



Yeast strain affects 3-isopropyl-2-methoxypyrazine concentration and sensory profile in Cabernet Sauvignon wine

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- Pyrazines are compounds naturally found in varieties like Sauvignon blanc and Cabernet Sauvignon, as well as in most unripe grapes. There are many types of pyrazines, the best known being isobutyl-methoxypyrazine (IBMP), responsible for the bell pepper aroma. Another methoxypyrazine, isopropyl-methoxypyrazine (IPMP) has recently been identified as the causal agent of “ladybug taint” (LBT), first investigated in Canadian wines.
- LBT is an off-flavor due to the accidental incorporation of an insect known as Asian lady beetle (*Harmonia axyridis*) into grape juice. Wines affected with LBT have been described with the following descriptors: *peanut*, *bell pepper*, *asparagus*, and *earthy/herbaceous*. The insect is found in many countries where it had been introduced as a biocontrol agent for aphids.
- There is, therefore, a need for strategies for reducing IPMP, both to reduce greenness of unripe grapes and to decrease the severity of LBT. The current authors hypothesized that yeast strains might provide such an approach, as they have been shown to influence many volatile compounds. The goal of this study was to determine the effect of various commercial strains of *Saccharomyces* yeast on IPMP concentration in Cabernet Sauvignon, and to describe the impact on their sensory profiles.
- Researchers used a commercial Cabernet Sauvignon juice concentrate, which they spiked with IPMP (30 ng/L). They divided the juice into 5 carboys, which they inoculated with each of 4 commercially-available yeast strains: **Lalvin BM45**, **Lalvin EC1118**, **Lalvin ICV-D21**, and **Lalvin ICV-D80**. They left one carboy without IPMP addition as a control (inoculated with EC1118). All fermentations were conducted in triplicate.
- Within 2.5 months of completing the fermentations, researchers conducted chemical and sensory analyses in triplicate. For the **chemical analyses**, they performed basic analysis (pH, TA, Brix, ethanol, malic and lactic acids, and nitrogen), as well as IPMP determination (solid-phase microextraction coupled to gas chromatography mass spectrometry, or SPME-GM-MS).
- For the **sensory analysis**, they used a panel consisting of 6 students from Brock University who had undergone 3 training sessions. During these sessions, the panel generated and reached consensus on the descriptors to be used to describe the wines (red berry, vanilla/caramel, canned green vegetables, green pepper, candy, jammy, earthy/peanut/musty, metallic, bitter). The wines were then evaluated in triplicate on a 15-cm scale, labeled at 1 cm with “absent” and at 14 cm with “very high”.

• **Effect of strain on yeast populations.** Because yeast could potentially reduce IPMP by adsorption to their cell walls, researchers were interested in monitoring cell biomass. 1) Strains BM45 and D80 were slow to start – consistent with manufacturer’s claims-, and at the end of fermentation, these strains had the lowest populations. In contrast, strain EC1118 achieved the highest populations.

• **Effect of strain on IPMP.** 1) The IPMP concentration of the wine inoculated with BM45 (aprox. 40 ng/liter) was significantly higher than that of the wines inoculated with the other yeast strains (aprox. 50 ng/liter). This corresponded to an increase of 11 ng/liter from the levels originally found in the juice. IPMP production has not been previously reported for *Saccharomyces* (even though a pathway for the biosynthesis of IPMP has been proposed for the bacteria *Pseudomonas*). The current authors conducted a parallel experiment to check whether components in the yeast preparation other than the yeast could have contributed to the increase of IPMP, but could not find any contamination sources.

• **Effect of strain on sensory characteristics.** 1) The higher intensity displayed by the D80-fermented wines for green pepper aroma (3.4 score, compared to a 2.4 to 2.8 score for the remaining strains) and canned green vegetable aroma (4.5 score, against a 3.2 to 3.8 score for the remaining strains) suggest that this is a strain to be avoided with juice containing elevated IPMP. The authors speculate this is probably due to this strain producing fewer masking aromatic compounds. 2) In contrast, D21- fermented wines had low intensity of all five attributes associated with LBT, and high intensity of jammy and red berry flavors. Thus, the authors recommend **D21 as particularly interesting for use with juices affected by LBT, or sourced from underripe grapes.** (The manufacturer –Lallemand- describes this strain as “enhancing varietal character and fruit intensity”, and also as “reducing the potential for herbaceous character in Cabernet Sauvignon”. 3) Finally, the higher IPMP concentration found in BM45-inoculated wines did not translate into higher intensities of the LBT-associated attributes. The authors speculate that the IPMP changes observed may not have reached a difference threshold for this compound in wine.

In summary, the authors found that different yeast strains showed different abilities to mask both the green character and the “ladybug taint” character of wines. Of the four strains tested, Lalvin BM45 increased the measured IPMP levels, and Lalvin D80 increased the green pepper aroma score, and therefore these two strains should be avoided when facing problematic juices (LBT-contaminated or high in IPMP). In contrast, Lalvin ICV D21 had the lowest green aroma intensities, and the highest jammy and red berry flavors, and therefore, is the authors’ top recommendation among those studied. Wouldn’t it be interesting to explore whether this strain could offer some help in situations such as the “smoke taint” experienced in many regions of California and Australia in 2008? *[Editor’s note: Of course this needs to be replicated as these findings may not be universally applicable depending upon the matrix of the juice and fermentation conditions]*

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