Development of multivariate models to monitor and control grape quality and wine production

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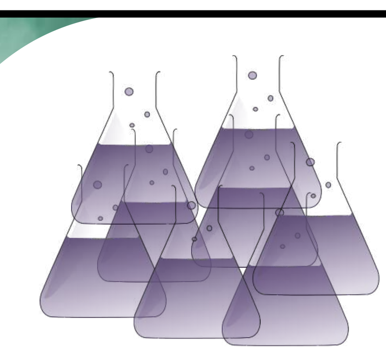
Introduction

Spanish agricultural sector has a great economic impact due to the quality of its production, both in raw fruits and in later processed products. A well-known example are grapes and wine. However, increasing production in vineyards in recent years harms agricultural sector as wineries could not assume it, which cause low prices in origin.

Taking into account grape quality, there could be different solutions: best grapes can be directly consumed, while grapes with lower quality can be derived to juices or pre-prepared convenience food products with added value. In order to classify and derive the products, prior physicochemical analysis would be needed.

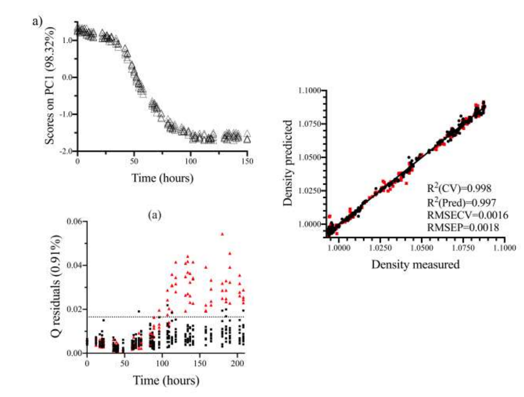
Modern fast techniques allow obtaining a huge amount of data more quickly, more greenly and with less sample pretreatment, without destroying the sample, and directly from the vineyard.

Previous work*



Alcoholic fermentation

Portable MIR



Analytical measures optimization

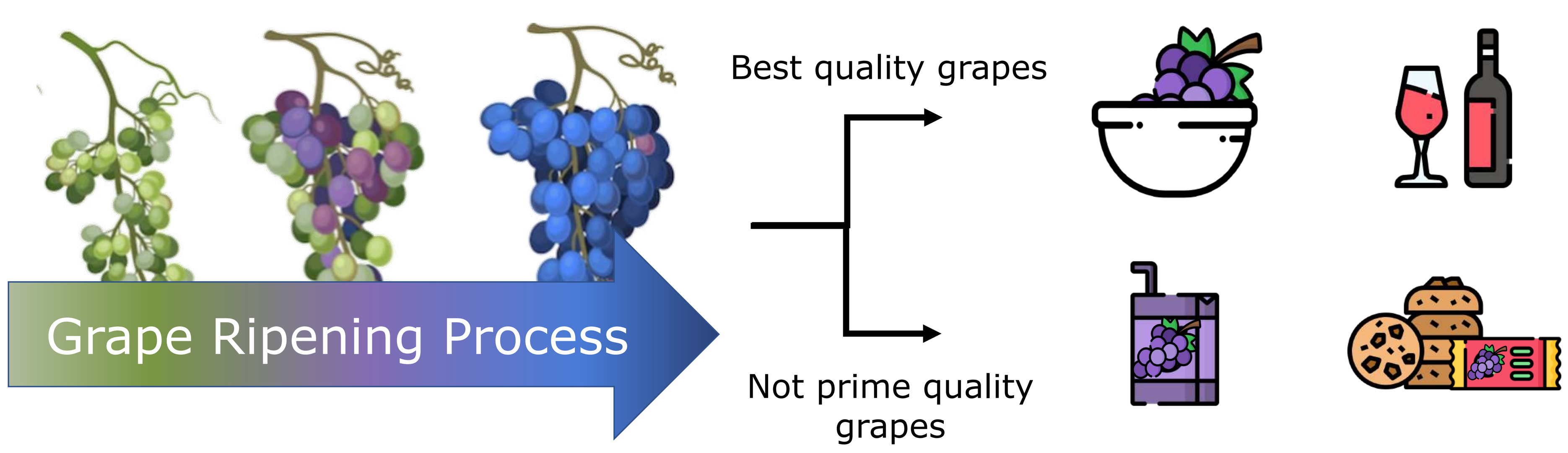
The alcoholic fermentation was analyzed using a portable MIR. The process was monitored at micro-scale in order to obtain a greater number of samples. The optimization achieved a complete monitoring of the process, which obtain the same profile of the density measured typically used in wineries. Moreover, sluggish fermentations (fermentations which slow their fermentation rates) and lactic acid bacteria contaminations were detected in early stages. Finally, typical oenological parameters were also predicted along the fermentation.

