Minerality in Sauvignon Blanc – Part 2
A Research Summary

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Basic Wine
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Part 1 of our Minerality in Sauvignon Blanc series investigated i) cultural differences in the perception of minerality, ii) how minerality is perceived and iii) sensory attributes associated with the perception of minerality.

Part 2 is a research summary of a study titled “Perceived minerality in Sauvignon Blanc wine: Chemical reality or cultural construct?”. This study aimed to determine the relationship between the perceived mineral character in wine and wine chemical composition. Certain chemical compounds were identified to be either positive or negative predictors of perceived minerality.
Method

Sensory evaluation

Judges were asked to evaluate the wines by rating a list of given descriptors, including “minerality”, according to their intensity. For more information, please read Part 1.

Chemical analysis

Table 1 lists the range of chemical compounds and physical parameters measured using various analytical techniques. The compounds were tested to identify any correlations with the sensory perception of “minerality”.

Table 1. List of physical parameters and chemical compounds investigated to identify correlations with the sensory perception of “minerality”.

<table>
<thead>
<tr>
<th>Basic Analyses</th>
<th>Fermentation derived volatile aroma compounds</th>
<th>Volatile organic acids</th>
<th>Volatile thiols</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Benzoaldehyde</td>
<td>Acetic acid</td>
<td>3MH</td>
<td>Al</td>
</tr>
<tr>
<td>Residual sugar</td>
<td>Ally-3-hexen-1-ol</td>
<td>Isobutyric acid</td>
<td>3MHA</td>
<td>As</td>
</tr>
<tr>
<td>Total acid</td>
<td>Diethyl succinate</td>
<td>Butanoic acid</td>
<td>4MMP</td>
<td>B</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Ethyl acetate</td>
<td>Hexanoic acid</td>
<td>Benzenemethanethiol (BMT)</td>
<td>Ca</td>
</tr>
<tr>
<td>Free SO₂</td>
<td>Ethyl butanoate</td>
<td>Octanoic acid</td>
<td>Ethyl-2-mercaptoacetate (E2MA)</td>
<td>Cd</td>
</tr>
<tr>
<td>Total SO₂</td>
<td>Ethyl decanoate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl hexanoate</td>
<td>Non-volatile organic acids</td>
<td>Methoxypyrazines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl isobutyrate</td>
<td></td>
<td></td>
<td>IBMP</td>
<td>Fe</td>
</tr>
<tr>
<td>Ethyl octanoate</td>
<td></td>
<td></td>
<td></td>
<td>K</td>
</tr>
<tr>
<td>Ethyl pentanoate</td>
<td></td>
<td>Malonic acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanol</td>
<td>Shikimic acid</td>
<td></td>
<td>Hydrogen sulphide (H,S)</td>
<td>Mn</td>
</tr>
<tr>
<td>Hexyl acetate</td>
<td>Lactic acid</td>
<td></td>
<td>Methylmercaptan (MeSH)</td>
<td>Na</td>
</tr>
<tr>
<td>Isoamyl acetate</td>
<td>Acetic acid</td>
<td></td>
<td>Ethylmercaptan (EtSH)</td>
<td>Ni</td>
</tr>
<tr>
<td>Isoamyl alcohol</td>
<td></td>
<td></td>
<td>Dimethyl Sulphide (DMS)</td>
<td>P</td>
</tr>
<tr>
<td>Isobutanol</td>
<td></td>
<td></td>
<td>Diethyl Sulphide (DES)</td>
<td>Pb</td>
</tr>
<tr>
<td>Phenylethyl alcohol</td>
<td></td>
<td></td>
<td>Dimethyl disulphide (DMDS)</td>
<td>S</td>
</tr>
<tr>
<td>Trans-3-hexen-1-ol</td>
<td></td>
<td></td>
<td></td>
<td>Zn</td>
</tr>
</tbody>
</table>

Results

Citrus as a positive predictor of minerality confirmed

» In Part 1 of this series, the sensory attribute, “citrus” was identified as being a good predictor of perceived minerality. In the current study, 3MH (the chemical compound typically responsible for the citrus/grapefruit aroma) was proven to be a positive predictor of perceived minerality which is consistent with the sensory observations.

» Another compound contributing to the fruity aroma in wine is isoamyl acetate, which also showed to be a positive predictor for the French participants.
The more flavoursome a Sauvignon Blanc wine was considered to be, the less minerality was reported?

» Considering the above information, the previous hypothesis of “The more flavoursome a Sauvignon Blanc wine was considered to be, the less minerality was reported” (Part 1), is not supported when looking at the chemical data alone. 3MH and isoamyl acetate are both compounds that contribute flavoursome fruity aroma to a wine and they both proved to be positive predictors.

» The detachment of the sensory observation with the chemical content of the wine could be due to the complex interaction effects of the various compounds present as well as the specific concentrations at which these compounds were present.

Is BMT the source of the mineral character in wine?

» Previous studies identified benzenemethanethiol (BMT) as a potential source of perceived flinty characters\(^{2,3,4}\), however, in the present study, BMT was not found to be a significant predictor of minerality.

Organic acids and the freshness of the wine. Is there an association with minerality?

» In Part 1, “freshness” was a sensory attribute which linked positively with minerality.

» For the New Zealand participants, malic acid was a positive predictor of minerality while lactic acid was a negative predictor. Malic acid is a much sharper acid contributing to a larger extent to the freshness of a wine compared to lactic acid.

» During MLF, the malic acid is converted to lactic acid together with the development of a range of aromatic compounds (such as diethyl succinate which was also a negative predictor). This could lead to a decrease in the perception of freshness and thus minerality. Another study\(^5\) also reported the negative association between buttery and milky attributes (associated with MLF) and perceived minerality.

» For the French participants, tartaric acid and total acidity were negative predictors of perceived minerality. This supports the sensory observation where sour taste was negatively correlated to minerality.

Reductive sulphur compounds are not indicators of minerality in wine

» No correlation between the reductive sulphur compounds and perceived minerality were identified. This also supports the sensory observations discussed in Part 1 where perceived reduction notes were not an indicator of minerality in wine.

Sulphur dioxide, the silent contributor

» The most interesting result is probably the identification of sulphur dioxide as a positive predictor of perceived minerality.

» For the New Zealand participants (who equally rely on olfaction and palate information)\(^6\), bound SO\(_2\) was the most important predictor

» Free SO\(_2\) was the most important predictor for the French participants (who rely more on olfactory information)\(^6\).
This result is particularly relevant to the wine industry as free and bound SO₂ are usually not considered when profiling the aromatic composition of wines. This study shows that the SO₂ content requires more serious consideration and should also be considered, maybe as chemical markers, during future sensory evaluations.

Minerals and minerality

The contribution of basic elements to the perception of minerality received some support in the study. Ionic Ca²⁺ and Na⁺ were positive predictors of perceived minerality for the New Zealand participants. Therefore, an increase in the basic elements, whether it be via the vineyard (which is unlikely) or oenological treatments, could be a predictor of a higher perceived minerality in the wine. This is definitely an area that needs further investigation.

This work truly shows the complexity of the concept of minerality in wine both from a sensory and chemical perspective. Strong disagreement exist between wine experts regarding the minerality and it remains an ill-defined sensory concept. A topic that needs more research.

More attention should be given to the sulphur dioxide content of a wine. The possibility of sulphur dioxide enhancing the perception of minerality through complex sensory interactions also exists.

Contact Carien


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