

BEER FLAVOUR TERMINOLOGY<sup>1</sup>M. C. MEILGAARD<sup>2</sup>

(Stroh Brewery Company, Detroit, Michigan, U.S.A.)

C. E. DALGLIESH AND J. F. CLAPPERTON<sup>2</sup>

(Brewing Research Foundation, Nutfield, Surrey)

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**Joint Working Groups of the European Brewery Convention, the American Society of Brewing Chemists, and the Master Brewer's Association of the Americas have developed a system of flavour terminology to meet the dual needs of (i) enabling brewers to communicate effectively about flavour and (ii) naming and defining each separately identifiable flavour note in beer. The system comprises 44 terms to meet the first objective while 78 additional terms are suggested for the second. The industry is urged to use this terminology and comment on it.**

**Key words:** beer, flavour.

## INTRODUCTION

The arguments for an agreed flavour terminology are the same as those for an agreed chemical terminology, biological terminology or for a common scale of temperature. There are a number of important advantages in precise descriptions which have the same meaning to everyone suitably trained. For example, a brewer assessing the flavour effects of a process change must use the same terminology as the taste panel leader. Again, a chemist investigating a flavour defect must be able to make sense of the literature on his subject, and he must understand the flavour language not only of brewer and panel leader, but also of maltster and hop supplier as well as that of the engineer, the manager, the foreman, etc. Last, but not least, if any progress is to be made in the basic science of flavour chemistry, then a chemist in one laboratory must make certain that he defines his flavour terms in the same way as his colleagues in other laboratories.

Early progress towards an international system is recorded in a 1975 report published in brewing journals of several countries (4). Discussion at the annual meetings of the collaborating organizations and extensive consultation and voting by mail resulted (1977) in an intermediate system which was published in the MBAA's book, *The Practical Brewer* (5). Proposals arising principally from experience in meeting practical brewing requirements have led to the third, and for the time being final, form (Table I). Terminology is never static, nor should it be. It reflects both the changes in common usage and the results of research as they become available. But the Joint Working Groups urge all brewers and brewing researchers to use the present system for a period sufficiently long to identify (and report on) both advantages and defects. Then, in say five years time, a new working group must be given the task of bringing the terminology up to date.

The proposed system has a dual purpose: it aims to provide, firstly, a simple and easily understood terminology which will enable brewers and other interested parties to communicate effectively about flavour; and, secondly, also to provide a more comprehensive system which will enable flavour researchers, brewers and marketing professionals to describe and define each separately identifiable flavour note in beer. In Table I, the first objective is met by limitation to the class terms and the first-tier terms, shown together in the Flavour Wheel (Fig. 1), while the second objective can be satisfied

by using the complete system including the second tier of terms.

## BASIC PRINCIPLES

The system is based on the following principles:

*Each separately identifiable flavour characteristic has its own name.*—Although this means that there are over 100 terms, the large majority of those taking part in the discussions felt that it would be wrong to simplify. Flavour is a complex phenomenon, and the system must contain enough terms to enable an expert taster to describe what he finds. It must also provide suitable forms of terminology for all users irrespective of their level of training and experience.

*Similar flavours are placed together.*—A user must be able to see at a glance the terms from which he can choose. The order of terms should be the same in different languages. If a new term is introduced then it should be obvious where it goes in the system.

*No duplication on terms for the same flavour characteristic.*—Ideally both duplication and overlapping should be avoided, but in practice this leads to conflict with principle No. 1 above and with the requirement that all flavour characteristics must be covered. Language is an incomplete tool providing a limited choice of words. For example, in five cases it was found necessary to permit overlapping pairs\* of chemical-name terms and generally-descriptive terms. It helps to think of the totality of beer flavour as a three- or multidimensional continuum (2,9) in which related compounds are together, and each compound and each term occupy a point or small volume in space. In such a system, 0613 Isovaleric and 0612 Cheesy would be close together but not coincident. Term 0613 would be closer to the 'fatty acid' area and 0612 would be more diffuse and would incorporate part of the 'butyric' and 'diacetyl' areas. A taster who has been trained to recognize 0613 would do so when finding it in a sample. Other tasters must use 0612 though it covers more than just the flavour note present in the sample.

*The system is compatible with the 'EBC Thesaurus for the Brewing Industry'.*—Close collaboration is maintained with the EBC Information and Documentation Group, and the two systems of terminology are almost identical. Such small differences as exist are due to the different dates at which the two systems have been revised, and by the strictly hierarchical nature of the Thesaurus which requires a broader term to cover each class, e.g. 'Fat and Oil Flavour' for Class 6.

