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BOOK REVIEW

Flavour Science, Recent Developments

Taylor, A.J. and Mottram, D.S. (1996) The Royal Society of Chemistry, Cambridge. pp. xiv + 472.
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The book *Flavour Science, Recent Developments* contains the proceedings of the Eighth Weurman Flavour Research Symposium, held in Reading, UK on 23–26 July 1996. This book is indispensable for everyone who wants to keep up-to-date on the most recent developments in the area of flavour science.

The introduction to this book reads as follows:

> Flavour science is a multidisciplinary subject encompassing biochemical, chemical and physical aspects of food science, the organic chemistry of natural products and the physiology and psychology of sensory perception. Over the past 25 years, the science has developed from a systematic study of organic compounds found in the volatiles of food into a science which aims to provide an understanding for all aspects of flavour from its generation in the food to its perception during eating.
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> *Flavour Science* reflects these developments by presenting the latest research in the subject from international contributors. It is divided into seven subject areas reflecting the major divisions of flavour science: Flavours of Biological Origin; Biotechnological Production of Flavour; Chirality and Flavour; Thermally Generated Flavour; Novel Methods of Flavour Analysis; Sensory Methods in Flavour; and the currently 'hot' topics of Flavour Binding and Flavour Release.
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> This book is unique and international in its coverage, providing a broad overview of an important yet often diverse area. It will have appeal to professionals, graduates, postgraduates and researchers in all areas of food science.

This symposium was attended by 105 invited participants from 17 countries in Europe, America, Asia and Australia. The book contains 86 lectures, posters and workshop presentations. These are mainly research papers and are divided into seven subject areas. The content of these sections will be briefly discussed.

Section 1 is called 'Flavour of Biological Origin' and contains 17 papers covering 96 pages. Only four of the 17 papers finish with a heading 'Conclusion', and in all the other papers one has to find the conclusions under the heading of 'Discussion and results'. A few topics in this section are the following. Whitfield *et al.* investigated the presence of bromophenols in ocean fish and prawns and the source of these compounds in the animals' diet. They found that the bromophenol content of these animals tends to depend on the algae growing in their feeding region. Outbreaks of iodine- or iodoform-like flavours in fish and prawns can now be attributed to their dietary intake. Some papers cover the subjects of the influence on the flavour composition after special treatment of the biological source. Finally a series of papers treat the composition of the volatile compounds from their natural origin. A fine example of these is a paper of Krammer *et al.* about new sulphur compounds in buchu leaf oil. They identified 13 new flavour compounds, of which the sensory properties were evaluated and correlated with the complex flavour impression of the oil. It is a pity that the subject 'buchu' in the index has to be found under the keyword 'bachu'.

Section 2 is named 'Biotechnological Production of Flavours' and concerns eight papers covering 44 pages. None of these papers has a heading 'conclusion'. Two of the

papers make do with an 'introduction' of less than 10 lines; all the others have more than 20 lines. A fundamental study is from Reil and Berger on the genesis of aroma compounds in phototropic culture of grapefruit. Benz and Mulheim investigated the biotechnological production of vanillin ex eugenol and ex ferulic acid. Most of the other papers deal with the enzymatic formation of flavour complexes or simple flavour compounds.

Section 3, under the heading 'Chirality and Flavour', consists of five papers covering 34 pages. Only one paper has a heading 'Conclusion' while another has a section entitled 'Discussion and conclusions'. Worthwhile to mention are the studies of Tresll *et al.* on the formation of gamma- and delta-lactones by different biochemical pathways, and the investigations of Braigie *et al.* on the effect of processing on chiral aroma compounds in fruits and essential oils. The data of Braigie *et al.* show that it would be almost impossible to use chiral analysis alone, particularly on a single compound, to specify the origin of the citrus oils.

