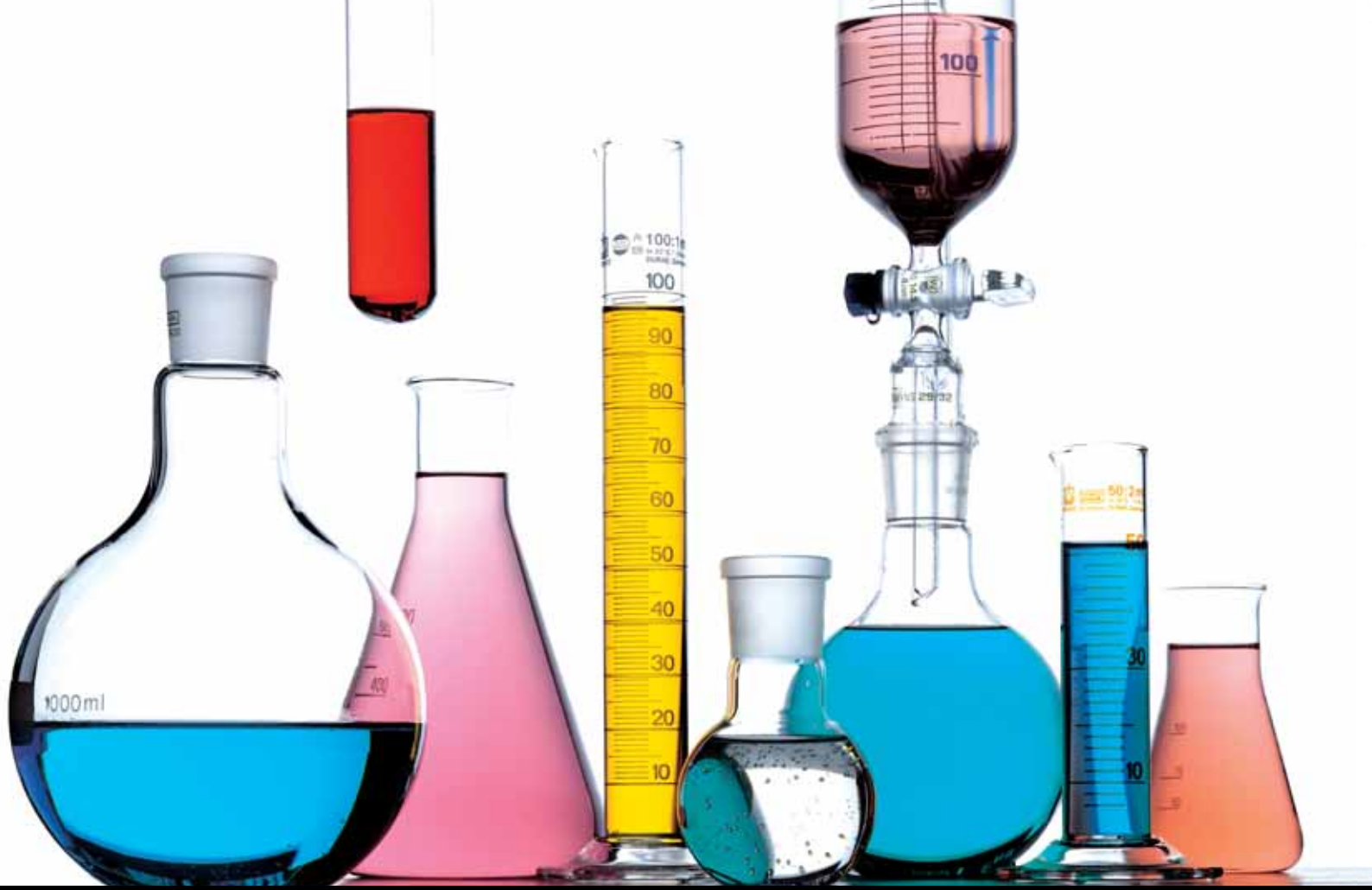

FLAVOUR THRESHOLDS

Compilations of flavour threshold values in water and other media (Edition 2011)

L.J. van Gemert

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COMPILATIONS OF FLAVOUR THRESHOLD VALUES IN WATER AND OTHER MEDIA

(second enlarged and revised edition)

Published by Oliemans Punter & Partners BV, The Netherlands

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(second enlarged and revised edition)
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PREFACE SECOND EDITION

This edition is revised and enlarged. Errors were corrected and more trivial names included. And a large number of CAS (Chemical Abstract Service) Registry Numbers were added.

