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19.7 TESTING OF OPTICAL PROTOTYPES FOR THE FRUIT AND VEGETABLE SECTOR: CASE STUDIES FROM PRE- TO POST-HARVEST

Roberto Beghi*, Valentina Giovenzana, Alessio Tugnolo, Andrea Casson, Riccardo Guidetti

Department of Agricultural and Environmental Sciences (DiSAA), Università degli Studi di Milano, via Celoria 2, 20133 Milano, Italy.

**Presenting author: Roberto Beghi, Department of Agricultural and Environmental Sciences (DiSAA), Università degli Studi di Milano, via Celoria 2, 20133 Milano, Italy, roberto.beghi@unimi.it*

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Abstract

Monitoring the ripeness progress until the harvest is a crucial issue since fruit quality is closely related to it. Therefore, the research for non-destructive methods which could explore many samples and give a rapid and comprehensive overview of ripening would be helpful. Moreover, the evaluation of the postharvest quality, e.g. senescence of ready-to-eat vegetables, could be greatly helped by new analytical methods that are rapid and integrated into the production process to meet consumer demand.

The aim of the research was to design, build and test prototypes of miniaturised low-cost and user-friendly devices envisaged mainly to support small-scale growers both in pre-harvest and in post-harvest monitoring. The systems were tested on two case studies: (i) to monitor the ripening of wine grape until harvest and (ii) to evaluate the postharvest life of fresh-cut salad to discriminate freshness levels during the shelf life.

Pre-prototypes of fully integrated, stand-alone optical device incorporating MEMS sensors (tuned photodiode arrays, interference filters, LEDs, optics) were designed and built. Two systems equipped with digital 6-channel sensors each for spectral identification in the visible and SW-NIR. The sensors cover 12 independent on-device optical filters from 400 nm to 860 nm.

Optical analyses were collected on grape bunches and on leaves of fresh-cut salad using the two prototypes. Reference parameters (i.e. soluble solids content and titratable acidity for grape, and colour and senescence classes for fresh-cut salad) were analysed on each sample for the calculation of predictive models using MLR regression technique.

The correlation between the optical data and the parameters were explored and the results were encouraging underlining a small loss of information comparing data from the prototypes to models from more expensive commercial vis/NIR devices.

Keywords: vis/NIR spectroscopy, simplified system, MEMS, ripeness, senescence, chemometrics