

# Flavour Creation



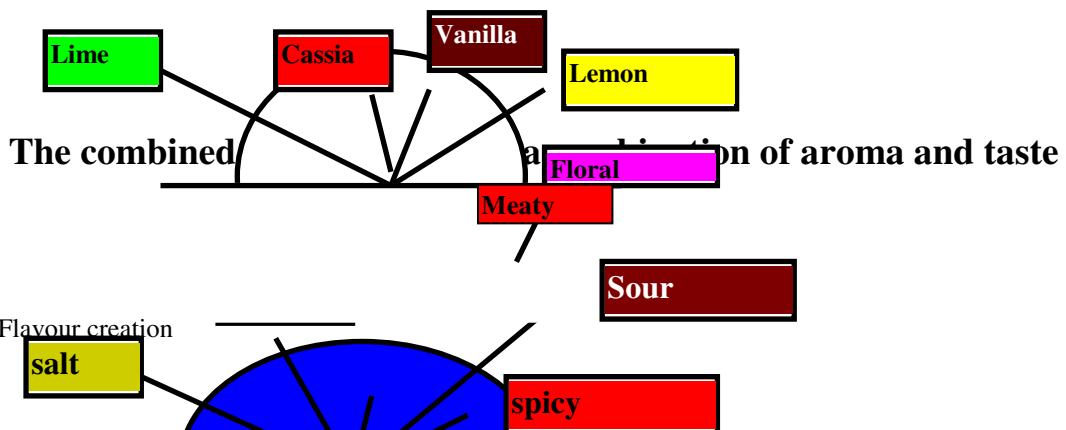
## What is Flavour ?

Flavour = Taste + Aroma

Basic Taste = Salt, Sweet, Sour, Bitter, Umami, and Fat

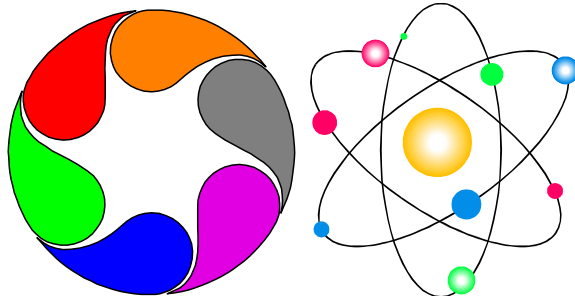
Plus irritants  
Heat (Chilli, Pepper)  
Cooling (Menthol)  
Metallic

**Aroma =** Thousands of volatile components



# ~~Understanding flavour Technology~~

## The Art and Science of flavours



**Where art and science meet**

**Science - Known measurable by instruments**



**Art -Unknown. Not measurable by instruments  
but detected by the people**

## **The Art and Science of flavours**

### **The essence of creativity**

Most flavour companies talk of flavour creation, this is in reference to the art of producing commercial flavours. In the industry flavour laboratories are labelled flavour creation laboratories and flavour application laboratories.

About 80% or more of all commercial flavours are produced by application of the art and only 20% or less by application of the science.

### **Fantasy flavours.**

Fantasy flavours are flavours that are man made by blending components to make a unique combination.

The worlds most famous fantasy flavour is Coca Cola, others worth mentioning are Soy Sauce, KFC flavour, Salami, Coffee, Chocolate, Tomato ketchup, Gingerbeer, Ginger ale, BBQ, Lemonade, Beer, Sub Zero etc.

### **Cartoon flavours**

When we watch a cartoon we really believe the characters are real, even though the fine detail is missing as in a normal picture. Our mind fills in the gaps. When we duplicate a complex flavour we only need to include the key elements to fool our sense of taste that the flavour is real.

Most flavours on the market fall into this category as not all the components that contributed to the original flavour need to be included to produce a realistic flavour. Such flavours are regarded as having high impact and strong character.

A flavour must contain the character impact components of the product the flavour is imitating. To duplicate Coca Cola you can have many formula but each must have the key elements that are characteristic of the flavour. (Lime, cinnamon, vanilla). Other components that are present as background components can be regarded as wallpaper. Some flavours have only one main character impact component and lots of background or wallpaper components that are not as important. Flavours such as vanilla have vanillin/ethy vanillin as the key impact component with the background components adding character shades. There are many flavours such as cheese, tomato, strawberry, to name a few, which **do not have one main character component**, their taste or aroma is due to a combination of components. In fact a majority of flavours do not owe their flavour to one component. With the spices some such as clove (eugenol), Cinnamon (cinnamic aldehyde), coriander (linalool), mustard (allyl iso thio cyanate) owe their unique aroma to mainly one component there are more that owe their aroma to a combinations of flavourings.

