

PREVENTION OF DEFECTS IN WINE

Different problems may appear along the wine making process that alter the desired characteristics, thus providing unwanted aromas, colour changes or precipitates that decrease its organoleptic quality. Detecting these defects in their initial phases allows to treat them before they are irremediable and constitutes one of the fundamental tasks of the oenological laboratory.



Defects can appear at any time during the process and are more frequent when musts that are not in perfect sanitary condition or some unconventional procedures are used (wines without sulphites, aging on lees, unfiltered fermentations, ...) in which additional precautions must be taken. A frequent control on the product allows to detect small deviations of some critical parameters that point to these defects.

Prevention starts from the very first moment with the selection of grapes of the highest possible quality. The presence of fungal infections produces an increase in parameters such as **gluconic acid** or **glycerol** that already anticipate possible difficulties in later stages if adequate corrective procedures are not applied. To check them at grape reception have become a routine procedure in many countries to evaluate the quality of the grape before pressing.

One of the most frequent problems at the fermentation stage is the appearance of unwanted odours associated with the formation of hydrogen sulphide, thiol-esters and mercaptans (smell of rotten eggs, garlic, onion, cabbage) under reducing conditions. These molecules appear as a consequence of the digestion of amino acids (cysteine and methionine that contain sulphur) associated with low levels of nutrients and that occurs more frequently in slow and cold fermentations. Therefore, it is important that the yeasts have a sufficient nitrogen source (which implies checking the levels of **PAN** and **Ammonium** regularly) so that the degradation pathway is not significant. Also, it is very important to have an adequate aeration/agitation that allows oxygen to transform sulphides into sulphates and release the remains of hydrogen sulphide gas, but not so strong to produce excessive oxidation of the must. If such odours do appear, then there is no choice but to cause precipitation of the sulphides by treating with copper sulphate, carefully controlling its levels (legal maximum level of 1 mg / L, OIV Oeno 2/89) since an excess of **copper** also causes unpleasant metallic flavours, in addition to causing the risk of cuprous casse once bottled if a subsequent stabilizing treatment is not applied. Furthermore, adding ascorbic acid in a controlled way (legal limit of 250 mg / L, OIV Oeno 11/01 and 12/01) facilitates the transformation of dimercaptans (which do not precipitate with copper) into mono forms, (which do precipitate with copper).

Excessive oxidation is also a defect that causes the must to brown and the appearance of caramel aromas due to the formation of **acetaldehyde**, which should be kept below 75-100 mg/L. In addition, excessive aeration favours the appearance of aerobic microorganisms (acetobacter) able to spoil the wine. The presence of **free sulphites** is capable of neutralizing the acetaldehyde formed, so it is necessary to always maintain adequate levels, in addition to avoiding the formation of air pockets in the fermentation tanks by filling the top of the tank with inert gas.

If, despite everything, it is not possible to avoid the appearance of aerobic bacteria, **acetic acid** levels will increase due to the transformation of ethanol to acetic acid (smell of vinegar) and ethyl acetate (smell of glue), both main components of the called **volatile acidity**. To avoid this, it is essential to maintain a low pH (acidic, below 3.2, preferably 3.0), maintain a high alcoholic degree, prevent its growth on the surface (in addition to the addition of sulphites) and control the tank temperature around 10 °C. In case that significant amounts of acetic acid are

produced (above 0,7 - 1 g/L it is already detectable on the palate) there is no other choice but to eliminate it through reverse osmosis processes (quite expensive) or dilution with other wines without acetic acid.

The malolactic fermentation (MLF) of red wines transforms malic acid (with a harsh taste) into lactic acid (much more pleasant), while consuming much of the residual sugar remaining after alcoholic fermentation, but if it is not done completely (as verified by monitoring the disappearance of **malic acid** and / or appearance of **lactic acid**), the leftovers of sugar can cause an unwanted second fermentation in the bottle (not to be confused with chaptalization procedure) with the risk of explosion or uncorking. If the presence of significant levels of residual sugar is desirable, the best way to prevent it is to sterilize by pasteurization after bottling (OIV Oeno 5/88).

The alcoholic medium and the high content of organic acids affect the solubility of many salts, like **iron, copper and calcium**, which can form precipitates that cloud the wine. Before bottling, it is necessary to ensure that the conditions necessary for the formation of these precipitates, which are generically called casses, do not exist. Iron casse (blue casse in red wines, due to the formation of ferric tannate, or white casse in whites, due to the formation of ferric phosphate) is caused by an excess of Fe^{3+} ion (levels above 8 mg/L) can be prevented by adding citric acid (maximum legal concentration of 1 g/L, OIV Oeno 17/70) which acts as a complexing agent, keeping it in solution. Cupric casse produces a browning of the wine due to the appearance of reddish precipitates of Cu^+ (the reduced form of the ion) in addition to providing an unpleasant bitter taste and may also appear at very low concentrations of copper, in the range of 0.5- 0.6 mg/L. Furthermore, the appearance of this precipitate is accelerated by exposure to sunlight, especially in the presence of wines with a high protein content, which acts as a binder.

Tartaric casse occurs when the calcium and potassium salts of tartaric precipitate due to the effect of cold and appears when the concentration of calcium or potassium is excessive. **Tartaric acid** is the main acid in wine and is found in very high concentrations naturally, so its salts are in near-saturation conditions; the best prevention in this case is to accelerate the appearance of said precipitates by cooling to remove them by filtration (OIV Oeno 2/04). The difficulty of this process lies in finding the adequate cooling rate since, if it is slow, the precipitation is incomplete, but macroscopic crystals are formed; if it is fast, it is more intense, but the size of the crystals is smaller and the filtering is more complex.

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