PROGRESS IN FLAVOUR RESEARCH 1984

Proceedings ot fhe 4th Weurman Flavour Research Symposium

Edited by

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DEVELOPMENTS IN FOOD SCIENCE 10

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PREFACE

Some ten years ago Dr C. Weurman, who had carried out pioneering work in flavour research at T.N.O. since 1956, began to organise an aroma research symposium. His aim was to bring together, in an informal way, a limited number of researchers from all disciplines related to aroma research. Unfortunately, Dr Weurman was unable to see his idea realised since he died a few months before the symposium took place.

The meeting was held at the Central Institute for Nutrition and Food Research T.N.O., Zeist (The Netherlands) in May 1975. It was so successful that it was decided that similar symposia should be organised on a regular basis. Since that time, such meetings, called the Weurman Flavour Research Symposia in memory of the late Dr Weurman, with the same objective, have been held every three years in different countries. Each symposium has covered the progress in each of the areas involved and has improved the mutual understanding between research workers in different areas of flavour research.

This year the symposium was organised by the Laboratoire de Recherches sur les Arômes de l'Institut National de la Recherche Agronomique (I.N.R.A.) from Dijon and was held in Dourdan (France). We hope that it gave the participants the same possibilities as previous symposia for updating their knowledge of the field through the series of communications, poster sessions, workshops and free discussions.

The Editor wishes to thank the I.N.R.A. for its support. He also thanks most sincerely the Organising Committee for their work in the preparation of this meeting and for their assistance during the meeting itself: Drs Paula Jounela-Eriksson, H. Maarse, F. C. Guglielmina, Professor P. Schreier and, particularly, Dr D. G. Land who, in addition to the tremendous help he gave during the preparation, also volunteered for the difficult task of preparing the summarising lecture.

The Editor is also grateful to Drs J. Piggott, P. Punter, B. Toulemonde, and D. Woolley, who organised the various workshops. He would also like to thank his secretary, D. Guilleminot, who cheerfully accepted the extra burden of work that this symposium entailed.

The Editor is grateful to the companies Delsi, Nermag, Martini et Rossi, and Moët et Chandon for financial support. He would also like to extend his thanks to the staff of V.V.F. du Normont (Dourdan) who helped to create a most comfortable atmosphere during the meeting.

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SESSION I

SENSORY TECHNIQUES AND APPLICATIONS

Chairman : Paula Jounela-Eriksson

J. Adda (Editor) *Progress in Flavour Research 1984*
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A NEW MODEL FOR DESCRIBING INTERACTIONS IN ODOUR MIXTURES

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ABSTRACT

Sensory interactions between flavour compounds are well-known. The flavour intensity of a mixture can be susceptible to effects like additivity, suppression or enhancement, whilst the flavour quality may also change. Various models to quantify or describe this phenomenon have been proposed in the literature, but the great drawback of such models is that they are not in agreement with psychophysical laws and that they provide no indication of the flavour quality of the mixture. Starting from the power law of Stevens, a new model for odour-odour interactions is proposed.

INTRODUCTION

The perception of flavour as such is extremely difficult, if not impossible, under practical conditions, but under strictly-controlled laboratory conditions, trained panellists will be able to distinguish between specific flavours because interactions and interferences can be minimized. By contrast, many interactions take place in practical situations. Interactions between flavours can be described by theoretical models and such a model can also be constructed for odour-odour interactions, which is the main subject of this paper.

Attention will also be given to the following pertinent questions:

- what types of flavour interactions can be distinguished?
- what models are there for odour-odour interactions and what are their shortcomings?
- what model can solve such problems?
- what is the scope of the model and what its constraints?

FLAVOUR INTERACTIONS

We can distinguish three basic types of flavour interactions:

Interactions between different senses

As Kramer (ref.1) pointed out in his suggestive "circle", flavour is part of the overall sensory perception of a product. In practical situations, a product is seen as a sensory entity and only on analysis are different sensory properties distinguished like appearance, texture, aroma and taste. This is, of course, a necessary simplification because we have to realise that appearance influences taste, texture aroma etc. We tested the sweetness and sourness of red, orange and yellow-coloured Seven-Up. The red drink came out significantly sweeter and the yellow one significantly sourer, showing that the appearance of a product influences the perception of taste.

Interactions between product and flavour

The perception of a flavour is also dependent on the type of product. A strawberry flavour will, for instance, be perceived in a different way in ice-cream, jam or yoghurt. This is no doubt caused by product ingredients, which may bind some flavour compounds, or by a different pH, temperature and the lypophylic or hydrophylic character of the product. This results in different aroma compositions reaching the sensory sites in the nose.

Interactions between flavours

Flavour compounds can influence each other. Here, we can distinguish taste-taste, taste-odour and odour-odour interactions. The effects are usually designated as additivity, suppression and enhancement. Additivity means that the overall intensity of a combination of two different flavours is equal to that of a similar combination of the same flavour (cf. Yamaguchi et al. who give a more detailed classification (ref.2)):

if $I_a = f_a(C_A)$ and $I_b = f_b(C_B)$

then $I_{(a+b)} = f_a(C_A)+f_b(C_B)$

Suppression means that the combination gives an intensity lower than expected:

$$I_{(a+b)} < f_a(C_A)+f_b(C_B)$$

and enhancement means that the combination gives an intensity higher than expected:

$$I_{(a+b)} > f_a(C_A)+f_b(C_B)$$

Combination of different flavour compounds, may change the flavour quality as well. A specific example of quality change is "masking" where one flavour (or off-flavour) is suppressed. Major attention will be given to such interactions, particularly odour-odour interactions.

EXISTING MODELS

In the literature, two models are presented describing the interactions between different flavour compounds. One type gives a quantitative description in mathematical terms. Berglund was the first to present a vector approach. This approach and some variations have recently been reviewed by Laffort and Dravnieks (ref.3).

$$I_{AB} = \sqrt{I_A^2 + I_B^2 + 2I_AI_B \cos \alpha_{AB}}$$

The interaction is described by a factor cos α, which may have a value beween 1 and -1. In the vector model, the maximum value of cos α gives "additivity" and enhancement will therefore result in imaginary odour intensities.

A modification of the model, the U model by Patte & Laffort, solves this problem.

$$I_{AB} = I_A + I_B + 2 \cos \alpha_{AB} \sqrt{I_A I_B}$$

However, like the vector model, it cannot be brought into line with the power law of Stevens. To overcome this difficulty, the value of cos α can be made variable (the UPL model). However, this makes the model not very transparent and its predictive ability is rather poor (ref.3).

The second model is a qualitative description developed by Köster (ref.4). It consists of a plot of iso-intensity curves for the relative concentration of two odorants and their mixtures. (see Fig.1).

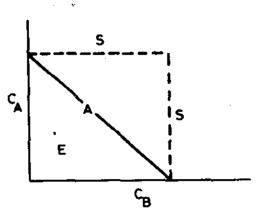

Fig. 1 Köster iso-intensity plot