- Process Control
- Early detection of deviations
- Parameters prediction

Objectives

The main goals are to predict the physicochemical parameters of the final wine along the entire grape ripening process. And to establish a classification model that sorts grapes, according to their quality, to the different products. These objectives would be achieved using chemometric tools.

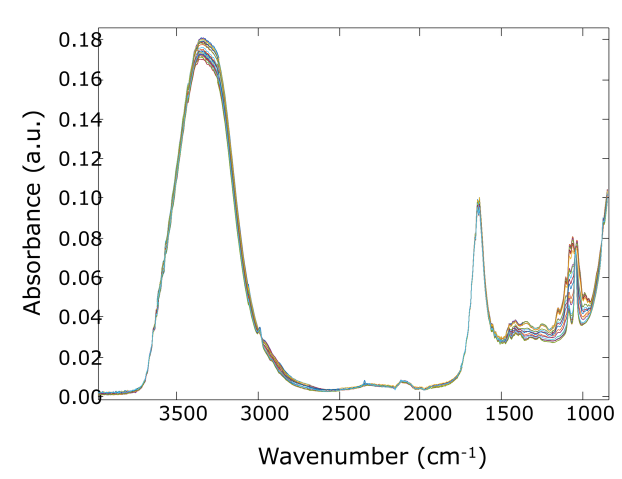
Process



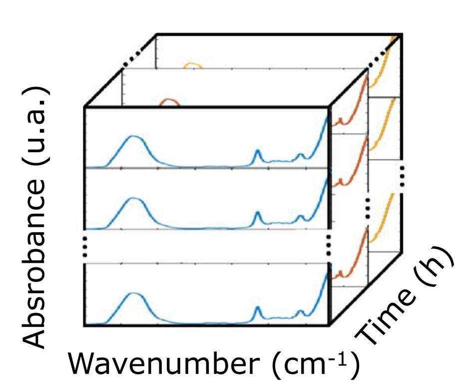
Methodology

Portable MIR

Grape or grape must ATR or DRIFT as sampling devices



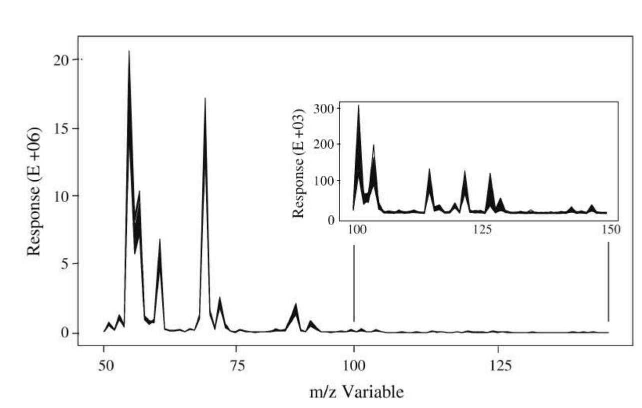
Bidimensional examples of the analytical response

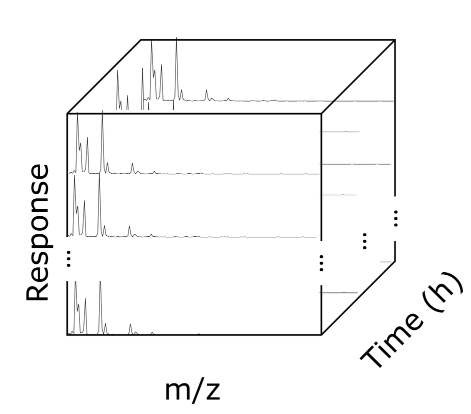


Data is contained in a three-dimensional matrix as it is measured during ripening

HS-MS (electronic nose)

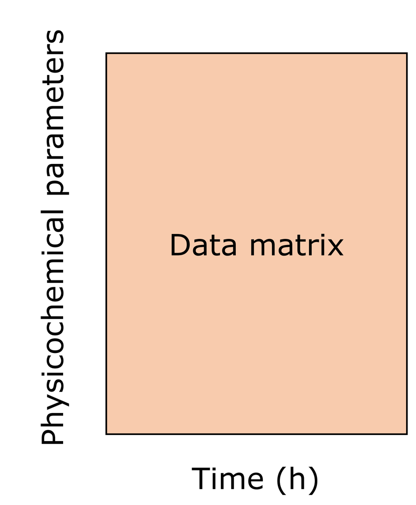
Analysis of the whole volatile fraction without chromatographic separation





Combination of one or both fast analytical techniques matrixes with physicochemical data

Physicochemical analysis



Physicochemical parameters & Classification to final products

Chemometrics approaches to unravel the information contained in the large data matrixes

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