Around fifteen hundred new threshold values found in the literature were listed in the compilations.

A table with approximate total numbers of compounds, threshold values and references is given below.

Compilation	*Compounds*	*Threshold values*	*References*
WATER	2,160	6,140	1,250
OTHER MEDIA	1,010	3,900	580
PEPTIDES	680	870	90
Total		**10,910**	

L.J. van Gemert, August 2011

INTRODUCTION

Thirty years of compiling
Together with the compilations of odour threshold values [1], the present compilations cover the whole spectrum of odour, flavour and taste thresholds. The first activities started in the beginning of the seventies of the former century. During the since than passed 30 years working on these compilations has been done in a discontinuous way. It is only during the last one and a half year that a lot of efforts have been put in it, in order to finish the job.

Odour and flavour, or orthonasal and retronasal perception
Odour threshold values are obtained by sniffing, i.e. orthonasal olfaction during which the stimuli are outside the mouth. It can also be described as 'smelling through the front door'.
In the present compilations flavour threshold values are listed. Flavour is here defined as all perceptions based on the senses of odour and/or taste and/or the common chemical sense - or other "chemical" senses -, when a food or a drink is put into the mouth. Thus, odour can again be perceived, but this time via the retronasal route, or 'smelling through the back door'. Some researchers have retronasal perception made impossible, or at least restricted it to a very high degree. If so, this is indicated - for instance, the use of a nose plug - after the listed threshold values.

Importance of flavour threshold values
Many volatile and non-volatile compounds have been identified in food products, as well as in (drinking) water. The importance of these compounds for the flavour and/or taste of foods and drinks, including drinking water, as well as their contribution to taints and off-flavours can be assessed if their concentrations and threshold values are known.

Three different compilations
In the first compilation the flavour threshold values established in water are listed. And in the second one the threshold values measured in other media, than water, are compiled. The third one contains the threshold values of peptides and derivatives in water and, only a few, in other media. This compilation has been separated from the first two because of its quite different system of nomenclature. A list of abbreviations or symbols used is presented on the first page of this part.

The present compilations contain almost 9,400 threshold values. In total about 1570 references are listed and the number of compounds ranges from approximately 625 for the compilation with flavour threshold values of peptides and derivatives, to approximately 1870 for the compilation with flavour threshold values in water. The one for other media (than water) contains threshold values for about 920 compounds.

In all three compilations the compounds are listed alphabetically, ignoring structural prefixes. For each compound the data are given chronologically. The references are quoted by author(s) and the year in which the relevant artic1e bas been published. Full titles are given in the lists of references.

A few extra references with additional information about flavour threshold values in water are presented at the end of the list of regular references.

Types of flavour thresholds
Two types of flavour thresholds, i.e. the absolute and the difference threshold, can be distinguished. The detection and the recognition thresholds are absolute thresholds. The first being the minimum concentration which can be detected without any requirements to identify or recognize the stimulus,

while the second one is the minimum concentration at which a stimulus can be identified or recognized. In many publications it is assumed that there are different recognition threshold values for different taste characteristics of one and the same chemical compound. Especially, a number of taste compounds show different threshold values for basic tastes like, sweet, bitter, sour, salty and umami.

Detection and recognition threshold values are listed and if known, indicated as such. Difference thresholds, the smallest change in concentration of a substance required to give a perceptible change, are not listed. Also, remarks about the taste, or no taste, of compounds, without any quantitative information, are not included.

