Effects of Alcohol Removal on the Chemical Composition of Wine Using Low Vacuum Thin Film Distillation

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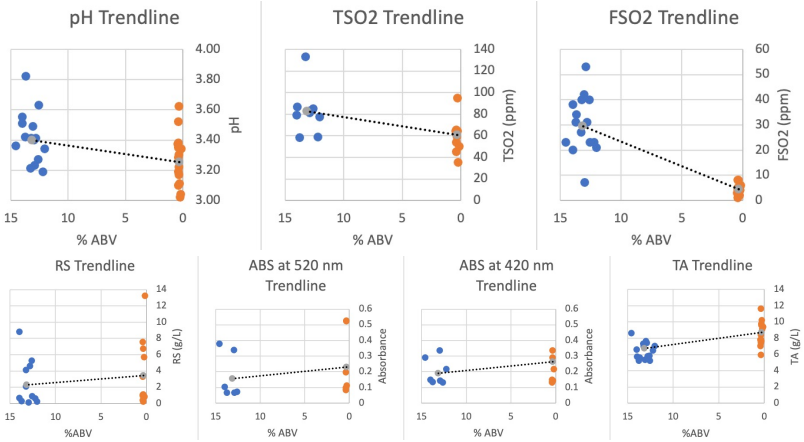
Introduction

Alcohol content is one of the most common identifiers of wine with the ABV often being an indicator of a grape's varietal. However, with the rise in global temperatures producing higher alcohol content wines and consumer demands trending towards lower alcohol wines, winemakers have been utilizing various winemaking techniques in order to meet expectations. One such technique is the use of low vacuum thin film distillation. Low vacuum thin film distillation is a distillation technique performed under reduced pressure, which allows for the separation of compounds at a lower boiling point than would be possible at ambient pressure. This presentation will detail how the chemical components of wine change after alcohol removal via low vacuum thin film distillation.

Materials and Methods

Sixteen samples of various styles of wines were de-alcoholized to <0.5% ABV on a Spinning Cone Column. Each sample was analyzed before and after de-alcoholization for pH, TA, RS, color, and F/TSO_2. ABV was determined by an Anton Paar Wine Alcolyzer, pH was determined by a Hanna Instrument pH probe, TA was determined by titration, RS was determined by a Vintessential Laboratories enzymatic kit, FSO_2 was determined by A/O method, TSO_2 was determined by a modified ripper method, and color was determined by absorbance at 420 nm and 520 nm.

Figures



Tables

	Average Pre-dealcoholization	Average Post - dealcoholization	Average Δ	Average %Δ
Ethanol (ABV)	13.15 ± 0.71	0.31 ± 0.08	-12.03 ± 3.28	-97.6 ± 0.6
RS (g/L)	2.3 ± 2.8	3.4 ± 4.1	0.8 ± 1.2	50 ± 17
ABS at 520 nm	0.156 ± 0.138	0.231 ± 0.203	0.058 ± 0.068	47 ± 27
ABS at 420 nm	0.192 ± 0.081	0.265 ± 0.105	0.066 ± 0.040	39 ± 15
TA (g/L)	6.8 ± 1.6	8.7 ± 1.7	2.0 ± 0.8	30 ± 13
pH	3.40 ± 0.18	3.26 ± 0.17	-0.14 ± 0.04	-4 ± 1
TSO_2 (ppm)	82 ± 21	61 ± 17	-18 ± 12	-26 ± 10
FSO_2 (ppm)	30 ± 11	5 ± 3	-25 ± 13	-81 ± 17

Conclusions

It was determined that as alcohol concentration decreased, residual sugar, color, and acidity increased in concentration while F/TSO_2 and pH decreased in concentration. This phenomenon can be attributed to the boiling point of each compound. Sugar, acid, and phenolic compounds have higher boiling points than the selected distillation temperature, while SO_2 has a lower boiling point; pH decreased due to an increase in acidity. The change in concentration for all parameters tested showed a dependency on the original matrix of the wine and the amount of alcohol that was removed. Wines with higher concentrations and larger alcohol adjustments had larger fluctuations than wines with low concentrations and less alcohol removed.