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Study of the Bitartrate Formation at Cold Stabilization of Wines

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Abstract

The wine samples were tested in the laboratory, after a period of 30 days at -4ºC. The wines were tested before and after refrigeration. The analyses of the wines were determined in time, monitoring the potassium bitartrate precipitation.

Keywords: refrigeration, wine, potassium bitartrate

1. Introduction

The tartrate stabilization process for wines has become widespread in the last 50 years and today it is applied to almost all wines before bottling (Ribereau- Gayon, Peynaud, Ribereau-Gayon, & Sudraud, 1977).

Among the techniques used in this area, cold treatment is without doubt the most widely applied (Celotti, Bornia, & Zoccolan, 1999; Goertges & Stock, 2000; Gomez Benıtez, Szekely Gorostiaga, Veas Lopez, Palacios Macıas, & Perez Rodrıguez, 2002; Guerif, 1993; Mourgues, 1993; Moutounet, Saint-Pierre, Batlle, & Escudier, 1997; Ribereau-Gayon, Glories, Maujean, & Dubordieu, 1998). Several modes of operation can be found for this technique but the method designated traditional cold treatment is the most commonly used (Blouin, 1982) (henceforth this method is referred to as cold treatment).

This technique involves cooling the wine down to a temperature close to its freezing point and storing it in isothermal tanks during a period of approximately one week (Ribereau-Gayon et al., 1977). This treatment is usually carried out after fining and filtration of the wine in order to facilitate the crystallization of potassium bitartrate (KHT).

The grapes are rich tartaric acid and potassium. The grape juice and the wine have high concentrations of potassium bitartrate. The wine quality is not altered by the presence of this crystalline settlement. It is always necessary to remove the excess of potassium acid tartrate before bottling the wine, with a view to satisfying the consumer's preferences. One of the techniques used to prevent potassium acid tartrate is that of cool stabilization. This process consists in refrigerating the wine down to a temperature of 0.5 to 1ºC above freezing point. This paper deals with the effects of low temperatures in the white wines clearing process. The wine samples were tested in the laboratory before and after refrigeration.

2. Materials and Method

A sampling was carried out in a commercial cellar during 4 months in order to determine the effect of the cold treatment on the composition and stability of the wine.

2.1. Necessary equipment

- ✓ Cooling device, equipped with measuring and control gauge
- ✓ Oxygenated water 10%
- ✓ Installation equipped with vacuum tromps

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The study was carried out using the following types of wines: Fetească Regală (Table 1). The wines were obtained in accordance with the usual procedures of wine making.

Table 1 Samples used for analyses

Sample	Wine
A1	Souvignon, Merlot
A2	Cabernet, Merlot
A3	Sangiovese, Massaretta, Merlot
A4	Sangiovese, Merlot
A5	Sangiovese, Merlot, Canaiolo
A6	Sangiovese, Merlot,Cabernet
A7	Sangiovese, Merlot,Cabernet, Ciliegliegiolo, Pollera
A8	Merlot, Sangiovese
A9	Cabernet
A10	Sangiovese, Merlot,Cabernet
A11	Sangiovese, Canaiolo
A12	Sangiovese,Cabernet, Merlot

2.2. Cold treatment

A standard cold treatment process was used by means of the refrigeration of the wine at a temperature close to its freezing point (between −3 and −4 °C) and storing it at this temperature from 1 to 4 months. The wine is refrigerated in colourless bottles capacity of 250 ml. The potassium acid tartrate crystals were added after 2-3 hours of cold treatment. It was homogenized and kept refrigerated from 1 to 4 months

2.3. Analytical determinations

European official methods of analysis were used to determine the pH and total acidity. Tartrate stability was measured by observing the formation of crystalline sediment in a sample stored at low temperature (−4°C). All the determinations were carried out in duplicate, with the arithmetic means of the results presented.

3. Results and Discussion

After 30, 60 and 90 days of being stored under refrigeration, the wines presented a visible layer of potassium acid tartrate.

For samples A2, A3, A4 and A5 (Figure 1) is observing an increase in the amount of tartaric acid, a maximum variation is registered for sample A7 followed by a decrease in the amount of tartaric acid for A8 and A9 samples.

When precipitating, the potassium acid tartrate excess reduces acidity, giving the wine certain suppleness.

