

The influence of processing parameters during reverse osmosis on organic acids retention in conventional and ecological Cabernet Sauvignon wine concentrates

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Introduction

Ecological wine production excludes the use of chemical adjuvants and pesticides in vineyard, unlike conventional wine production. This results in different concentrations of organic acids in final products. The organic acid content in red wine is very important due to its impact on wine aroma and it differs between wine varieties. Most common organic acids in red wine are tartaric, acetic, lactic or succinic acid. Their concentrations depend on wine production and storage conditions. Wine production procedures can also include membrane filtration of wine, such as reverse osmosis (RO), that is used for wine concentration and chemical composition correction. This process can influence the composition of organic acid in wine. Therefore, the aim of this study was to investigate the influence of different pressures (2.5, 3.5, 4.5 and 5.5 MPa) and temperature regimes (with and without cooling) during reverse osmosis process on organic acid content in conventional and ecological Cabernet Sauvignon red wine concentrates.

Materials and methods

In this study, conventional and ecological Cabernet Sauvignon red wines were used. These wines were produced in 2018 in cultivation area Zmajevac, Baranja vineyard, Croatia. The reverse osmosis process of red wine was conducted in a LabUnit M20 laboratory filter (De Danske Sukkerfabrikker, Nakslov, Denmark) equipped with a plate module and six flat sheet RO98pHt polyamide membranes. During the concentration of conventional and ecological red wines, four different pressures (2.5, 3.5, 4.5, and 5.5 MPa) and two temperature regimes (with and without cooling) were applied. Organic acids (tartaric, succinic, lactic and acetic acid) were determined by a 1260 Infinity high-performance liquid chromatography (HPLC) system (Agilent Technologies, Santa Clara, CA, USA) equipped with a Poroshell 120 EC-C18 column (4.6 × 100 mm, 2.7 μm), quaternary pump and diode array detector (DAD).

