

HIGH PRESSURE STABILIZATION OF WINES: IMPACT OF PRESSURE CHANGE TECHNOLOGY ON WINE QUALITY

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INTRODUCTION

Current EC regulations are demanding a significant reduction in the use of SO₂ in wines. Therefore alternative methods to control microbial spoilage and oxidation are sought after. The PreserveWine project is a partnership of European SMEs that has identified a promising non-thermal process that can achieve biological stabilization of wines while reducing the use of SO₂ and keeping their quality.

PRESSURE CHANGE TECHNOLOGY (PCT)

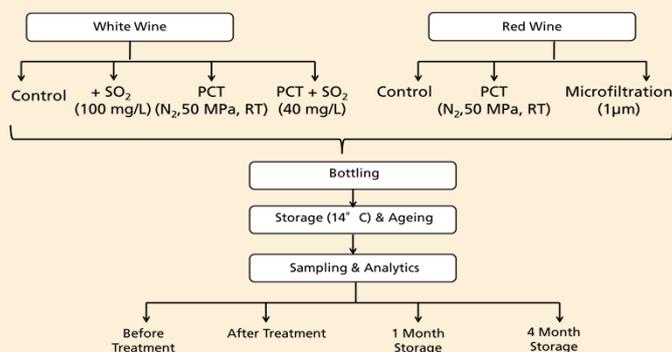
PCT is a novel non-thermal technique for biological stabilization of heat-sensitive liquid products. It involves charging a liquid with pressure (25 to 50MPa) and an inert gas (e.g. N₂, Ar) at moderate temperatures (5° C to 40° C). High pressure enhances the solubility of the gas in the liquid and the diffusion of the dissolved gas through the cell membranes of the microbial contaminants. A sudden pressure release liberates the cell inner pressure while rapidly discharging and expanding the gas to atmospheric conditions. Cell membranes are damaged and microorganisms are inactivated. Pasteurization hygiene levels of apple juice subjected to PCT treatment at room temperature have been previously reported.

OBJECTIVES

- To evaluate the effects of PCT on the wine quality and shelf life stability
- To develop a continuous unit (2 L/min) for application trials at various winemaking stages.

MATERIALS AND METHODS

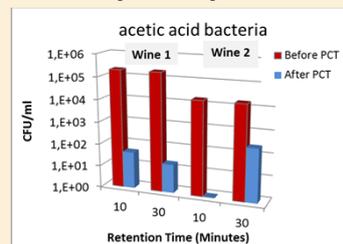
Effects of process parameters (retention time, pressure, and type of gas) on microbial reduction were tested in red Bordeaux wines using a batch system. Bottling experiments with red Barbera wine and white Chardonnay/Pinot Noir wine provided by the Azienda Agricola Tenute dei Vallarino (Canelli, Italy) were conducted as outlined below:



Usual wine chemical parameters were measured according to the Oenological Codex Edition 2011 specifications. Aroma analyses were conducted using GC-MS and CPG-FID. Microbial counts just before and just after the PCT treatment were carried out on YPD agar for yeast and MRS agar for bacteria. A 26-person jury tasted the wines using triangular and hedonic test (ISO 8487).

RESULTS

Effect of process parameters

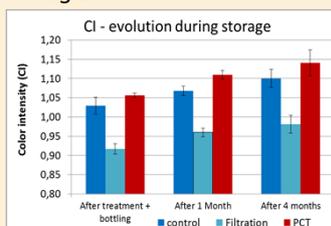
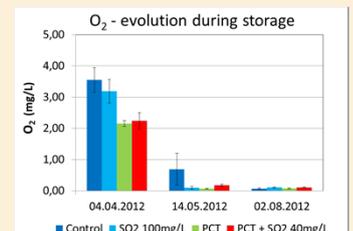


Influence of retention time on acetic acid bacteria reduction after PCT treatment of red wine (Ar, 50 MPa)

- After 10 minutes, full reduction (4-log) of acetic acid bacteria
- No benefit on increasing retention time up to 30 minutes.

Bottling experiments

White wines.- PCT treatment combined with half the concentration of total SO₂ (40 mg/L) was sufficient to prevent yeasts from developing, significantly reduced the amount of dissolved oxygen and maintained its color during storage.



Red wines.- PCT treatment resulted in unchanged total anthocyanin and polyphenol contents and significantly higher color intensity (CI) than control and microfiltered wines. Sensory tests reported non-significant differences between trials ($\alpha = 0.05\%$).

CONCLUSIONS AND OUTLOOK

- Scientific knowledge on the effects of Pressure Change Technology on the wine quality and shelf life stability was gained
- A continuous PCT system (2 L/min) was designed, built, installed, TÜV certified and set into operation for performance tests
- Validation of continuous system on winemaking is still ongoing
- A compact, mobile PCT-demonstration unit (10 L/min) is being developed to conduct on-site pre-industrial demonstration trials.

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