



Title: “The role of yeast in grape flavor development during fermentation: The example of Sauvignon blanc”

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These French authors identify and quantify some of the compounds responsible for the varietal character of Sauvignon blanc wines. They also study which yeasts maximize the presence of these compounds.

- We know that aromatic compounds from the grapes themselves are important for quality and regional character. But whereas some varieties (like the Muscats) produce musts with similar aromas to those of the resulting wines, the musts of the majority of varieties are practically **odorless**. This is true for Merlot, Cabernet Sauvignon, Syrah, Sauvignon blanc, Semillon, Pinot noir, Gamay, Chardonnay, and Chenin blanc, among others. Which lead Peynaud to say in 1980, “It is the winemaking that reveals the aroma hidden in the fruit. The wine tastes more of fruits than the grape does. Fermentation acts to reveal aroma by liberating the aroma compounds in the grape”. As Louis Pasteur had already stated in 1876, “The taste and properties of the wine could depend on the special nature of yeasts which develop during the fermentation of the grapes”.

- 1) **Identification of compounds responsible for SB aroma.** Sauvignon blanc (SB) wines comprise a large variety of flavors that have been described as: green bell pepper, boxwood (or cat urine when strong), broom, eucalyptus, black currant bud, rhubarb, tomato leaf, nettle, grapefruit, passion fruit, white peach, gooseberry, asparagus, and acacia flower. When copper is added to a SB wine, the aromatic characteristics of the wine are totally lost. This strongly suggested that the compounds responsible for the varietal character in SB are **sulfur compounds with a thiol group**. This is because copper reacts with sulfur compounds to produce insoluble odorless sulfides.

- By using a reagent that reacts specifically with thiol groups (hydroxymercuribenzoate, HMB), the authors were able to isolate the volatile thiols from the wine. Then they recovered the volatile thiols from the column to which they had been fixed by treating with an excess of competing thiols (a cysteine solution). Finally, the exiting thiols were studied by gas chromatography coupled to mass spectrophotometry.

- This way, the authors were able to identify 3 main compounds important for SB aroma: 1) mercapto-methyl-pentanone (4MMP), which has a strong odor of boxwood, broom and cat urine; 2) mercapto-hexil-acetate (3MHA), with an odor of boxwood, grapefruit and passion fruit; and 3) mercaptohexanol (3MH), with aroma also of grapefruit and passion fruit. (A fourth compound with aroma of citrus zest was also identified, but its concentration in wines seldom exceeds its aroma threshold.) The authors were able to show that the intensity of boxwood odor perceived by tasters was strongly correlated with the aromatic index of 4MMP and 3MHA. Similarly, grapefruit and passion fruit aromas were well correlated with the *aromatic index* of 3MH. (The “aromatic index” is the concentration of a compound divided by its detection threshold.)

- **2) Identification of precursors of SB aroma compounds.** Now that we knew the compounds responsible, the authors wanted to understand their precursors, to be able to maximize them in the grape. The only flavor precursors isolated up to now in grapes are glycosides, able to release monoterpenes in Muscat. The authors note that **sulfur-cysteine complexes** in SB constitute a new category of aroma precursors in fruits. So they had developed a method to measure these precursors in SB musts (described in another article). This method is based on the cleavage of the C-S link between the thiol and the cysteine with an enzyme (β -lyase) attached to a resin column. The volatile compounds are then released through the column and measured as before. This method has been applied to study the influence of “terroir” on SB aromatic maturity.

- **3) Role of yeasts on SB varietal aroma.** The enhancement of SB varietal flavor by yeast metabolism is due to the degradation of cysteine precursors, leading to the formation of the corresponding volatile thiols. The authors were able to confirm that, when fermentation is inhibited by *pimaricin*, the development of aroma is very low. They also noted that only a portion of these precursors is transformed. So they compared the ability of 4 different yeast strains to release aroma compounds in musts from 4 different Bordeaux vineyards. **Certain yeasts (VL3c and EG8) were the most effective at enhancing these aromas (as compared to VL1 and 522d).** These differences in behavior were also observed when the authors fermented model musts with an added S-cysteine complex.

- The authors noticed that some *Saccharomyces bayanus* var. *uvarum* wild strains have a high ability to release volatile thiols. So in their laboratory they obtained interspecific hybrids *S. cerevisiae* x *S. bayanus*. Of the nine hybrid strains tested, 7 strains presented a greater ability to reveal aroma compounds from S-cysteine precursors (without producing the excess of phenylethyl ethanol typical of these wild strains). One of these hybrids strains was tested successful in 4 wineries from Bordeaux and Sancerre. **The wines fermented by the hybrid strain contained higher 4MMP and 3MH compared with wines fermented by *S. cerevisiae* VL3c.** This hybrid was able to ferment at low temperature without producing phenylethyl alcohol and its acetate.

In summary, volatile thiols are involved in the aroma of Sauvignon blanc wines and are liberated during alcoholic fermentation by the action of yeast on sulfur-cysteine precursors. *S. cerevisiae* strains VL3c and EG8 are more effective in enhancing these aromas than strains VL1 and 522d. The authors have shown that some interspecific hybrids *S. cerevisiae* x *S. bayanus* developed in their lab are particularly useful in this aroma release, and initial trials in wineries have given successful results. Haven't heard a word yet about their commercialization.

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