*Subjective terms such as good/bad, young/mature, balanced/unbalanced are not included.*—These hedonic terms have meaning within an active flavour panel and almost every brewery panel uses them. But they cannot be standardized on an international basis.

*The meaning of each term is illustrated with readily available reference standards.*—Flavour terms cannot be adequately defined other than by the use of reference standards (6,7). Eleven standards had been confirmed at the time of writing and are shown in Table I. The concentrations listed are three

<sup>1</sup> Published for the Joint Working Groups of the European Brewery Convention, the Master Brewers Association of the Americas and the American Society of Brewing Chemists.

<sup>2</sup> Present address: Pedigree Petfoods, Melton Mowbray, Leicestershire, UK LE13 1BB.

\* The five pairs are: 0131 Isoamyl acetate and 0143 Banana; 0132 Ethyl hexanoate and 0142 Apple; 0133 Ethyl acetate and 0120 Solvent-like; 0613 Isovaleric and 0612 Cheesy; and 0732 DMS and 0734 Cooked sweet corn.

TABLE I.  
Recommended Descriptors

Class term	First tier	Second tier	Relevance	Comments, synonyms, definitions	Reference standard
Class 1—Aromatic, Fragrant, Fruity, Floral					
	0110	Alcoholic	OTW	The general effect of ethanol and higher alcohols.	Ethanol, 50 g/litre
		0111 Spicy	OTW	Allspice, nutmeg, peppery, eugenol. See also 1003 Vanilla.	Eugenol, 120 µg/litre
		0112 Vinous	OTW	Bouquet, fuscly, wine-like.	(White wine)
	0120	Solvent-like	OT	Like chemical solvents.	
		0121 Plastics	OT	Plasticizers.	
		0122 Can-liner	OT	Lacquer-like.	
		0123 Acetone	OT		(Acetone)
	0130	Estery	OT	Like aliphatic esters.	
		0131 Isoamyl acetate	OT	Banana, peardrop.	(Isoamyl acetate)
		0132 Ethyl hexanoate	OT	Apple-like with note of aniseed. See also 0142 Apple.	(Ethyl hexanoate)
		0133 Ethyl acetate	OT	Light fruity, solvent-like. See also 0120 Solvent-like.	(Ethyl acetate)
	0140	Fruity	OT	Of specific fruits or mixtures of fruits.	
		0141 Citrus	OT		
		0142 Apple	OT	Citral, grapefruit, lemony, orange-rind.	
		0143 Banana	OT		
		0144 Blackcurrant	OT	Blackcurrant fruit. For blackcurrant leaves use 0810 Catty.	
		0145 Melony	OT		(6-Nonenal, <i>cis</i> or <i>trans</i> )
		0146 Pear	OT		
		0147 Raspberry	OT		
		0148 Strawberry	OT		
	0150	Acetaldehyde	OT	Green apples, raw appleskin, bruised apples.	(Acetaldehyde)
	0160	Floral	OT	Like flowers, fragrant.	
		0161 2-Phenylethanol	OT	Rose-like.	(2-Phenylethanol)
		0162 Geraniol	OT	Rose-like, different from 0161. Taster should compare the pure chemicals.	(Geraniol)
		0163 Perfumy	OT	Scented.	
	0170	Hoppy	OT	Fresh hop aroma. Use with other terms to describe stale hop aroma. Does not include hop bitterness (see 1200 Bitter).	
		0171 Kettle-hop	OT	Flavour imparted by aroma hops boiled in the kettle.	
		0172 Dry-hop	OT	Flavour imparted by dry hops added in tank or cask.	
		0173 Hop oil	OT	Flavour imparted by addition of distilled hop oil.	
Class 2—Resinous, Nutty, Green, Grassy					
	0210	Resinous	OT	Fresh sawdust, resin, cedarwood, pinewood, sprucy, terpenoid.	
		0211 Woody	OT	Seasoned wood (uncut).	
	0220	Nutty	OT	As in brazil-nut, hazelnut, sherry-like.	
		0221 Walnut	OT	Fresh (not rancid) walnut.	
		0222 Coconut	OT		
		0223 Beany	OT	Bean soup.	(2,4,7-Decatrienal)
		0224 Almond	OT	Marzipan.	(Benzaldehyde)
	0230	Grassy	OT		
		0231 Freshly-cut grass	OT	Green, crushed green leaves, leafy, alfalfa.	( <i>cis</i> -3-Hexenol)
		0232 Straw-like	OT	Hay-like.	
Class 3—Cereal					
	0310	Grainy	OT	Raw grain flavour.	
		0311 Husky	OT	Husk-like, chaff, 'Glattwasser'.	
		0312 Corn grits	OT	Maize grits, adjuncty.	
		0313 Mealy	OT	Like flour.	
	0320	Malty	OT		
	0330	Worty	OT	Fresh wort aroma. Use with other terms to describe infected wort, e.g. 0731 Parsnip.	
Class 4—Caramelized, Roasted					
	0410	Caramel	OT	Burnt sugar, toffee-like.	
		0411 Molasses	OT	Black treacle, treacly.	
		0412 Licorice	OT		
	0420	Burnt	OTM	Scorched aroma, dry mouthfeel and sharp acrid taste.	
		0421 Bread-crust	OTM	Charred toast.	
		0422 Roast-barley	OTM	Chocolate malt.	
		0423 Smoky	OT		