Results

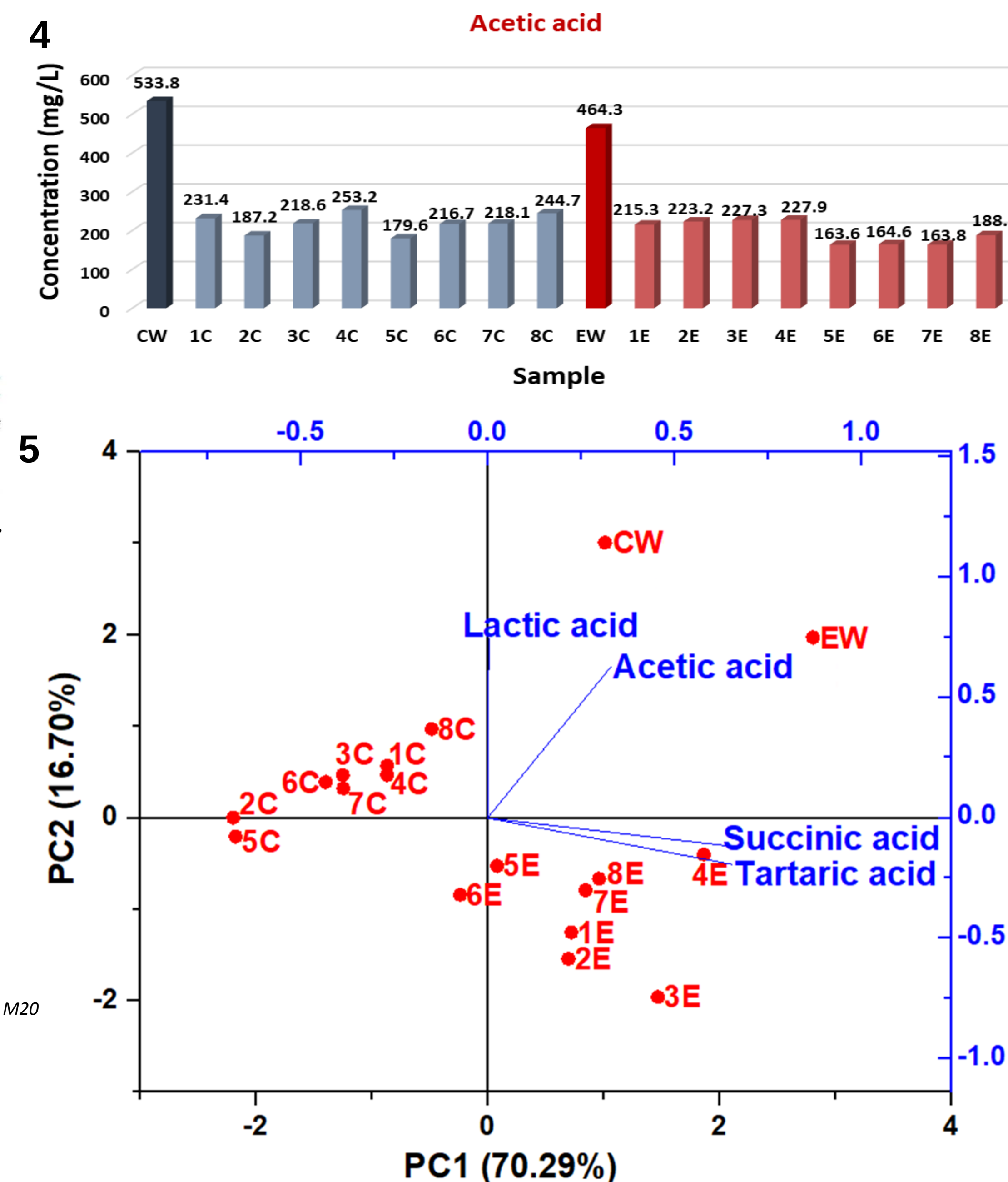
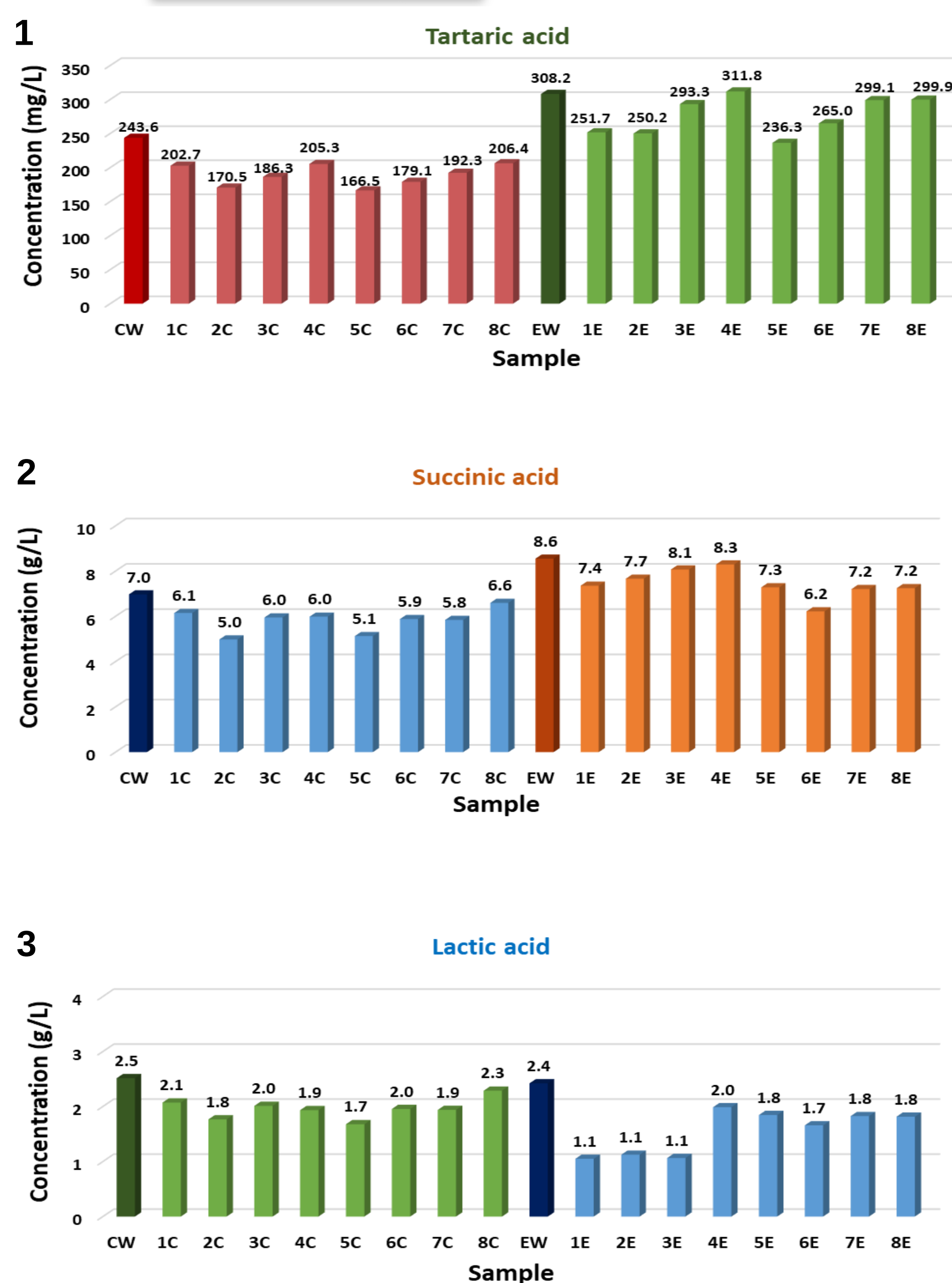


Figure 1-4. Concentrations of tartaric, succinic, lactic and acetic acid in initial conventional and ecological Cabernet Sauvignon wine and reverse osmosis retentates obtained at 2.5, 3.5, 4.5 and 5.5 MPa with and without cooling.

Figure 5. Principal component analysis (PCA) biplot of organic acids acid in initial conventional and ecological Cabernet Sauvignon wine and reverse osmosis retentates obtained at 2.5, 3.5, 4.5 and 5.5 MPa with and without cooling.

Abbreviations: CW – conventional wine; EW – ecological wine; 1-4 – pressures of 2.5, 3.5, 4.5 and 5.5 MPa with cooling, respectively; 5-8 – pressures of 2.5, 3.5, 4.5 and 5.5 MPa without cooling, respectively.

Conclusions

- ✓ The results showed that initial concentrations of all acids decreased after RO process, but the retention of organic acids was higher if higher pressure and cooling was applied, especially at 5.5 MPa with cooling.
- ✓ The pressure of 2.5 MPa with cooling was also favourable for organic acids retention in conventional wine concentrate.
- ✓ The retention of organic acids during reverse osmosis process depended also on initial wine composition. Higher retention of tartaric and succinic acid was achieved in ecological wine concentrates, and higher retention of lactic acid was achieved in conventional wine concentrates at same processing parameters.
- ✓ The retention of acetic acid was similar in both wine concentrates, and its initial concentration decreased for more than 50%.
- ✓ The PCA analysis showed visible changes in organic acid profile of both wine, with differences between concentrates obtained at different operating conditions and it confirmed above-mentioned conclusions. The highest retention of tartaric and succinic acid was achieved during RO process of ecological wine at 5.5 MPa with cooling.

Literature

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