When threshold values were reported for different groups of subjects, only results from controls or tasters with a 'normal' sensitivity, when available, have been listed. In a number of cases a remark concerning the sensitivity of the subject(s) has been put after the threshold value. Thus, in principle results from patients or 'insensitive' tasters have been excluded.

Concentration units
A great diversity of concentration units is used in the literature. For comparison reasons all data have been converted, if necessary, to mg/kg for those in water and in other media. Most conversions are straight forward. When not indicated the anhydrous form has been used for the conversion from moles to mg/kg. For the conversion of the threshold values in water or other media volume units to weight units the specific weight of the volatile compound or media was not taken into account, i.e. it was supposed to be unity.

In the first two compilations only for a limited number of cases threshold values expressed in millimoles (mM) were listed. The third compilation concerning threshold values of peptides and their derivatives gives mainly mM values.

Definition of threshold value
There are different definitions or calculation methods for the threshold value. These vary from defining the threshold value as the lowest (most sensitive subject) detection threshold to the highest (most insensitive subject) recognition threshold. Standardization based on comparison of these different interpretations has not been applied.

Whole mouth vs. partial mouth procedures
It is evident that flavour threshold values are dependant upon a large number of factors, including whether the whole mouth or only a part of the mouth has been exposed to the stimuli. For this reason in general a remark has been put after the value when a partial procedure has been applied. Thus, remarks like 'Geschmackslupe', three drop method, tongue dipping, etc. all indicate partial exposure.

Interpretation of graphical information
In a large number of publications threshold values were only presented in graphics. This means that in some cases only information about threshold values was extracted by taking the lowest and highest measured, or by taking the values presented on the axis below and above the mean threshold values, or by taking the mode or the median.

Original sources
Only data from original references have been compiled, i.e. from publications in which the actual determination of the threshold values is described, or in which the values are given for the first time. Same groups or laboratories report threshold values without reference to the earlier published articles in which the threshold value was reported for the first time. In such cases publications - from the same group - are referred to in which the threshold value is reported.

Nomenclature
In the first two compilations the rules for the nomenc1ature from the International Union of Pure and Applied Chemistry (IUP AC) have been followed, with references to trivial names, especially for rather 'simple' compounds. For the more complex compounds trivial names, if available, were used. Data for apparent mixtures have not been inc1uded. An exception was made for mixtures of (*Z*)- and (*E*)-geoisomers, (*R*)- and (*S*)-enantiomers (and diastereoisomers) and cis/trans configuration epimers.

Acknowledgements
Many persons have contributed in some way or another to the compilations during the past 30 years. Some were helpful in finding articles with threshold data, others suggested improvements in the nomenclature, including the trivial names, of the chemical compounds and a few had comments on the conversion of the concentration units. All contributions are appreciated very much.
And I am grateful to Pieter Punter of Oliemans Punter & Partners BV, who enabled the publishing of this compilation. The Edition 2003 contains the same threshold data as the first printing [(2)].

Your comments are welcomed
A lot of effort and hard work bas been put into the compilations in order to make these as accurate and complete as possible. But, it is impossible to exclude errors or to find all available information. Therefore, I would be very grateful if users of these compilations could inform me of any errors or omissions.

Leo van Gemert, Zeist, The Netherlands

IMPORTANT

The threshold data are derived from a search in the literature. By any doubt, the original references should always be consulted.
The threshold values are compiled with the necessary care. It cannot be guaranteed that the data are free of errors. The author and publisher are not liable for damage resulting from the use of the data in these compilations.

References

[(1)] L.J. van Gemert, Odour thresholds. Compilations of odour threshold values in air, water and other media (Edition 2003), Oliemans Punter & Partners BV, 2006

[(2)] L.J. van Gemert, Compilations of flavour threshold values in water and other media, Boelens Aroma Chemical Information Services, 2003

For additional information, please visit our website www.thresholdcompilation.com or send an email to info@thresholdcompilation.com. On our website you can also find information about our compilations of odour thresholds.