspace
  - SPME—static headspace
- SPME applications
  - SPME/MS
  - SPME/GC-O
- Dynamic headspace/purge and trap techniques
- New approaches in headspace trapping and elution

This publication contains chapters on the basic theory of headspace analysis, as well as the theory and application of newly developed headspace techniques such as solid phase micro extraction, SPME, and electronic noses. New concentrating and desorption techniques are described in addition to a raft of food applications including tomato and citrus juices, alcoholic beverages, baguettes, dairy products, lipids, grill flavoring, baked potato, and meat. Chapters on off-flavors as well as aroma-food matrix interactions are also included.

The target audience for this book is food and flavor scientists, industrial flavorists,
prefumers, food technologists, and quality control managers as well as academics and students interested in flavors and fragrances.

The editors are most appreciative of the efforts of each of the chapter authors.

Russell L. Rouseff
Keith R. Cadwallader
CONTENTS

1. Headspace Techniques in Food, Fragrances and Flavors: An Overview 1
   Russell Rouseff and Keith Cadwallader

2. Headspace—Gas Chromatography: An Ideal Technique for Sampling Volatiles
   Present in Non-Volatile Matrices 9
   Leslie S. Ettre

3. Aroma Compounds-Proteins Interaction Using Headspace Techniques 33
   E. Jouenne and J. Crouzet

4. Electronic Noses in Food Analysis 43
   John-Erik Haugen

5. The Strengths and Weaknesses of the Electronic Nose 59
   W. James Harper

6. Solid Phase Microextraction 73
   Janusz Pawliszyn

7. SPME-MS-MVA as a Rapid Technique for Assessing Oxidation Off-Flavors
   in Foods 89
   R. T. Marsili

8. GC-Olfactometry with Solid Phase Microextraction of Aroma Volatiles from Heated
   and Unheated Orange Juice 101
   R. Rouseff, R. Bazemore, K. Goodner, and M. Naim

9. Headspace Volatile Aldehydes as Indicators of Lipid Oxidation in Foods 113
   Fereidoon Shahidi
10. A Comparison of Headspace Entrainment on Tenax with Solid Phase Microextraction for the Analysis of the Aroma Volatiles of Cooked Beef
   J. Stephen Elmore, Eleni Papantoniou, and Donald S. Mottram

11. Choice and Use of Standards for Dynamic Headspace Trapping and Application to the Analysis of the Volatiles of Baked Potato
   Jennifer M. Ames, S. Craig Duckham and Jokie Bakker

12. Aroma Components of an Oil-Based Grill Flavoring by Direct Thermal Desorption-Gas Chromatography-Olfactometry and Sample Dilution Analysis
   Thomas E. Webb and Keith R. Cadwallader

13. Solvent Desorption Dynamic Headspace Sampling of Fermented Dairy Product Volatiles
   S. A. Rankin

14. Dynamic Headspace Analysis of Fresh Tomato Juice
   Mathias K. Sucan and Gerald F. Russell

15. Apparatus for the Quantitative Analysis of the Aroma of French Bread and Its Loss during Storage
   G. Zehentbauer and W. Grosch

16. Automated, Microprocessor Controlled Short Path Thermal Desorption System for Analysis of Volatiles in Foods