TABLE I continued

Class term	First tier	Second tier	Relevance	Comments, synonyms, definitions	Reference standard	
Class 5—Phenolic						
0500 Phenolic		0501 Tarry	OT	Pitch, faulty pitching of containers.		
		0502 Bakelite	OT			
		0503 Carbolic	OT			
		0504 Chlorophenol	OT	Phenol. Trichlorophenol (TCP), hospital-like. Iodophors, hospital-like, pharmaceutical.		
		0505 Iodoform	OT			
	Class 6—Soapy, Fatty, Diacetyl, Oily, Rancid					
	0610 Fatty acid	OT	Soapy, fatty, goaty, tallowy. } Dry, stale cheese, } Hydrolytic } old hops. } rancidity Rancid butter. Butterscotch, buttermilk. } Oxidative rancidity.  As in refined vegetable oil. Gasoline (petrol), kerosene (paraffin), machine oil.	(Octanoic acid). (Isovaleric acid)  Butyric acid, 3 mg/litre Diacetyl, 0.2-0.4 mg/litre		
	0611 Caprylic	OT				
	0612 Cheesy	OT				
	0613 Isovaleric	OT				
	0614 Butyric	OT				
0620	Diacetyl	OT				
0630	Rancid	OT				
	0631 Rancid oil	OTM				
0640	Oily	OTM				
	0641 Vegetable oil	OTM				
	0642 Mineral oil	OTM				
Class 7—Sulphury						
0700 Sulphury		0710 Sulphitic	OT	Sulphur dioxide, striking-match, choking, sulphurous-SO <sub>2</sub> . Rotten egg, sulphury-reduced, sulphurous-RSH.	(KMS)	
		0720 Sulphidic	OT			
		0721 H <sub>2</sub> S	OT			
		0722 Mercaptan	OT	Rotten egg. Lower mercaptans, drains, stench.	(H <sub>2</sub> S) (Ethyl mercaptan)	
		0723 Garlic	OT			
		0724 Lightstruck	OT			
		0725 Autolysed	OT	Skunky, sunstruck Rotting yeast (see also 0740 Yeasty) Higher mercaptans.	DMS, 100 µg/litre	
		0726 Burnt rubber	OT			
		0727 Shrimp-like	OT			
		0730 Cooked vegetable	OT	Mainly dialkyl sulphides, Sulphurous-RSR'.		
		0731 Parsnip/celery	OT	An effect of wort infection.		
		0732 DMS	OT	(Dimethyl sulphide)		
		0733 Cooked cabbage	OT	Overcooked green vegetables.		
		0734 Cooked sweet corn	OT	Cooked maize, canned sweet corn.		
		0735 Cooked tomato	OT	Tomato juice (processed), tomato ketchup.		
		0736 Cooked onion	OT	Fresh yeast, flavour of heated thiamine (see also 0725 Autolysed). Brothy, cooked meat, meat extract, peptone, yeast broth.		
	0740	Yeasty	OT			
		0741 Meaty	OT			
Class 8—Oxidized, Stale, Musty						
0800 Stale		0810 Catty	OTM	Old beer, overaged, overpasteurized. Blackcurrant leaves, ribes, tomato plants, oxidized beer.	(Heat with air) (p-Menthane-8-thiol- 3-one) 5-Methylfurfural, 25 mg/ litre	
		0820 Papery	OT			
		0830 Leathery	OTM			
		0840 Moldy	OT	A later stage of staling, then often used in conjunction with 0211 Woody. Cellar-like, leaf-mold, woodsy. Actinomycetes, damp soil, freshly dug soil, diatomaceous earth.	(Geosmin)	
		0841 Earthy	OT			
		0842 Musty	OT			
				Fusty.		
Class 9—Sour, acidic						
0900 Acidic			OT	Pungent aroma, sharpness of taste, mineral acid.	(Acetic acid)	
		0910 Acetic	OT	Vinegar.		
		0920 Sour	OT	Lactic, sour milk. Use with 0141 for citrus-sour.		
Class 10—Sweet						
1000 Sweet		1001 Honey	OT	Can occur as an effect of beer staling, e.g. the odour of stale beer in a glass, oxidized (stale) honey. May be qualified by sub-classes of 0140 Fruity.	Sucrose, 7.5 g/litre	
			OT			
		1002 Jam-like	OT			

