LIGHT-STRIKE

PART 2

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Basic Wine

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Light-Strike occurs when riboflavin (naturally occurring in wine) is elevated to an excited state due to **light exposure leading to the oxidation of amino acids which may in-turn lead to the development of particularly stinky sulphur compounds** such as dimethyl disulphide (see Part 1). The taint manifests by first reducing fruit flavours after which characters of "overcooked cabbage", "damp cardboard", and "sewage" start to develop.

Part 2 of this series will look at **strategies to prevent Light-Strike** from occurring.

Preventing Light-Strike

Other than selecting an **appropriate yeast strain** and **avoiding certain winemaking processes and additives** (see Part 1), some other strategies can help to prevent Light-Stike from setting in.

Phenolic compounds

Some natural constituents of wine can prevent the odours and flavours associated with Light-Strike. Studies have shown that **phenolic compounds can provide protection from this taint likely by reacting with the excited riboflavin molecule before it reacts with the sulphur-containing amino acids**[1]. Tannins are particularly effective in protecting wine against Light-Strike. Therefore, red wines are naturally less susceptible to light-struck flavours compared to white wines (even in the presence of relatively higher riboflavin concentrations).

Removing riboflavinfrom wine

Several **fining agents** have been tested for their efficiency in removing riboflavin from wine[2]. A model wine spiked with 350 µg/L riboflavin was treated with the following fining products:

- 6 types of bentonite (2 x calcium-based; 4 x sodium-based)
- 2 types of charcoal (1 x large pore; 1 x small pore)
- Zeolite
- Polyvinylpolypyrrolidone (PVPP)
- Kaolin
- A colloidal suspension of pure silica
- Egg albumin

Fining the model wine with the **bentonite products removed 40% of the riboflavin** in the solution (irrespective of the type of bentonite used). Even though the treatment reduced the riboflavin concentration, the remaining concentration of riboflavin was still quite significant. **A higher removal rate was obtained by increasing the bentonite dosage**. However, this removal was **not directly proportional** to the amount of bentonite added. Furthermore, the initial bentonite concentration was already large and would likely **have adverse effects** on the wine quality[2,3]. Fining trials are advised to determine the minimum bentonite needed to remove as much riboflavin as possible.

Fining the model wine with zeolite decreased the riboflavin concentration by 50%. The egg albumin product, which reportedly contained 1% of riboflavin-binding proteins, did not remove any riboflavin. PVPP, silica and kaolin were also not effective in removing riboflavin[2].

Charcoal seems to be the best suited for the removal of riboflavin and a dosage of 10 mg/L removed 94% of the riboflavin present in the model wine[2]. There was a difference in effectivity between the two tested charcoal products with the larger pore size (chemically activated) being more effective than the smaller pore size (physically activated). The study also showed that 2 hours of contact was sufficient for the removal of the riboflavin from the model wine.

When tested using a real wine (as opposed to a model wine), the fining agents were less effective in removing riboflavin from the wine. Competitive adsorption due to the presence of other wine components might explain this observation. In a real wine, a longer contact time did not lead to more effective removal. Bench trials should be performed to determine the minimum contact time resulting in the highest riboflavin removal.

Limit light exposure

The type of packaging used will determine the amount and type of light reaching the wine. Packaging such as aluminium cans and Bag-in-Box® will effectively **prevent light exposure** and reduce the risk of the taint developing.

Glass bottles, on the other hand, will allow varying amounts and wavelengths of light to pass through the packaging, possibly affecting the wine. Standard clear bottles (flint) generally transmit more than 80% of visible UV radiation above 360 nm[4]. Green bottles block 50% light (particularly in the region below 520 nm which is where Light-Stike sets in), while amber bottles transmit very little (10%) radiation below 520 nm[5]. **Darker coloured bottles can thus limit light exposure** and protect the wine from developing aroma compounds associated with Light-Strike[6].

It is technically feasible to **modify glass to improve its ultraviolet (UV) protection** by adding certain minerals. Clear bottles can thus be specifically manufactured to transmit less UV radiation by adding

UV absorbing species during manufacturing or by adding a film coat that contains UV absorbing properties[5]. The problem is that many of the better UV absorbing species also discolour the glass[5]. Other than that, its use is generally not considered to be an economically viable option due to the increased manufacturing costs.

Conclusion

Various factors influence the onset and severity of the Light-Strike taint. The wine's composition, the spectrum of the light source, the intensity and duration of radiation and the optical properties of the glass bottle[6] can all play a role. Sunlight is clearly the main source of damaging radiation but in retail and domestic environments artificial light sources, such as fluorescent tubes, also contribute to the damage by emitting UV radiation as well as visible light. As artificial shop-lighting is often the principal source of light exposure for many wines, it would be wise to put your wine to the test to determine if there is a predisposition to this taint.

Ever solutions offers 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 and could help to decide on strategies to avoid Light-Strike from affecting your wine.

REFERENCES

(1) Kolb, C. A.; Kopecký, J.; Riederer, M.; Pfündel, E. E. UV Screening by Phenolics in Berries of Grapevine (Vitis Vinifera). *Functional Plant Biology* **2003**, *30* (12), 1177. https://doi.org/10.1071/FP03076.

(2) Fracassetti, D.; Gabrielli, M.; Encinas, J.; Manara, M.; Pellegrino, I.; Tirelli, A.; Sciences, N.; Gildo, D. C. Approaches to Prevent the Light-Struck Taste in White Wine. **2012**. https://doi.org/10.1111/ajgw.12295.

(3) Pichler, U. Analisi Della Riboflavina Nei Vini Bianchi e Influenza Della Sua Concentrazione. *L'Enotecnico* **1996**, *32*, 57–62.

(4) Clark, A. C.; Dias, D. A.; Smith, T. A.; Ghiggino, K. P.; Scollary, G. R. Iron(III) Tartrate as a Potential Precursor of Light-Induced Oxidative Degradation of White Wine: Studies in a Model Wine System. *Journal of Agricultural and Food Chemistry* **2011**, *59* (8), 3575–3581. https://doi.org/10.1021/jf104897z.

(5) Hartley, A. The Effect of Ultraviolet Light on Wine Quality. *WRAP.org.uk* **2008**.

(6) María Mislata, A.; Puxeu, M.; Mestres, M.; Ferrer-Gallego, R. The Light Struck Taste of Wines. In *Grapes and Wine*; IntechOpen, 2021. https://doi.org/10.5772/intechopen.99279.

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