

Stand-alone LED sensors for future field monitoring of grape (*Vitis vinifera* L.) ripeness

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Grape ripening until the harvest is a crucial issue since berry quality is closely related to it. The research for nondestructive methods, which could explore many samples and give a rapid and comprehensive overview of ripening, is helpful. Anyway, monitoring large areas requires the collection of several data derivable from the grape, which would be useful for a local-scale mapping of the ripening and for multi-year management of the grapevine. Although the literature reports different works regarding optical hand-held systems capable to check the status of the grape, these instruments are incompatible with the data necessary for large monitoring campaigns. In this context, a stand-alone and cost-effective optical device was designed, built, and tested with the goal to support growers in planning the optimal harvest date and improve vineyard management, following a viticulture 4.0 concept. Hence, a first prototype version of a fully integrated optical device incorporating different components (photodiodes, LEDs, and electronics) was developed by INL under the scope of the i-Grape consortium. Each module is equipped with four detection channels for optical measurements in the Vis- and SW-NIR ranges. The optical data were collected on grape berries in a commercial vineyard owned by Sogrape, using the prototype and one commercial hand-held spectrometer, which works among 400 and 1000 nm, with a resolution of 0.3 nm. As reference values, the common technological and phenolic parameters were analysed on each sample. Results were encouraging, underlining a small loss of information for the MLR models employing the prototypes compared to the PLS models calculated using the commercial spectrometer.

Keywords: Vis/NIR spectroscopy, simplified system, sensors, chemometrics

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