## Aroma components of Food

Food	Character-impact compound	Contributory flavour compounds
Almonds	Benzaldehyde	vanilla
Apple	Ethyl 2 methy butyrate	Hexenal trans -2 hexenal acetaldehyde
Banana	iso Amyl acetate	eugenol acetaldehyde
Blackcurrant	para Menta-8- thio-3-one (Corps de Cassis) (4(Methyl Thio)-4-Methyl-2-pentanone)	Esters, ionone terpenes
Butter	Diacetyl	Di methyl sulphide delta deca lactone gamma lactones butyric acid
Cabbage	Di methyl disulphide	2- propenyl iso thiocyanate
Celery	3- Isobutylidene-3,4 dihydophthadide	Cis -3 Hexenyl pyruvate 2,3 -Butanedione
Lemon	Citral	d- Limonene
Mushroom	1- Octen-3-one	
Mango	Terpenes (Alpha Pinene, Beta Ocimene)	Sulphur compounds Esters, Cis-3-Hexenol Undecalactone
Pear	Ethyl trans 2,cis 4-decadienoates	Hexyl acetate iso Amyl acetate
Potato	2 Ethyl -3- Methoxy pyrazine	Methional
Strawberry	Furaneol Cis-3-Hexenol Ethyl Butyrate Ethyl methyl phenyl glycidate	Undecalactone Methyl Cinnimate Diacetyl, Linalool
Raspberry	1-p-Hydroxyphenyl-3-butanone (Raspberry ketone)	cis-3-Hexenol Damascenone Alpha & Beta Ionones
Tangerine/ Mandarin	d limonene	Methyl n- methyl anthranilate, thymol sinseal
Tomato cooked	di methyl sulphide	trans 2 Hexenal cis - 3- Hexenal 2- iso Butylthiazole beta ionone

## Photograph flavours

Exact duplication of a natural flavour is often requested. Sometimes customers say “ I want a very natural” flavour, when they mean I want an **exact duplicate** of the named product.

Such flavours are delicate and have many more components and natural extracts compared with cartoon flavours.

In Japan, Europe and parts of Asia such flavours are wanted.

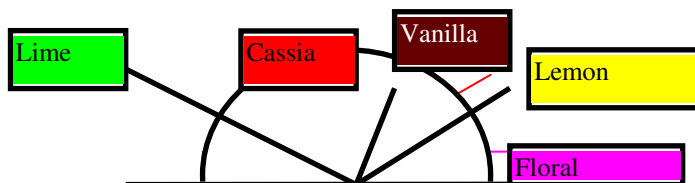
When such a customer says “I want a natural flavour”, we have to find out exactly what he wants.

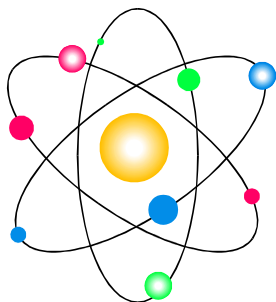
## Natural Extracts

Extracting natural components with a solvent to produce a flavour is part and parcel of the flavour industry for the past fifty years. Many different solvents are used but for our purposes ethanol/water is generally the best. The latest solvent is super critical carbon dioxide. This gives excellent results but apart from a few cases is not commercially viable. The technology relies on the partition coefficient to extract the flavour components and leave the less polar and insoluble components behind. Our expertise in extraction goes back more than thirty years. The technology has changed little since. The secret is in selecting the material to be extracted and reducing the labour component by optimising the extraction method.

## Flavour Profile

This is usually represented by a graphic that represents the components in a complex mixture. Top note, middle and residue note are often used to describe the flavour of an essence. Profiles can be calculated if we know the concentrations and threshold values. More often than not they are just drawn subjectively in order to describe a profile we want.





## Flavour Science

That is the essence of science: ask an impertinent question, and you are on the way to a pertinent answer.

Jacob Bronowski , The Ascent of Man

There is a flood of information on this in the last couple of years. Vast increase in number of books written on subject.

Not all volatile substances have odours. The shape and polarity of the compounds determine their odour. There are numerous optical isomers with different odours. l-carvone is spearmint whereas d-carvone is dill or caraway. Several lactones and ionones have different odours depending on their optical rotation. It is to be expected that one optical isomer will have a different threshold to its mirror image.

It is only in recent years that such compounds were separated on GLC columns. This phenomenon explains the various claims that “natural” is better, meaning that synthetically made aroma compounds are different to those in nature.

