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FACT SHEET

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TARTRATE STABILITY IN WINES

One of the most common sediments that forms instability in wine is potassium bitartrate (also known as potassium hydrogen tartrate – KHT), and less frequently, calcium tartrates (CaT). In the course of wine maturation, when the dissolved tartrates' concentration exceeds their solubility in wine, they crystallize and begin to precipitate. The timing and amount of crystallization will depend on the composition, pH and ethanol concentration of the wine, as well as the storage temperature.

Depending on ethanol concentration, the solubility of the tartrates decreases as the ethanol concentration increases. Therefore, spontaneous crystallization can be observed during alcoholic fermentation. Once the final ethanol concentration is reached, during wine storage or aging, the solubility of the tartrates is affected by the storage temperatures. At lower storage temperatures, the solubility of the tartrates decreases, meaning further crystallization can occur. Moreover, colloidal substances, such as phenolic compounds, coat the crystals and prevent their growth. These are also called "protective colloids." However, they can change their stability and lose their protective effect on wine, causing crystals to precipitate several months after the fermentation or during wine storage.

Enhancing crystallization by speeding up the process and removing the formed crystals is the main theory of tartaric stabilization. At the same time, there are other methods that aim to delay or inhibit crystallization.

Methods of Tartrate Stabilization in Winemaking

Different methods are available for producing stable wines in terms of tartrates. While cold stabilization is traditionally used in wineries, other methods, and enological products are currently available and frequently used.

1. Cold stabilization

Cold stabilization is the most traditional method used for ensuring tartaric stability in wines. This method involves aggravating the crystallization of tartrates in excess, followed by their removal from wine.

To perform cold stabilization (without tartrate crystal seeding, which will be mentioned in the following paragraph), the wine is rapidly cooled until close to its freezing point and kept under this temperature for a period of time depending on different parameters and type of wine. The cold temperature is generally accompanied by stirring, which facilitates agglomeration of the crystals. Following this treatment, the crystals are eliminated by filtration at low temperatures before the wine is brought back to its storage temperature.

The effectiveness of the cold stabilization depends on wine composition. It may be time and energy-consuming. To render cold stabilization more rapidly, it's possible to incorporate tartrate crystal seeding, such as cream of tartar. This seeding helps to reduce the length of the treatment, from days to hours.

The following points are important to consider during cold stabilization treatment:

- **Preparation before stabilization:** Prior to the cold stabilization, consider performing a coarse filtration to eliminate debris of yeast and bacteria. This also allows the elimination of some of the protective colloids, making the stabilization process easier. On the other hand, fine filtration is not recommended to be performed before cold stabilization since it can eliminate the microcrystals that are crucial for crystallization phenomena.
- **Calcium tartrates:** Applying cold stabilization methods, keep in mind that calcium tartrates, although more insoluble than potassium bitartrate, are hardly precipitated by these treatments. Therefore, calcium tartrates can still cause instability after cold stabilization, as they need longer times to precipitate compared to potassium bitartrate.
- **Oxidation:** The ability of oxygen absorption increases as the temperature of the wine decreases. Especially if stirring is involved in the process, it's important to be cautious about the oxygen exposure in wine.
- For applications of cream of tartar, make sure that the application rate does not exceed the amounts listed in Food and Drug Regulations for Canada. Find the link to the regulations at the end of this document.

2. Electrodialysis

Electrodialysis is a relatively new technique used to achieve tartaric stability in wines. With this physical method, the action of an electric field and selective membranes allows for the extraction of potassium, calcium and tartrate ions in supersaturation in wine.

Among the advantages ofelectrodialysis are obtaining reliable results in both potassium hydrogen tartrate and calcium tartrate stability and lower energy requirements than cold stabilization. However, an initial capital cost for equipment purchase is necessary.

4. Metatartaric acid

Metatartaric acid is a polyester produced by inter-molecular esterification of tartaric acid. It's used in winemaking to prevent the precipitation of potassium hydrogen tartrate and calcium tartrate.

Metatartaric acid has an inhibiting effect on crystallization. However, the stability it provides isn't permanent. It will be several months or years, depending on the pH and the storage temperature of the wine. Therefore, its usage is not suitable for the wines intended to have a long aging period and to be stored in higher temperatures because of various reasons, including climate or the season.

Finally, make sure that the application rate does not exceed the amounts listed in Food and Drug Regulations for Canada. Find the link to the regulations at the end of this document.

5. Mannoproteins

Mannoproteins are released as a result of yeast wall degradation towards the end of fermentation and during maturation when the yeast cells start autolysis. As a naturally occurring compound in wine, recent research and advances made usage of mannoproteins possible in various enological products with different properties and effects.

In the context of tartrate stability, the addition of mannoproteins provides tartrate stability by inhibiting the formation of tartrate crystals and keeping tartrates in the solution in wine. Various advantages of mannoproteins have been shown in terms of providing efficient tartrate stability, being a naturally occurring compound in wine, its ease of usage and low energy requirements, as well as positive effects on the mouthfeel of the wine depending on the wine style.

6. Carboxymethylcellulose

Carboxymethylcellulose (CMC) is a cellulose derivative that acts as a protective colloid to inhibit crystallization in wine. The following points are important to consider while using any CMC product:

- It's an efficient method for providing stability in terms of potassium hydrogen tartrate, however not for calcium tartrate.
- CMC promotes the solubilization of proteins. Therefore, before its application, the wine should be protein stable. Moreover, the wines treated with lysozyme will show haze if CMC is applied consequently.
- CMC can interact with phenolic compounds in red and rosé wines, causing haze or precipitation.
- It's important to read the technical factsheets of the specific CMC product provided by the supplier and apply them accordingly. For specific wines, it's recommended to conduct benchtop trials to determine an adequate rate of application.

7. Others

- It's possible to find different options in the market, such as a combination of these products with gum arabic. Gum arabic is a natural product obtained from the acacia tree.
- Recently, the usage of potassium polyaspartate, a new solution for tartrate stability, was approved in Canada. It's a synthetic polyaminoacid that provides tartrate and colour stabilization.
- There are other alternative techniques such as cation exchangers, among some others.

Final remarks

Choosing the most convenient method will depend on the winery's goals and available resources at the cellar. The following considerations are important to take into account during winemaking:

- **Sparkling wine:** For sparkling base wines, it's very important to achieve tartrate stability. The effervescence in sparkling wines can be intensified with the tartrate crystals in wine. This can cause a gushing effect during disgorgement, causing product losses, or even during consumer consumption leading to a negative consumer experience. Finally, after the second fermentation in bottle or tanks, the changed parameters of wine, such as ethanol concentration, will have a destabilizing effect. Therefore, these changes should be taken into account while performing stabilization.
- **Blending:** When two or more wines are blended, the wine composition, more importantly, the alcohol and pH of the final wine, will be modified. This causes a change in the tartrate crystals solubility and, therefore, equilibrium of the stability. Therefore, if any blending will be performed, it's recommended to move forward with tartrate stabilization afterwards.

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