TABLE I continued

Class term	First tier	Second tier	Relevance	Comments, synonyms, definitions	Reference standard
		1003 Vanilla 1004 Primings 1005 Syrupy 1006 Oversweet	OT OT OTM OT	Custard powder, vanillin.  Clear (golden) syrup. Sickly sweet, cloying.	(Vanillin)
Class 11—Salty					
1100	Salty		T		Sodium chloride, 1.8 g/litre
Class 12—Bitter					
1200	Bitter		TAf		(Isohumulone)
Class 13—Mouthfeel					
	1310 Alkaline		TMAf	Flavour imparted by accidental admixture of alkaline detergent.	(Sodium bicarbonate)
	1320 Mouthcoating		MAf	Creamy, 'onctueux' (Fr.).	(Ferrous ammonium sulphate) Quercitrin, 240 mg/litre*)
	1330 Metallic		OTMAf	Iron, rusty water, coins, tinny, inky.	
	1340 Astringent		MAf	Mouth puckering, puckery, tannin-like, tart.	
	1341 Drying		MAf	Unsweet.	
	1350 Powdery		OTM	O—Dusty cushion, irritating, (with 0310 Grainy) mill-room smell. TM—Chalky, particulate, scratchy, silicate-like, siliceous.	60% of normal CO <sub>2</sub> content for the product 140% of normal CO <sub>2</sub> content for the product
	1360 Carbonation		M	CO <sub>2</sub> content.	
	1361 Flat		M	Undercarbonated.	
	1362 Gassy		M	Overcarbonated.	
	1370 Warming		WMAf	See also 0110 Alcoholic and 0111 Spicy.	
Class 14—Fullness					
	1410 Body		OTM	Fullness of flavour and mouthfeel.	
	1411 Watery		TM	Thin, seemingly diluted.	
	1412 Characterless		OTM	Bland, empty, flavourless.	
	1413 Satiating		OTM	Extra-full, filling.	
	1414 Thick		TM	Viscous, 'epais' (Fr.).	

\* Quercitrin is both astringent and bitter.

Particular Relevance: O = Odour T = Taste M = Mouthfeel W = Warming Af = Afterflavour

times the difference threshold for addition to a typical, light lager beer. This should ensure detection by approximately nine persons out of ten (8). Standards which have been proposed but not yet accepted are shown in parenthesis. Purification studies are under way for approximately half of these. Volunteers interested in participating should apply to the first author. Work on reference standards, including recommended methods of purification, will be published later.

#### DESCRIPTION OF THE SYSTEM

The system consists of 14 classes. (Table I). These are given general names to indicate the types of flavours which they contain. It is important to note that only those terms given a four-digit number are intended for use as descriptors. The remainder serve to indicate the class in which any given type of flavour should be sought. Some classes have a broader term (*e.g.* 0700 Sulphury which serves as a common descriptor for all terms in the class; other classes do not have this because language does not contain a suitable term).

There are three kinds of descriptors: class terms, first tier, and second tier. Broadly speaking, the first two are common terms familiar to most people, and together they form a vocabulary designed to fill most everyday needs.

The 'Flavour Wheel' (Fig. 1) is presented to facilitate the location of these terms within the system. The wheel is meant as a memory aid and not as a new system of classification of odours and tastes. Despite the diversity of terms, a logical sequence is obtained in most cases, but certain discontinuities appear, *i.e.* where 'sulphury' follows 'oily'. It can be argued that

this occurs because a multidimensional continuum has been reduced to two dimensions.

The second tier of terms in Table I, together with the reference standards, serve the second purpose, of naming and defining each separately identifiable flavour note in beer. These terms form the theoretical backbone of the system and will be used mostly by specially trained panels. They also serve to define certain first-tier terms for which a reference is not available, *e.g.* '0220 Nutty' comprises a group of flavour notes exemplified by walnut-like, coconut-like, beany and almond-like'.

