Determination of sensory descriptors in tropical red wine using visible/near infrared (Vis/NIR) spectroscopy

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Sensory wine evaluation accomplished in the wine industry, normally by enologists or experts, is subjective and susceptible to variations due to the fact that it is not followed by statistical analysis. Alternatively, the Quantitative Descriptive Analysis (QDA®) allows describing and quantifying sensory differences among samples with ANOVA, mean tests, and multivariate analysis using a previously selected and trained panel. Therefore, QDA® is expensive, high labor and time consuming for the wine industry. This study aimed to develop and validate models to determine wine sensory profile using visible/near infrared (Vis/NIR) spectroscopy.

A total of 48 'Syrah' red wines produced in the São Francisco River Valley (Brazil) were used in our study. The wines were elaborated at the Enology Laboratory with grapes harvested at different maturity stages and submitted to different periods of maceration. Samples were subjected to QDA®, using three replications and a non-structured 9 cm scale. Samples of 30mL of wines (18°C) were presented in wine glasses (ISO format) with three digit codes and evaluated by a panel composed for 13 trained judges. The evaluations were conducted in individual booths with white light and adequate temperature. For spectra acquisition, wine samples were subjected to transflectance analysis using a benchtop spectrometer (XDS, FOSS NIRSystems, MD, USA) in the spectral range from 400 to 2500 nm. Four separate measurements were carried out on each sample and the four spectra were averaged to provide a mean spectrum. Samples were previously divided into calibration and prediction sets using the SPXY (Sample set Partitioning based on joint **x**–*y* distances) algorithm. Multivariate calibration models were developed using raw data and the Partial Least Squares (PLS) regression. Predictive performance of the models was evaluated in terms of the coefficient of determination in the external validation step (R^2_v) and the root mean square error of prediction (RMSEP).

According to the results, the calibration models showed that the sensory descriptors 'astringency', 'alcoholic aroma', 'spicy aroma', 'sourness', 'body' and 'color intensity' were predicted with acceptable accuracy using NIR spectroscopy. The predictive model performance is detailed as following: astringency, R^2_v and RMSEP values were 0.68 and 0.35, (range: 2.60-5.00); alcoholic aroma, R^2_v and RMSEP values were 0.77 and 0.38 (range: 2.40-4.60); spicy aroma, R^2_v and RMSEP values were 0.66 and 0.18 (range: 0.70-1.60); sourness, R^2_v and RMSEP values were 0.80 and 0.33 (range: 2.80-5.50); body, R^2_v and RMSEP values were 0.74 and 0.20 (range: 2.70-4.10); color intensity, R^2_v and RMSEP values were 0.82 and 0.20 (range: 5.00-6.80), respectively. Despite of the small number of samples used, results suggest that Vis/NIR spectroscopy can provide an easy and accurate approach to determine sensory descriptors in Tropical Brazilian red wines.

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Novelty

Sensory red wine profile was determined by visible/near infrared (Vis/NIR) spectroscopy. The sensory descriptors ‘astringency’, ‘alcoholic aroma’, ‘spicy aroma’, ‘sourness’, ‘body’ and ‘color intensity’ were predicted with acceptable accuracy through developed models. The use of Vis/NIR spectroscopy associated with chemometric techniques is a promissing alternative to determine the sensorial profile of tropical red wines.