P28 – Using near-infrared spectroscopy to quantify quality-determining sugars and acids in grape must

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Abstract

The most useful quality-determining factors for grape must are sugars and acids due to their importance for the production of high quality wine. Moreover, German wine law divides different categories according to the sugar content of the must depending on the EU defined wine-growing zones. Therefore, in most cooperatives the sugar content in particular is one basic factor for payment.

Winegrowers have the possibility to manually measure the sugar and acid contents in their vineyards prior to harvest. However, these measurements are individual observations and do not represent the whole plot. Cooperatives check the quality of berries upon delivery for payment and further cellar logistics. An early detection of must characteristics prior to delivery on a grape harvester for example would improve the harvest and cellar logistics in big cooperatives.

While there are already many applications for near-infrared spectroscopy to detect ingredients in biological samples, there is still no applicable detector for determining ripeness in viticulture. To close this gap, an apparatus was built and tested in the laboratory. It consists of a near-infrared sensor and a flow cell, recording spectra in the range of 1100 nm to 1350 nm of grape must. This must was collected from 100 berries from each of four different red and white *Vitis vinifera* (L.) varieties from different vineyards. The spectra were acquired throughout the growing season in 2021 in Rhineland-Palatinate (Germany). Reference values for the main sugars (glucose, fructose), as well as acids (malic-, tartaric acid) were determined with high-performance liquid chromatography.

Using chemometric methods, i.e. partial least square regression and leave-one-out cross-validation, it was possible to estimate root mean square prediction errors (RMSEP) of 4.96 g/l and 0.60 g/l and a determination coefficient (R^2) of 83% for sugars and acids, respectively. Coefficient of determination and RMSEPs were higher for red varieties compared to white varieties for both substance classes. This high prediction accuracy could enable automatic ripeness measurements during the harvesting process on the harvester, thus reducing the workload during harvest and offering more planning security.

Keywords: grapevine, spectroscopy, NIRS, ripening, quality, harvest