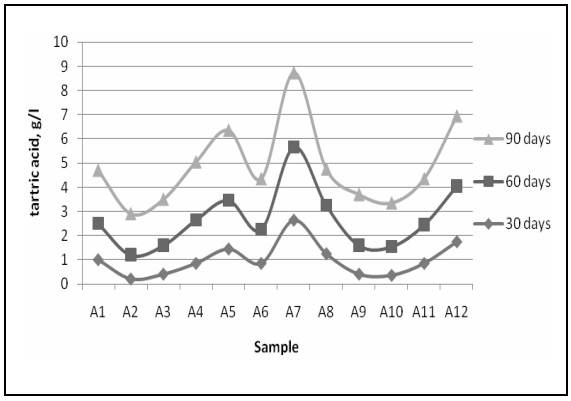

Figure 1. Variation of tartric acid in refrigeration process

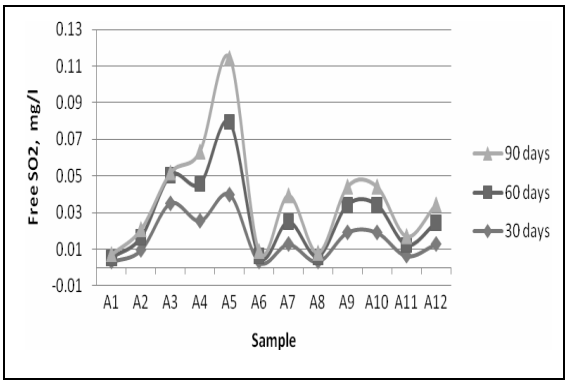

Figure 2. Variation of free SO_2 (mg/l) in refrigeration process

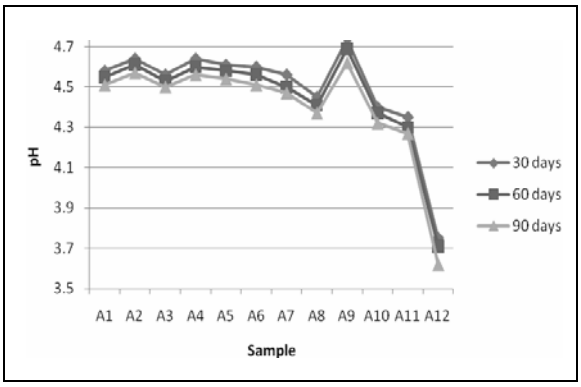

Figure 3. Variation of pH in refrigeration process

As a result of refrigeration, by precipitating one gram of potassium acid tartrate, the title acidity is reduced by 0.399 g/l, approx. 0.4 g/l in tartaric acid. Precipitation of potassium acid tartrate leads to a change in the pH. With wines having a pH below 3.6 this precipitation of potassium acid tartrate causes a reduction of pH values. In figure 4 is presented bitartrate potassium crystals formatted by refrigeration processes for sample A5.

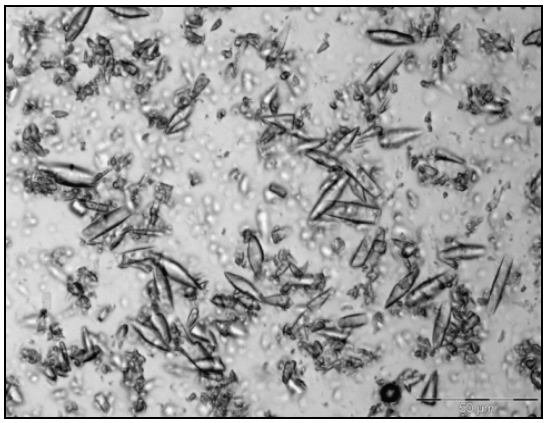

Figure 4. Bitartrate potassium crystals formatted by refrigeration processes for sample A5.

The quantity of sulphuric anhydride is not influenced by the effect of refrigeration; it is used in the making and conditioning of wines, due to its reductive, antioxidant properties and its high antiseptic effect. Figure 3 is observed a slow decrease of pH for samples A1 - A7, registering a peak for sample A8, followed by a slow decrease for samples A9 - A11. A sudden drop in the pH values was registered for sample A12.

Cold treatment led to decreases in the pH, total acidity, potassium, tartaric acid and these values changed in different ways depending on the type of wine. Precipitation of potassium acid tartrat determines pH modification. At wines with reduces pH, smaller then 3.6, precipitation of potassium acid tartrat determines a pH decrease.

In figure 2 can be observed an increase of SO_2 values which are influenced by wine type. A maximum was registered for sample A5. The quantity of SO_2 wasn't influenced by refrigeration effect; it is utilized at wine obtaining a conditioning because of its reducing and antioxidant properties and because of high antiseptic effect.

4. Conclusion

The results of this study show that, owing to the complexity in wine composition, the stability of potassium acid tartrate is difficult to predict. The consequences of this phenomenon on wine characteristics must be still studied.

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