Introduction

This is a preview which only displays sample 5: black pepper.

Get the full document here: https://artoftasting.nl/product/red-wine-flavour-compounds-information-booklet/

This document provides extensive information about 10 flavour compounds that commonly occur in red wine. It is meant to accompany the red wine tasting kit, which features wine samples that have the described flavour compounds added. You can order the kit here: https://artoftasting.nl/product/tasting-kit-red/

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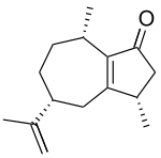
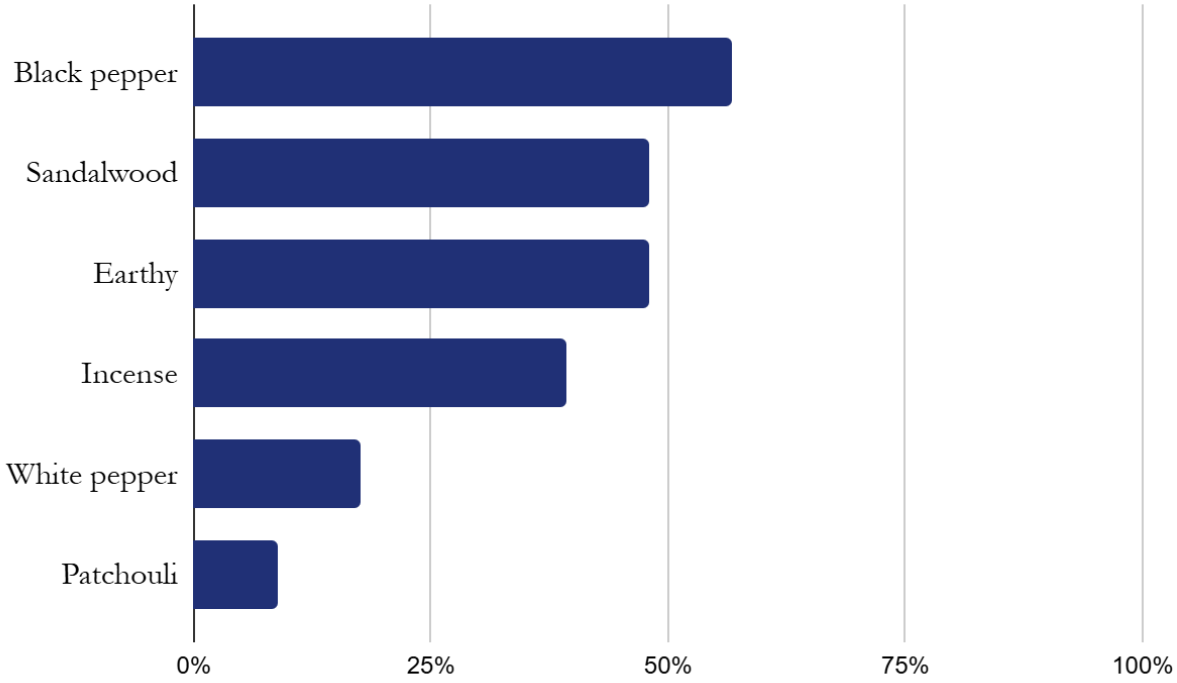


Flavour compound ⓘ

Rotundone

Descriptors ⓘ

Black pepper, sandalwood, earthy, incense, white pepper, patchouli, marjoram, peppercorn, agarwood, nut grass, smoke, floral, cypriol



Origins ⓘ

Primary flavour. The compound is synthesised by a select number of grape varieties, famously Syrah. The flavour is present in the grape in its free form. This means the flavour is already noticeable when tasting grapes in the vineyard, it does not need fermentation to be released.

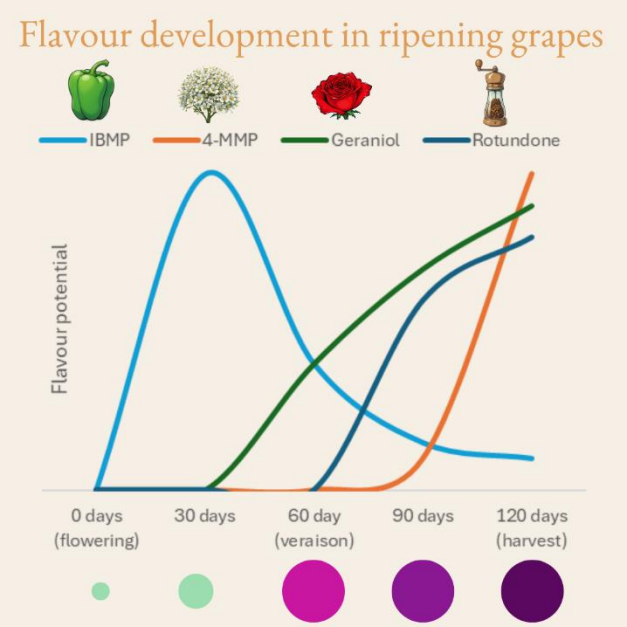
Other origins ⓘ

Other than in Syrah, the flavour compound is produced by red varieties Duras, Durif, Schioppettino and Vespolina. It is also found in the white variety Grüner Veltliner. Recently it was shown to also be produced in the white PIWI variety Donauveltliner [1].