Section 4 is called 'Thermally Generated Flavour' and contains 17 papers covering 90 pages. Seven of these papers deal with the Maillard reaction, which describes a reaction between proteins and carbohydrates and is responsible for the changes in the flavour, colour and nutritive value, and the formation of mutagenic compounds. Interesting are the two papers of Schieberle and Hoffmann about the identification of the key odorants in processed ribose–cysteine Maillard mixtures by instrumental analysis and sensory studies, and the investigations on intermediates generating the compounds 2-methyl-3-furanthol, 2-acetyl-2-thiazoline and sotolon by a Maillard-type reaction. Weenen and Apeldoorn investigated the carbohydrate cleavage and the formation of alpha-dicarbonyls in the Maillard reaction. Grosch *et al.* studied the potent odorants in the aroma of roasted coffee by aroma extract concentration analysis (AECA) in addition to the well-known aroma extract dilution analysis (AEDA).

Section 5 is named 'Novel Methods of Flavour Analysis', and consists of nine papers covering 45 pages. Two of the papers, 'New Trends in Electronic Noses for Flavour Chemistry' by Talou *et al.* and 'Production of Representative Champagne Extracts for Olfactory Analysis' by Priser *et al.*, could have been better situated in Section 6 under Sensory Methods. The last paper in particular should be swapped with a paper of the same group under Section 6 entitled: 'Quantitative Analysis of New Potent Flavour Compounds in Burgundy Pinot Noir Wines', because this paper does not deal with sensory analysis. Several of the papers under this section discuss the headspace analysis of food flavours. Worthwhile to notice is a paper on 'Tandem Mass Spectrometry in Flavour Research' by Fay *et al.*

Section 6 is called 'Sensory Methods in Flavour' and comprises 10 papers covering 50 pages. For the readers of *Chemical Senses* this section with some papers from other sections are the most interesting. The papers of Grosch *et al.* in Section 4 and of Talou *et al.* and of Priser *et al.* in Section 5 also deal with fundamental aspects of sensory analysis. The paper of Aubry *et al.* should be omitted from this section. Most of the applied sensorial methods describe investigations and gas chromatography–olfactometry. To study the relationships between data of these investigations and gas chromatography–olfactometry partial least squares regression analysis has often been applied. Although many results are provided in this section there is sometimes a lack of description of the sensory methodology, which is used. The most interesting and perhaps also the most speculative paper in this section is that of Acree and Bloss. In this paper the perception of odours by humans has been considered from an ecological standpoint and has been compared with odour perception by other animals. Most of the other papers deal with the applied sensory analysis of food flavours, such as goat and cheddar cheese, wine, frozen salmon, orange juice and scotch malt whisky.

Section 7 is named 'Flavour Binding and Flavour Release' and has 17 papers covering 95 pages. Twelve of these papers have a heading 'Conclusion'. For the flavour chemist this is probably the most interesting section. All the papers are of good quality. Binding and release of flavours can play an important role in applied flavour chemistry and technology, e.g. binding to proteins and cell wall materials (wood), and release from water (soft drinks), ethanol (beverages) and ice cream. Within this section are the papers: 'Time Course Profiling of Volatile Release from Foods during the Eating Process' by Linforth *et al.*; 'Effect of Fat Content on Volatile Release from Foods' by Ingham *et al.*; and 'The Use of Time-intensity Analysis for the Development of Fat-free Foods' by Vroom *et al.*

Finally, Section 8 is devoted to three workshops. Nursten and Reineccius conducted a workshop on current and future problems in flavour research; Braigie guided a workshop on the chemical nature of naturalness; and Mlotkiewicz and Elmore reported on a workshop about the electronic nose. In this last workshop Talou gave an overview of the

evolution of the electronic nose. Major improvements for the devices would be the development of sensors (i) which were not affected by humidity and (ii) which were more specific.

The subject index of only six pages is rather short. The layout of the book is of a high standard, tables and formulas are clear and the text is easy to read.

This book is a must for everyone who is interested in or working in the field of flavours, as well in those in research, development and production as in sensory analysis and flavour formulation.

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