ESTERS 101 - PART 1

Dr. Carien Coetzee

Basic Wine

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When it comes to Sauvignon Blanc aroma, the possibilities for creating wines with different aromatic profiles are almost endless. Aroma groups such as the volatile thiols and methoxypyrazines are known to be typical to Sauvignon Blanc and are considered to be impact compounds which impart potent aromatic attributes due to the extremely low sensory perception thresholds. However, Sauvignon Blanc aroma certainly does not start and finish with thiols and pyrazines. **Other aroma groups such as acetate esters, ethyl esters, alcohols, acids and terpenes can contribute significantly to Sauvignon Blanc aromatic composition and complexity.**

Esters represent the largest and one of the most important groups of aroma compounds produced during fermentation. They are **particularly important in young, fruit-driven Sauvignon Blanc wines** and are typically associated with **a diverse range of pleasant fruity flavours**. Attributes such as banana

and pineapple are often associated with esters, however, other flavours such as citrus and floral can also occur due to the presence of esters.

FORMATION OF ESTERS

- The vast majority of esters in wine are **created during fermentation**[7]. Esters are produced by the condensation of an **alcohol** and a coenzyme-A-activated **acid**[8]. This reaction is governed by an enzyme, alcohol acetyl transferase[8]. With the many different acids and alcohols found in wine, there is **considerable potential for the formation of a wide range of esters**. Yeasts are therefore the main contributor to ester formation. However, yeasts do not only ***produce*** esters, but it can also produce enzymes that ***degrade*** esters, called esterases[9]. The **balance between ester synthesis and hydrolysis by yeast enzymes is important for the net rate of ester accumulation in wine.**

- **Lactic acid bacteria** can also contribute significantly to the ester content in wine. The aroma compound that is mostly produced during malolactic fermentation is ethyl lactate, which characteristically contributes attributes described as milky, soapy, buttery and fruity. The production of this ester is **coupled to lactic acid formation and its synthesis can be correlated with the percentage of degradation of malic acid**[10].

- Esters can also **form naturally through chemical reactions**, however, these chemical reactions are slow and contribute little to wines. **Chemical hydrolyses** of esters can, however, lead to significant losses in ester content over time.

TYPES OF ESTERS

Acetate esters of the higher alcohols and the **ethyl esters** of straight-chain, saturated fatty acids are the most significant esters produced in wine[8]. A list of some of the important wine esters is shown in Table 1[11].

- The **acetate esters** comprise of an **acid group** (short-chain acetic acid) and a longer-chain **alcohol group** (fusel alcohols), mostly complex alcohols derived from amino acid metabolism. These are **low molecular weight esters** often termed **"fruit" esters** and have a distinctly fruit-like fragrance. It is also these esters that are considered to give wine much of its **vinous fragrance**. Examples of acetate esters are isoamyl acetate, with aromas of banana and fruits; and isobutyl acetate, with fruity and apple flavours.

- The **ethyl esters** comprise a short-chain **alcohol group** (ethanol) and a longer-chain **acid group** (such as medium- to long-chain fatty acids). The ethyl esters have weaker odours and, in general, does not appear to be aromatically significant in wine and will likely only add to the wines complexity at low concentrations. Higher concentrations would result in unwanted aroma characteristics. Examples of ethyl esters include ethyl hexanoate, with reported aroma characteristics that include fruity, strawberry, green apple and anise; ethyl octanoate, with sweet, fruity, ripe fruit, burned and beer characteristics; and ethyl decanoate, which imparts an oily, fruity and floral character.

Table 1. List of some esters found in wine, aroma perception thresholds and attributes used to describe the various odours.[11]

Esters				
Compound	**Perception threshold**	**Threshold determined in**	**Descriptors**	**Reference**
Acetate esters				
Isoamyl acetate	0.05 mg/L	12.5% ethanol, pH3.2	Banana, fruity, sweet	1
Hexyl acetate	0.4 mg/L	12.5% ethanol, pH3.2	Apple, cherry, pear, flower	1
2-Phenylethyl acetate	0.25 mg/L	10% ethanol	Rose, honey, tobacco, flower	2
Ethyl esters				
Ethyl acetate	12.3 mg/L	10% ethanol, pH 3.2	Pineapple, fruity, varnish, solvent	3
Ethyl butyrate	0.02 mg/L	10% ethanol	Acidic, fruity, apple	2
Ethyl lactate	146 mg/L	14% ethanol, pH3.5	Lactic, buttery, fruity	4
Ethyl hexanoate	0.014 mg/L	11% ethanol, pH3.4	Green apple peel, fruit, banana, brandy	5
Ethyl octanoate	0.005 mg/L	11% ethanol, pH3.4	Sweet, ripe banana, pear, soapy	5
Ethyl decanoate	0.2 mg/L	11% ethanol, pH3.4	Fruity, floral, grape, soapy, brandy	5
Diethyl succinate	1.2 mg/L	10% ethanol, pH 3.5	Fruity, melon	6

Ethyl acetate is quantitatively the most prominent ester in wine, due to its spontaneous or enzymatic formation from **ethanol and acetic acid**. It is therefore both an acetate and ethyl ester. At **low concentrations it may give desirable and fruity character** to the wine; however, at **higher concentrations, it can impart a solvent or nail varnish aroma**, and contribute to the perception of volatile acidity (VA).

Even though grape cultivars can differ considerably in terms of ester content, the **production of esters is not cultivar specific**, meaning that significant amounts of esters can form in **all wine varieties** and that the presence of these compounds will most likely not be the differentiating factor between the wines' aromatic compositions. Studies have shown that the amount of volatiles (esters, higher alcohols and fatty acids) present in Sauvignon Blanc and Chardonnay wines were not significantly different except for hexyl acetate, hexanoic acid, decanoic and octanoic acid occurring in higher concentrations in Sauvignon Blanc wines[12].

Sensorial interaction between different esters as well as between esters and non-ester compounds can alter the sensory experience of the wine. For instance, the presence of one ester might amplify or suppress the aroma perception of another. The combination of certain esters can also result in a completely different aroma from what they smell like individually.

CONCLUSION

One of the factors that make Sauvignon Blanc wines unique is the **diverse range of aromatic compounds** that occur. Some compounds have very low perception thresholds and a significant impact on the wine aroma, while others might only play a (crucial) supportive role.

Esters are known to contribute pleasant fruity attributes to wine, a property which is desired by most Sauvignon Blanc producers. In this Part 1 of the Esters 101 series, the **formation and types of esters** in wine are briefly discussed. In Part 2, a quick overview of factors affecting the ester content in wines will be addressed.

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