Influencing factors – vineyard ⓘ

Syrah produces the highest levels of the compound, when the grape is grown at the lower temperature limit of where it can ripen. Syrah is grown in moderate, warm and hot climates, where moderate climates produce the most peppery Syrah. Similarly, shadier conditions in the vineyard promote rotundone levels. Greater access to water also leads to more rotundone development in grapes.

The flavour develops quite late in the ripening cycle of the grape (see plot below of a typical ripening pattern, compared with other grape flavours). As a result, later harvest is associated with higher rotundone levels [2].



Influencing factors – winery ⓘ

Rotundone concentrates in the grape skins and stems. It has been shown that using whole bunches leads to higher rotundone levels, compared with using individual grapes [3].

As rotundone is present in greater concentrations in the skin compared with the pulp, you might think that extra maceration leads to higher levels. However, this appears not to be the case. Pre-fermentation and post-fermentation maceration does not increase rotundone levels. It appears that fermentation on the skin is sufficient for most rotundone extraction, and extraction time is not a limiting factor.

Rotundone is a very stable flavour compound and is unaffected by yeast, bacteria, or barrel ageing.

Bottle ageing ⓘ

This compound is stable during bottle ageing.

Assessment technique ⓘ

Cover the glass with your hand, swirl for about five seconds, release the hand and simultaneously take a long, two-second sniff. Rotundone is very noticeable on the palate. Note that rotundone does not cause the pungency that is found in black pepper. This is caused by piperine (major component of peppercorn, but not found in Syrah).

Wine styles ⓘ

Northern Rhône Syrah, Syrah from cooler New world regions such as Grampians (Australia), Central Otago (New Zealand) and Niagara (Canada).

Commercial examples ⓘ

Trinity Hill Syrah

Compound class ⓘ

Rotundone belongs to the class of terpenes, or more specifically, sesquiterpenes. Sesquiterpenes are less common than the monoterpenoids, which are more prevalent in wine. Sesquiterpenes other than rotundone have not yet been demonstrated to be important in wine flavour.

Precursor ⓘ

α-guaiene

Threshold ⓘ

The detection threshold is about 30 ng / litre. This sample contains 240 ng / litre.

Concentrations in red wine ⓘ

Wine style	Average (ng / litre)	Lowest (ng / litre)	Highest (ng / litre)	Number of wines analysed	Reference
Margaret River Shiraz	38	-	-	1	4
Barossa Valley Shiraz	1	-	-	1	4
Côte-Rôtie	94	39	142	4	5

Presence elsewhere ⓘ

Rotundone is named after its initial discovery in the tuber of Cyperus rotundus, also known as nutgrass. “Rotundus” means round, and refers to the appearance of the tuber.

Later it was discovered to be a major component of the aroma of white and black peppercorn. It has also been identified in some herbs such as marjoram and rosemary.

Specific anosmia ⓘ

25%

Miscellaneous ⓘ

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Further reading ⓘ

1. Regner, F., Hack, R., Nauer, S., & Zöch, B. (2016). Breeding of fungal resistant varieties derived from Grüner Veltliner by chromosomal selection. In *BIO Web of Conferences* (Vol. 7, p. 01014). EDP Sciences.
2. Caputi, L., Carlin, S., Ghiglieno, I., Stefanini, M., Valenti, L., Vrhovsek, U., & Mattivi, F. (2011). Relationship of changes in rotundone content during grape ripening and winemaking to manipulation of the ‘peppery’character of wine. *Journal of agricultural and food chemistry*, *59*(10), 5565-5571.
3. Capone, D. L., Jeffery, D. W., & Sefton, M. A. (2012). Vineyard and fermentation studies to elucidate the origin of 1, 8-cineole in Australian red wine. *Journal of Agricultural and Food Chemistry*, *60*(9), 2281-2287.
4. Mayr, C. M., Geue, J. P., Holt, H. E., Pearson, W. P., Jeffery, D. W., & Francis, I. L. (2014). Characterization of the key aroma compounds in Shiraz wine by quantitation, aroma reconstitution, and omission studies. *Journal of Agricultural and Food Chemistry*, *62*(20), 4528-4536.
5. Takase, H., Sasaki, K., Shinmori, H., Shinohara, A., Mochizuki, C., Kobayashi, H., ... & Takata, R. (2015). Analysis of rotundone in Japanese Syrah grapes and wines using stir bar sorptive extraction (SBSE) with heart-cutting two-dimensional GC-MS. *American Journal of Enology and Viticulture*, *66*(3), 398-402.