**Threshold value** *the concentration an aroma or taste can be detected (air, water and fat)*

**Recognition Threshold** *The concentration at which you can identify an odour. (air, water and fat)*

**Odour unit** *the concentration divided by the threshold*

**Flavour impact value** *the rate of change in perception with concentration.*

**The flavour contribution** *of a aroma component in a mixture to the total profile can be calculated from the total odour units and the number contributed by that aroma chemical.*

**Threshold in a food is dependant upon:**

The threshold of an the aroma in air.

**Concentration** *in the food*

**Solubility** *in oil and water*

**Its Vapour pressure**

**Partition coefficient** *between the air and the food*

**pH of the food** *some aroma compounds are effected by the pH, weak organic acids are protionated at low pH making them less soluble and hence more volatile.*

The concentration of an odour above a food is dependant on its solubility in that food and its vapour pressure and concentration in that food.

### **Additive and Synergistic effects**

The other aroma components, concentration and thresholds needs to be determined. The synergistic effects of these and their additive effects need to be determined.

We have started to assemble a data base on odour values. If we know the flavour threshold for each component in a flavour and divide it by its threshold value we can calculate the number of odour units that component contributes to the total flavour. From this information we can produce a flavour profile. Sometime in the distant future we could supply an accurate flavour profile with each flavour! This gets very complicated as we would need to know the solubility, vapour pressure as well as the threshold value in air for each component. This information is not easily available.

### **Threshold values of Vanillin and Ethyl Vanillin**

In air the detection threshold is given as  $7 \times 10^{-6}$  mg/m<sup>3</sup> of air.

<b>Threshold (ppb)</b>	<b>Ethyl Vanillin</b>	<b>Vanillin</b>
<b>Detection smelling in water</b>	0.1	0.2
<b>Recognition smelling in water</b>	1	4
<b>Water by tasting</b>	1	4
<b>Odour threshold in air</b>	0.01 ng/litre	0.02 ng/litre
<b>Vapour pressure</b>	1.9 µg/l	1.8 µg/l

Kirk Othmer (vol 10, 1993)

### **pH effect examples**

Trimethylamine has a strong fishy smell, with lemon juice or vinegar this alkaline compound is neutralised to the organic salt.

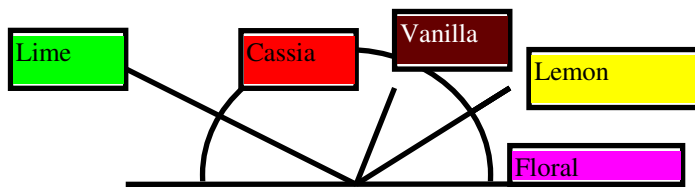
Milk sours and develops a distinctive smell. This is aided by the formation of lactic acid which reduces the pH making acids such as butyric less soluble and more volatile.

The opposite effect is achieved by bicarbonate of soda when used to deodorise carpets. The carpet which has free short chained acids is neutralised by the action of the bicarbonate which produces non volatile salts.