The column 'Particular Relevance' shows that most terms may be used to describe sensations of both odour (O) and taste (T). The symbols M, W and Af indicate those terms which may be used to describe mouthfeel effects, warming, and afterflavour.

Under 'Comments, Synonyms, Definitions' are given a number of terms which have been used in the past but should now be discouraged in favour of the more precise description given by the recommended terms. Thus the term 0910 Acetic is preferred to 'vinegary'. The flavour caused by caprylic and capric acids combined should be referred to as 0611 Caprylic (3). Term 0630 Rancid is no longer used for a 'butyric' flavour, only for oxidative rancidity (carbonyl compounds).

After much discussion it was decided that the term 'ribes', used in (4) and (5) and also in a research paper (1) by one of us, should after all be abandoned in favour of the more explicit and easily understandable term 0810 Catty. It was felt that a class term was needed to describe the composite off-flavour

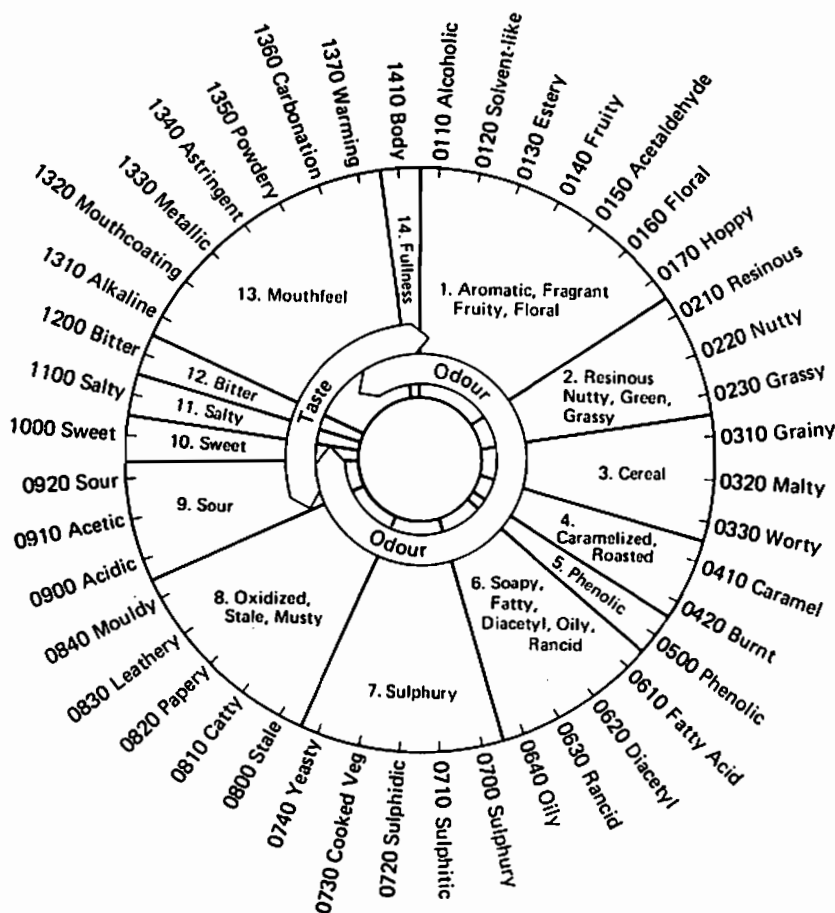


Fig. 1. Flavour wheel.

which develops as beer ages on the shelf under the influence of oxidation; the term 0800 Stale was chosen in preference to 'overaged', 'overpasteurized' or 'oxidized' as the latter are even more ill-defined.

#### USE OF THE NEW TERMINOLOGY

The system proposed here on behalf of the Joint Working Groups is recommended for acceptance and use by all brewers and brewing researchers in official reports and in scientific papers.

Within a brewery, or within a panel, different terminology may of course be used if this is convenient or customary, but such terms should be translated into the official terminology if results are published.

A panel manager putting together a taste testing form may choose from Table I the terms which are appropriate for any given test, and he may add others (such as hedonic terms, see above) if this is required. For example, in daily taste testing of one brewery's beer, 10–20 terms is probably optimal; whilst for a consumer test, two or three terms may be too many. On the other hand if, for example, a sulphury off-flavour develops, a form may be appropriate which has all of the 18 terms under 0700 Sulphury. The terminology is designed to be sufficiently flexible, but self-consistent, to meet all these requirements.

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