Glossary

Flavour compound

Name of the molecule/chemical compound.

Descriptors

A range of descriptors will be provided for each flavour compound, starting with the commonly agreed upon descriptor. These are intended to help you to build an association with the flavour compound. This list is a collection of descriptors that wine tasters have provided when smelling the compound. If you have an association with the flavour which is not on the list, feel free to share with Sietze (sietze@artoftasting.nl).

It is followed by a chart that shows how frequently a descriptor is used. This is based on descriptors of a group of wine tasters (people that have attended masterclasses). The main descriptor is typically the most frequently mentioned.

Origins

Origin and formation of the flavour compound are discussed. Primary flavours are those formed in the grape berry or during fermentation. Secondary flavours are the result of winemaking techniques, which is mostly oak ageing in the context of red wine. Tertiary flavours develop during bottle ageing.

Other origins

How the compound may find its way into wine via a different route than its main origin.

Influencing factors – vineyard

The natural factors and the viticultural practices that impact the level of this flavour compound.

Influencing factors – winery

The winemaking choices that affect the flavour compound in question.

Bottle ageing

How the flavour is affected by storage after bottling.

Assessment technique

The most effective method of detecting the flavour compound is presented here. This is related to the volatility of the compound. Volatile compounds are easily picked up by swirling the glass and taking a short, one-second sniff. Less volatile compound are more easily picked up with the following method: cover the glass with your hand (make sure your hand is free of odours!), swirl for about five seconds, release the hand and simultaneously take a long, two-second sniff.

The palate is also mentioned here: compounds range from being very noticeable on the palate to not being present on the palate at all. For flavours that should be very noticeable on the palate, the following technique may help: pinch your nose, take wine into your mouth, move the wine around in your mouth, swallow/spit the wine, release your nose. The flavour should now come through noticeably.

Wine styles

The wine styles that commonly display this flavour compound.

Commercial examples

“Real-world” commercially available wines that feature noticeable levels of this compound.

Compound class

Describes the chemical class/family of the flavour compound. This section may list related compounds.

Precursor

A precursor is a compound that becomes something else during a chemical conversion. In other words, this is your starting material before it becomes the flavour compound in question.

Grapes contain precursors to flavours that may be in a so-called "bound" form, i.e. the flavour compound is linked to a different compound that makes it non-volatile. Non-volatile compounds cannot reach olfactory receptors and therefore have no aroma. During fermentation, yeast breaks up the link and releases the flavour compound. Sometimes precursors are volatile and have an aroma. For example, 3-MH (3-mercaptohexanol), which smells of grapefruit, is the precursor to 3-MHA (3-mercaptohexyl acetate), which smells of passion fruit.

Threshold

The detection threshold is the minimum required quantity present of the compound to impart a flavour for 50% of the human population. For example, the threshold of IBMP is 8 ng / litre. At this concentration, half of the population will be able to differentiate this wine from the same wine with 0 ng / litre of IBMP. The detection threshold for flavour compounds may vary slightly between wine styles.

The conversion table is as follows:

1 g (gram) = 1000 mg (milligram)

1 mg (milligram) = 1000 μg (microgram)

1 μg (microgram) = 1000 ng (nanogram)

For reference, 1 mg is about the equivalent of a sugar granule.

The level of flavour addition to the sample in the tasting kit is also mentioned here (typically formulated at 8 times the threshold).

Concentrations in red wine

Concentrations of the flavour compound, based on analytical data from literature.

On the bar charts, the Art of Tasting wine sample is also included for reference. The detection threshold is indicated with a dotted line.

Some charts include natural sources other than wine, such as fruits and vegetables. The concentration of the compound in these sources is typically much higher than wine and is therefore not presented to scale.

Presence elsewhere

Sources of the compound other than wine, such as food, beverages or plants.

Specific anosmia

The percentage of the population that has specific anosmia towards this compound.

Specific anosmia is in inability to smell specific compounds, where your sense of smell is otherwise intact. We are equipped with around 400 types of olfactory receptors, however, individual differences exist. Some people may have some receptors not functioning or missing altogether. If one of the samples is not different

to the reference sample to you, you may have specific anosmia towards the compound. This is genetically determined.

For example, about 1 in 10 people have specific anosmia to geraniol, which smells of roses. That does not mean that roses are odourless to you, because you will still be able to detect the other aroma compounds that are released by roses. However, a rose will smell slightly different to you than to someone who is able to pick up geraniol.

Even when the level of the added aroma is increased tenfold, the person with specific anosmia is usually not able to pick up the aroma.

Specific anosmia is often likened to colour blindness: people with colour blindness struggle to recognise specific colours, but otherwise have a normal functioning sense of vision.

Miscellaneous

Miscellaneous information about the compound.

Further reading

References to articles cited in the text, as well as additional material for the keen reader to dig deeper into the flavour.