OBJECTIVE QUALITY ASSESSMENT OF CABERNET SAUVIGNON GRAPES AND WINES FROM CHILE

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INTRODUCTION

Cabernet Sauvignon (CS) is of high economic impact in Chile, with a yearly volume of 302 mili- liters, corresponding to 29% of the total wine production. CS also accounts for ¾ of the wines manufactured in a wide range of styles and qualities by Viña Concha y Toro (VCT). Quality assessment of the grapes grown in 54 VCT owned vineyards or purchased from approx. 700 external growers, and the produced wines, is obligatory. Sensory characteristics of wines are related to the chemical composition of grapes, and a number of marker compounds have been identified to represent VCT CS quality grades based on prior publications (Cleary et al. 2015, Bindon et al. 2016). Their standard analysis is done by high performance liquid chromatography (HPLC) or gas chromatography (GC). To avoid extensive chromatography and subjective sensory analysis these methods are aimed to be replaced using UV-Vis-Fluorescence and FT-MIR spectroscopy.

MATERIALS & METHODS

Characterization of VCT CS grapes and wines is done by annually compiling sets of approx. 100 samples from region IV to VIII of Chile, including viticultural influence factors like region, trellising system, yield, etc. and covering the range of quality manufactured by the company. Grapes and thereof produced standardized experimental wines (experimental scale of approx. 600 kg per sample) are analyzed for chemical markers including 9 anthocyanins, 21 low molecular weight polyphenols (LMWPs), 24 aromas including terpenes, C12 compounds, methoxy pyrazines and 11 routine parameters. Descriptive sensory analysis (DA) of the final wines includes the quantitative evaluation of overall quality, mouthfeel and orthonasal quality on a scale 1-9.

RESULTS

Spectra of extracted grape and wine samples are acquired in technical triplicates, and partial least square regression (PLS-R) models are created using chemical and sensory analysis data.

For the 100 samples of 2018, a major influence was found for increasing yield and berry size on decreasing concentrations of anthocyanins and LMWPs in grapes, which is presumably explained by a reduction of sink while keeping the same source potential. A minor impact of region and trellis system was observed. Aroma compounds were generally minor correlated. However, the sensory quality of the wines was significantly influenced by viticultural factors and the resulting grape composition (figure 1). Sensory DA revealed a clear representation of overall quality, mouthfeel and aromatic quality towards grapes classified as high quality by company markers. Quality is profiled by certain attributes (figure 2).

Figure 1. Principal component analysis of viticultural determinants, chemical markers of the CS grapes and the sensory evaluation of the corresponding wines

Aqualog (Horiba, Kyoto, Japan, simultaneous Absorbance- Transmission and Fluorescence Excitation-Emission Matrix, UV-Vis-Flu) and FT1200 (Foss, Hillerød, Denmark, Fourier transform mid infrared, FT-MIR) are targeted for spectroscopy analysis development.

Figure 2. Sensory space of VCT CS wines. Principal component analysis of 100 samples in regards of grape quality classification. Profiling of “quality” by representation in objective descriptors.

Spectra of the same 100 samples acquired with the Aqualog revealed fair correlations with the quantitative data of anthocyanins and LMWPs in PLS-R (figure 4). The example of total LMWPs shows, that although we observed a correlation R² of 0.91 with a root mean square error of cross validation (RMSECV) of 12.6 in a range of 70-280 mg L⁻¹, the impact of oxidation has to be considered for the technical replications due the high sensitivity of the Aqualog towards highly fluorescent compounds. This gets obvious in the contour plots showing increasing intensity of fluorescence in a sample over 24 h (figure 5). Following that observation, the impact of oxidation was minimized in a subset of 21 samples in triplicate, which improved the correlation to R² of 0.99 with an RMSECV of 3.4 for a range of 75-235 m L⁻¹ (figure 6). FT120 revealed a high correlation of R² 0.9 and RMSECV of 0.2 for sensory overall quality rating (figure 3).

CONCLUSIONS

The main viticultural determinants and chemical markers were revealed for typical VCT CS grapes and wines for vintage 2018, and will be continued for the vintages 2019 and 2020. So far it has been observed, that decreasing yield and berry size highly correlate with increasing anthocyanin and LMWP concentrations of grapes, which is again reflected by increased overall sensory quality of the wines. Region and trellising system were found to have a minor influence on grapes and wines. Volatile aromas were not distinctively correlated, however, CS quality has been rated as highly correlated to attributes like softness, astringency, etc. which are determined by non-volatiles. Regarding the spectroscopy, Aqualog UV-Vis-Flu is in advancing process to at least serve for the quantification of non-volatiles, and based on extensive development work the spectral database is augmented and proved to result in calibrations with high correlations. FT1200 gave good correlations with sensory analysis data.

REFERENCES


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