LIGHT-STRIKE

PART 1

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Basic Wine

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Exposure to **light** can potentially induce major changes to a wine's composition. This effect mainly occurs in bottled white and rosé wines exposed to light[1] and is commonly referred to as the "light-struck taste", "taste of light" or, in French, "goût de lumière".

Light-strike wines typically have unpleasant aromas[2–5] **with "reductive"-type attributes** described as "rotten egg", "garlic", "onion" and "boiled cabbage". In some cases, the wine can also turn brown and develop a metallic taste[1].

What causes Light-Strike in wine?

Light-induced changes in wine are mainly due to **photochemical oxidation reactions** which may affect many wine components resulting in changes in aroma and colour[4,6–8]. There is one compound that plays an **integral role in light-induced reactions** in wine. This compound is **riboflavin** (or vitamin B2).

Riboflavin is a highly photosensitive compound and serves as a photochemical activator when exposed to light. The key reaction causing Light-Strike is between such a photochemical activator and **sulphur-containing amino acids**, such as methionine and cysteine, all of which naturally occur in wine. Catalysed by ultraviolet radiation, these compounds react to form volatile compounds such as dimethylsulphide (DMS), dimethyldisulphide (DMDS), and hydrogen sulphide (H_2S)[9]. These compounds are typically responsible for the unpleasant "reductive" aroma attributes mentioned earlier.

Other light-induced reactions that can also contribute to Light-Strike in wines include the formation of furfural (which has been positively correlated to the "cooked vegetable" aroma of white wines stored under oxidative conditions[10,11]) and the oxidation of ethanol producing acetaldehyde (effect reported in model wine)[7]. The interconversion of diethyl disulfide and ethanethiol in the presence of sulfites has also been reported[12].

Riboflavin concentrations in wine

Riboflavin content in the **grape berry is typically very low** (3-60 µg/L)[13,14]. However, relatively higher concentrations in the grapes (e.g. 30-50 µg/L) can lead to higher riboflavin concentrations in the resulting wine.

The main source of riboflavin is the **metabolic activity of *Saccharomyces cerevisiae*** during alcoholic fermentation. Some yeast strains have the **ability to produce high concentrations** of riboflavin and the formation of more than 200 µg/L have been reported[15] in finished wines. The highest concentration found in literature is 350 µg/L[15,16].

Lower riboflavin concentrations (lower than 80-100 µg/L) could **limit the risk of the development of the Light-Strike in wines**[14]. When the riboflavin concentration in wine **is greater than 100 µg/L, the wine is considered to have a high risk of presenting the taint**[16].

Yeast, nutrients and riboflavin

Yeast strains differ in their riboflavin forming capabilities. In a study[14], 15 commercial yeast strains were used to ferment Chardonnay grape juice containing 5 µg/L riboflavin:

- 9 x *Saccharomyces cerevisiae*
- 5 x *Saccharomyces bayanus*
- 1 x *Saccharomyces uvarum*

Results showed that **half of the tested yeasts produced low concentrations of riboflavin** (less than 50 µg/L) and the **other half produced more than 50 µg/L**. **Three of the strains produced more than 100 µg/L which could potentially lead to the development of Light-Strike in wines**.

The riboflavin producing yeast strains have occasionally been found to be methionine producing as well, which may increase the risk of spoilage even further[14]. **Low riboflavin producing yeast strains can thus be used as a tool to limit riboflavin formation and therefore minimize the risk of Light-Strike in wines**.

Complex yeast nutrients (based on yeast extract) commonly used during winemaking usually contains vitamins, including riboflavin[14] and can therefore potentially contribute significantly to the final riboflavin concentration in the finished wines. Results from a study performed using different yeast nutrients showed that **nutrients based on yeast cell walls resulted in a wine with higher riboflavin** content when compared to the use of inorganic nutrients based on diammonium phosphate (DAP)[1]. Higher riboflavin concentrations were also obtained by **ageing wine on the yeast lees**[15]. Care should be taken when choosing oenological products as certain preparations can support the release of riboflavin.

Testing your wine for Light-Strike

Exposure of wine to light at wavelengths between **370 and 450 nm** (corresponding to the highest visible light absorption of riboflavin[17]) can serve as a test to **determine if a wine is susceptible to Light-Strike**. When performing this test, it is important to include a range of wavelengths as studies have shown that **different light sources resulted in different volatile sulphur concentrations** in white wine bottled in clear glass[1].

Ever solutions offer testing technology called "Light 7 stress" which is a unique tool equipped with LED technology that **recreates the entire light spectrum to assess the effects of light stress on wine**. **This test will verify a wine's predisposition to Light-Strike.**

Conclusion

Light exposure can result in what is known as light-struck flavours and aromas in wines. These are produced by the initiation of chemical reactions, resulting in the formation of sulphurous compounds with an unpleasant smell and taste.

Part 1 of this blog series briefly discussed the effect of Light-Strike, the mechanism involved, the prevalence and formation of riboflavin in wines and options for testing wines for predisposition to Light-Strike. Part 2 of this series will discuss options for preventing Light-Strike and lowering the risk of Light-Strike from occurring by reducing the riboflavin concentration in wine.

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