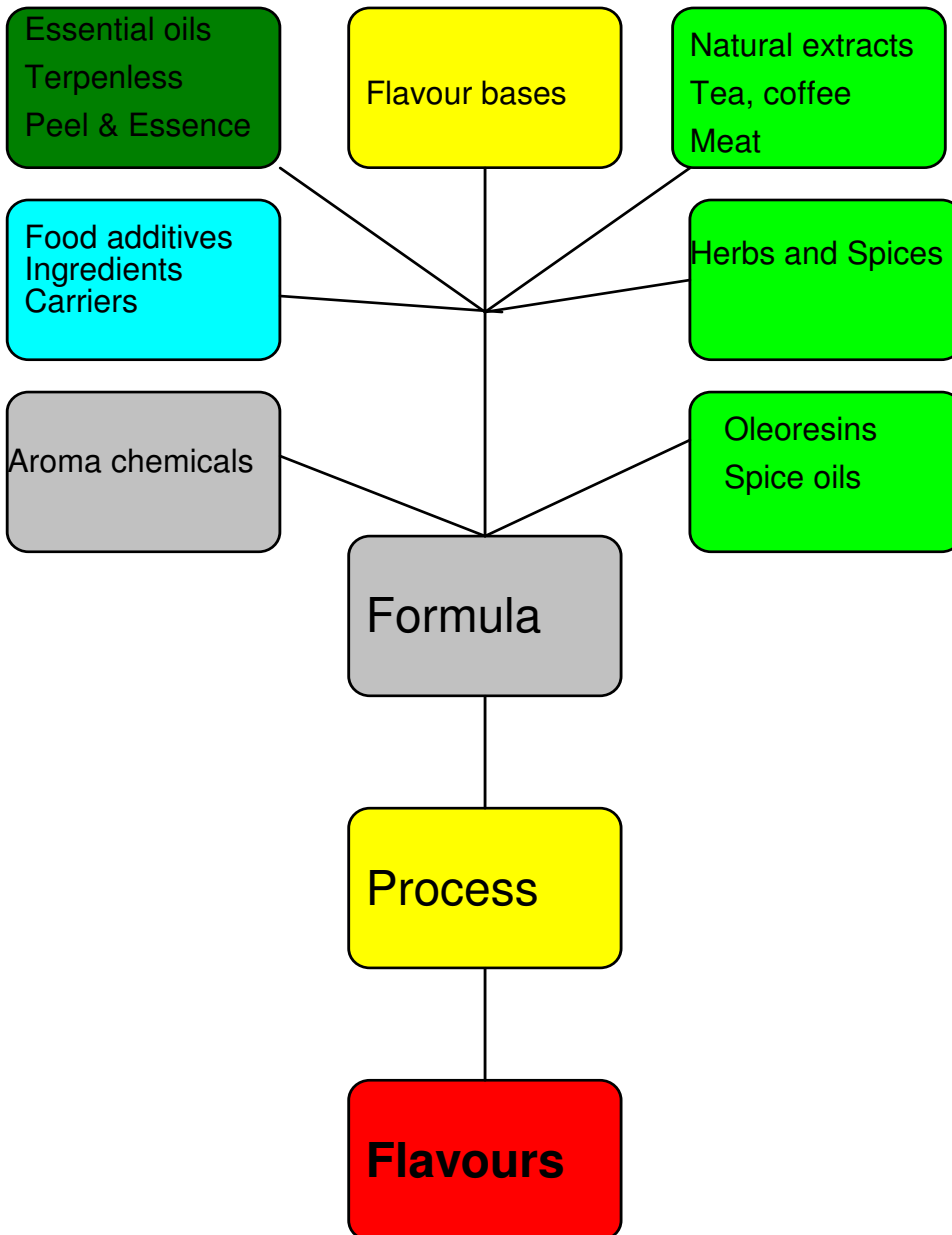
d-limonene is hydrated to alpha terpineol in acid drinks. Lemon-containing drinks move to a lime taste with age.

## Flavour perception

How the public views a flavour is often measured by sensoric evaluation companies, such as Smart Research, Research Partners etc. By presenting a sample and asking questions, they determine if the product is acceptable to the target market. Marketing people place reliance on this scientific evaluation of a new products using this method. However there have been numerous failures that rated highly in such tests and numerous successes that fared poorly. **Taste** preferences are **acquired** or learned. To design a flavour that will give a high rating in such a test you need to study the flavour of the leading brands. Type of flavour, colour strength, acidity, sweetness, salt level and umamy level are probably at the optimum levels and would score highly in such tests. You need to compose your flavour to mimic these key parameters and expand the flavour profile to give a “different aroma”. With sweet flavours the classic combination of lemon ,lime, vanilla always rates highly in soft drinks. This combination is used by Coke and Pepsi and can also be observed in lemonade and G.I. Lime.



## What goes into a flavour?





# FLAVOUR LEGISLATION

## **Natural**

Made from the named fruit or food by a physical process.

Products made from citrus oils, vanilla beans, tea extracts, ginger extracts are natural flavours.

## **W.O.N.F.**

With Other Natural Flavourings. Commonly used term in the USA, now regarded as natural in Australia. It means that the flavour is made from a blend of naturally derived components.

For example lemonade is made from citrus oils and natural citral, hence is W.O.N.F.

## **Nature identical**

An imitation flavour, where the chemical components are identical to those found in natural products. **In Australia Nature Identical flavours are labelled "Imitation".**

## **Artificial**

At least one of the flavouring components is artificial (not found in nature).

Australia now has a list of permitted artificial flavourings. Other countries have their own unique lists.

## **GRAS**

Means that all the components of the flavour meet the combined criteria of the GRAS list of the Flavour Extract Manufacturers Association of the U.S.A. and the "Code of Federal Regulations", title 21, parts 172 and 182.

## **Premix**

Where flavours and other food additives are mixed, it is difficult to say whether the flavour premix is natural or otherwise as it may contain permitted food additives.

At present individual flavour components are exempt from ingredient labelling but premixes are not.

Where we classify a flavour as a premix, it will contain ingredients that have food additive numbers. In this case, the ingredients are listed on the specification sheet.

For example:- If a natural beef flavour is wanted, we may have it listed under "Premix" as it may contain other permitted additives, such as MSG.

## **Halal**

Products indicated by (H) are suitable for use in foods consumed by Muslims.

Products indicated by (\*) contain ingredients that are regarded as Haram.

## **Country specific regulations**

China, Japan and other major Asian countries.